ESSAYS ON LOSS RESERVING AND ACCOUNTING CONSERVATISM

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ABSTRACT

This dissertation has three chapters studying accounting conservatism in the property-liability (P&L) insurance industry. There are two types of accounting conservatism – *ex-ante* (unconditional) conservatism and *ex-post* (conditional) conservatism. The former means that firms over-report liabilities initially, before more detailed information becomes available. The latter means that firms respond to this new information asymmetrically by recognizing expected losses more quickly than expected gains. My analysis throughout the dissertation focuses on the loss reserve accruals since it is the most significant accruals on the balance sheet. One benefit of studying the P&L insurance industry is that we have specific and detailed information regarding the development of loss reserve accruals over time.

Chapter 1 is an executive summary of the next two chapters, highlighting the key results, the policy implications, and the contributions of the dissertation. Chapter 2 studies the two types of accounting conservatism and explore three research questions: (1) whether *ex-ante* and *ex-post* conservatism prevails in the P&L insurance industry; (2) what the relations are between *ex-post* conservatism and other managerial incentives including *ex-ante* conservatism; and (3) how much the opportunity cost is for being conservative. I study all U.S. domiciled P&L insurance companies from 1996 to 2012 and follow the previous literature to measure accounting conservatism in Chapter 2. I find that both types of accounting conservatism prevail in the insurance industry. Besides, the back-of-the-envelope estimates based on the industry average insurer indicate that their opportunity costs are trivial compared to the amounts of net income and total assets. Chapter 2 also

shows that the practices of *ex-ante* and *ex-post* conservatism exhibit a nonlinear, U-shape relationship. This finding supports the view that the two types of conservatism can be compliments because they can serve for different purposes. *Ex-ante* conservatism is mainly used to create a cushion against future unexpected losses, whereas *ex-post* conservatism can reduce informational frictions.

In Chapter 3, I develop a new method of assessing conditional conservatism using more detailed data from the insurance industry. I look at how conditional conservatism affects insolvency risk and the financial strength rating of P&L insurance companies. I also investigate how a change to accounting rules affects conditional conservatism. The new method of measuring conditional conservatism is based on the concavity of the loss development curve. I study all U.S. domiciled P&L insurance companies from 1995 to 2015 and find that the greater the degree of conditional conservatism, the lower is insolvency probability, and the better is the financial strength rating, with other things being constant. The result indicates that regulators and rating agencies do reward insurers that voluntarily utilize conditional conservatism accounting strategy. Moreover, I find that the level of conditional conservatism is reduced after the enactment of the Model Audit Rule (MAR). MAR, like the Sarbanes-Oxley Act Section 404, increased board oversight of internal risk management. The result suggests that complying with additional disclosure requirements provides a "safe harbor" for insurance companies so that they have fewer incentives to be conditionally conservative.

To my big family. My achievements started from you.

To all professors who taught me. You gave me the power to change life and world.

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CHAPTER 1

EXECUTIVE SUMMARY

Accounting conservatism means that firms report a conservative estimate of losses or expenses that have an uncertain value in the financial report. In this dissertation, I study how and why companies use accounting conservatism when they reserve future losses. I look at the property-liability (P&L) insurance industry because all insurance companies are required to disclose how loss reserves are developed to new information for ten years in the statutory financial statement. The detailed data allows me to create new methods to measure the level of accounting conservatism at the firm-year level.

In addition to the data benefit, accounting conservatism is a critical accounting practice for insurance companies. Insurance companies are strictly monitored by state commissioners and rating agencies against insolvency risk. Loss reserves are the largest single liability entry on a P&L insurer's balance sheet. Based on A. M. Best (2013) report, reserve deficiency was the leading cause of insolvent events that occurred from 1969 to 2012. Hence, studying accounting conservatism through the reserving process helps us understand how accounting and actuarial practices impact the valuation and the information of the firm.

Insurance companies are required to file the statutory financial statement that has conservative provisions on reserve estimation. However, the level of conservatism set by the statutory accounting principles is for the whole industry. Insurers, at their own decision, can choose to be more conservative during reserving in order to reduce regulatory pressure. The benefit of alleviating regulatory pressure comes at the cost that insurers need to report more reserves and hold more surplus to cover the additional reserves. The increased cost of capital is an opportunity cost that insurers can avoid if not being conservative in financial reporting. A rational insurer should make this decision based on a cost-and-benefit analysis.

Chapter 2 of the dissertation studies the prevalence and the opportunity costs of two types of accounting conservatism – *ex-ante* (unconditional) conservatism and *ex-post* (conditional) conservatism. The former means that firms over-report liabilities initially, before more detailed information becomes available. The latter means that firms respond to this new information asymmetrically by recognizing expected losses more quickly than expected gains. The key differences between them are about timing and information content. *Ex-ante* conservatism likely occurs at an early stage when information is limited. In contrast, *ex-post* conservatism occurs later when new information arrives. *Only ex-post* conservatism relies on managers' expectations for future periods.

I follow the previous literature to measure accounting conservatism using traditional methods in Chapter 2. I find that both types of accounting conservatism prevail in the insurance industry. Besides, the back-of-the-envelope estimates based on the industry average insurer indicate that their opportunity costs are trivial compared to the amounts of net income and total assets.

Interestingly, I discover that the practices of *ex-ante* and *ex-post* conservatism exhibit a nonlinear relationship. For moderately conservative insurers, *ex-ante* conservatism preempts the adoption of *ex-post* conservatism. This supports the view that the two types of conservatism are substitutes for reducing reserve deficiency. For highly conservatism insurers, however, I observe that they increase the levels of *ex-ante* and *ex-*

post conservatism simultaneously. This finding provides evidence for the view that the two types of conservatism can also be compliments since they serve for different purposes. *Ex-ante* conservatism is unconditional on information and mainly used to create a cushion against future unexpected losses, whereas *ex-post* conservatism can reduce informational frictions.

Chapter 3 of the dissertation solely focuses on conditional conservatism and looks at its benefits and its interaction with accounting reform. I switched the expression to conditional conservatism to emphasize the feature of *ex-post* conservatism – its practice is always conditional on new information. Conditional conservatism often attracts more attention in research than unconditional conservatism because it relates to asymmetry. Companies have asymmetric responses to good and bad news. They use asymmetric recognition of losses and gains to reduce the information asymmetry – whether the company withholds any loss information that may adversely affect the benefits of other stakeholders.

In Chapter 3, I propose a new method to measure conditional conservatism at the firm-year level. I argue that the concavity of a loss development curve positively relates to the level of conditional conservatism. The more concave the loss development curve is, the more quickly insurers remedy reserve deficiency and the more slowly insurers reduce reserve slack. Based on this idea, I use the decile rankings (overall and by product line) of concavity to indicate the relative level of conditional conservatism of an insurer among all insurance companies. Compared to the traditional model that is used in Chapter 2, the new method accesses conditional conservatism at the more granular, firm-year level. It also examines the practice in both redundant-reserve (good-news) and deficient-reserve (bad-news) scenarios.

Using the new measures of conditional conservatism, I explore whether conditional conservatism reduces the likelihood of regulatory intervention and improves financial strength rating. Since insurers are strictly monitored by regulators and agencies against any opportunistic behavior that may cause reserve deficiency, conditional conservatism should help reduce this information asymmetry and earn credits to the insurer. I find that the probability of regulatory action is reduced and the probability of having a rating above A is increased when an insurer's decile rank of concavity increases.

Chapter 3 also examines how the enactment of the Sarbanes-Oxley Act (SOX) Section 404 and the Model Audit Rule (MAR) impacts insurers' usage of conditional conservatism. Both SOX Section 404 and MAR mandate companies to implement internal control over financial reporting (ICFR) that aims to improve the transparency and accuracy of financial reporting. However, SOX Section 404 was enacted at the end of 2004 and applied to public companies only. MAR took effect from the first day of 2010 and essentially changed the accounting practices of private insurance companies. Using a difference-in-difference model, I find the level of conditional conservatism was significantly reduced after MAR enactment.

This result supports the hypothesis of a safe harbor effect. The new financial reporting requirements by MAR help insurers convince state commissioners of the properness of accounting so that insurers no longer need to be conditionally conservative. One can view this as a shift in insurers' focus from reserving more losses to filing better documentation reports. The safe harbor effect indicates a severe side effect of MAR –

insurers may have higher insolvency risk after the new accounting rules because they have less solvency credibility. This was definitely not the intention of the policymakers who wanted companies to manage financial risks better after accounting reform. The side effect may matter to only financial institutions because financial institutions deal with complex financial risks and millions of customers. They must be conservative enough to ensure their ability to pay off customers' benefits and losses, as required by regulators. In comparison, non-financial institutions, such as car manufactures, do not have many complicated, uncertain transactions; thus, they need not be highly conservative in financial reporting.

This dissertation is the first study that distinguishes and measures the two types of accounting conservatism in the insurance industry. This helps us better understand insurers' reserving behavior and financial reporting. Beyond the insurance section, the dissertation also makes contributions to the literature in several ways. In Chapter 2, I find that *ex-ante* and *ex-post* conservatism relates in a nonlinear way. This is new and direct evidence indicating that the two types of conservatism can be not only substitutes but also compliments. I also estimate the monetary costs of being conservative, which adds to the growing debate on whether accounting conservatism can negatively impact firm value. In Chapter 3, I provide the first empirical evidence showing that conditional conservatism can reduce regulatory frictions and the bankruptcy risk of financial institutions. More importantly, I find that the accounting reform of MAR and SOX Section 404 might cause insurers to have higher insolvency risk since conditional conservatism was replaced by detailed documentation requirements. This finding gives policymakers a comprehensive picture of the impact of accounting reform on all types of institutions. Hopefully, it sheds light on accounting policies in the future.

Financial institutions have different accounting practices; however, they are often excluded from accounting studies. Through this dissertation, I want to show that financial institutions, especially insurance companies, deserve more attention in future research. With the firm-year level measure of conditional conservatism, future studies can examine what factors play a role in deciding the level of conditional conservatism. Another revenue for future research is what types of individual insurers view the two types of accounting conservatism as substitutes and what types view them as complements. This distinction may relate to firm size, financial conditions, and/or firm risk appetite.

CHAPTER 2

ACCOUNTING CONSERVATISM IN THE PROPERTY-LIABILITY INSURANCE INDUSTRY

2.1 Introduction

Accounting conservatism generally refers to the understatement of assets and revenues and overstatement of liabilities and expenses in the financial report (Watts, 2003a). Accounting conservatism can be broken into two distinct types: *ex-ante* and *ex-post* conservatism.[1] *Ex-ante* conservatism, also called news-independent and *unconditional* conservatism, means that firms over-report liabilities initially, before more detailed information becomes available. In contrast, *ex-post* conservatism (also called news-dependent or *conditional* conservatism) means that firms respond to this new information asymmetrically by recognizing expected losses more quickly than expected gains.

In this chapter, I aim to explore three research questions: (1) whether both *ex-ante* and *ex-post* conservatism exists in the property-liability (P&L) insurance industry; (2) how *ex-ante* conservatism and other managerial incentives affect the practice of *ex-post* conservatism; and (3) how much the opportunity cost is for being conservative in reserving. The P&L insurance industry is a perfect industry setting for studying accounting conservatism. I have firm-level detailed information about a specific type of accruals – loss reserves. Loss reserves are the largest liability on a P&L insurer's balance sheet. The estimation of loss reserves encounters significant uncertainty and thus has great space for accounting conservatism. Moreover, I can track the development of loss reserve accruals

[1] In this chapter, I choose to use the terminologies of *ex-ante* and *ex-post* conservatism because the measures of them rely on the difference in the times when they occur.

for ten years. I can separate the estimate of incurred losses in the first development year from the estimates of incurred losses afterward and use the former to measure *ex-ante* conservatism and the latter to measure *ex-post* conservatism. Since I can cut the timeline of loss development, I create relatively clean measures for *ex-ante* and *ex-post* conservatism.

Accounting conservatism is crucial to P&L insurance companies because it can significantly affect the book value of loss reserves and the value of the firm. The loss reserves reported in the statutory financial report not only affect net income but also determine whether insurers have enough money on the balance sheet to pay for future liabilities. Moreover, regulators and rating agencies both look at the adequacy of reported loss reserves to evaluate an insurer's insolvency risk.

Accounting conservatism is adopted at both the industry and the firm levels. At the industry level, accounting standard setters mandate the P&L insurers to file statutory financial reports following Statutory Accounting Principles (SAP), which have more stringent rules for reporting loss than Generally Accepted Accounting Principles (GAAP).[2] At the firm level, insurers can go beyond SAP by voluntarily engaging in an additional level of accounting conservatism. Prior studies find that on average, the incurred losses reported at an early stage are often higher than the incurred losses of the same policies reported later when more information becomes available (e.g., Beaver et al., 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010, 2012). The difference in the two reported

[2] For example, insurers are required to report the non-discounted value of loss reserves under SAP, whereas the value of loss reserves reported under GAAP is discounted. The accounting conservatism imposed by SAP is *ex-ante* (unconditional) conservatism because insurers must follow the accounting rules despite of any information.

incurred losses cannot be explained by the accounting rules; instead, it indicates that insurers employ more accounting conservatism than the level mandated by SAP.

Given the existence of firm-level conservatism, I ask which type of conservatism insurers are using: *ex-ante* or *ex-post*? I distinguish the two types of conservatism because they are associated with different managerial incentives (Basu, 2005). The goal of *ex-ante* conservatism is to have a *cushion* against future losses. The size of the cushion is pre-determined and not related to any information about future periods. *Ex-post* conservatism, however, provides timely loss information in the financial report and reduces the *information asymmetry* between the firm and financial report users.

My empirical analysis has three steps. I first examine the existence of *ex-ante* and *ex-post* conservatism in the P&L insurance industry. *Ex-ante* is measured by a positive deviation of initially reported incurred losses from a proxy of "true value," which is the incurred losses of the same insurance policies ultimately reported after at least six years when majority claims have been settled. *Ex-post* conservatism is measured by an *asymmetric* and negative relationship between the current net cash flows from underwriting and currently reported incurred losses.[3] The measure is illustrated in Figure 1.

The current net cash flows from underwriting is a predictor for expected revisions in future cash flows because loss shocks may affect both current and future loss payments (Ball and Shivakumar, 2005). Positive current net cash flows indicate favorable loss shocks and predict expected loss decreases (or good news), whereas negative current net cash flows indicate adverse loss shocks and predict expected loss increases in the future (or bad

[3] Loss reserves are the accruals, but I should use incurred losses in the model, which are the sum of losses paid and loss reserves. Loss reserves can go down under the natural loss settlement process because more losses are paid and less need to be reserved. The change in incurred losses captures the revision in loss reserves due to new information.

news). As shown by Figure 1, in the absence of other incentives, *ex-post* conservatism means that expected loss increases are recognized more quickly than expected loss decreases. When expected loss increases are expected, insurers adjust incurred losses upward quickly as net cash flows decrease; but when expected loss decreases are expected, insurers reduce incurred losses slowly as net cash flows increase.

I create an interaction term by multiplying the news predictor with a dummy variable for bad news to estimate the asymmetric timeliness coefficient. In addition to current net cash flows, I also use the change in net cash flows, the deviation of a firm's net cash flows from the industry median, the change in premiums, and the change in net investment gains as news predictors. Unlike net cash flow predictors, the change in premiums may proxy for underwriting quality and thus predict future loss payments. The change in net investment gains may indicate an insurer's capacity for paying future liabilities. I use data on all U.S. P&L insurance companies from 1996 to 2012. The results show that both *ex-ante* and *ex-post* conservatism significantly exists in the P&L insurance industry.

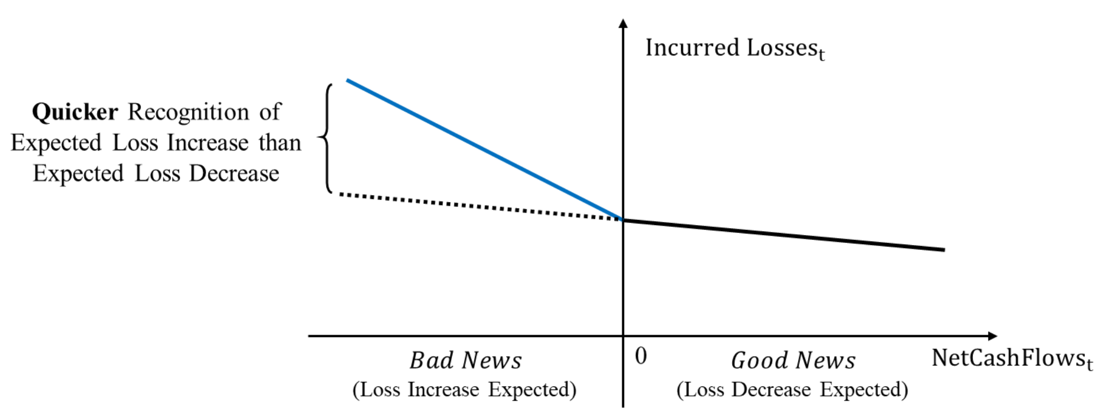

Figure 1: Illustration of *Ex-Post* Conservatism

In the second step, I multiply the asymmetric timeliness term with measures of *ex-ante* conservatism and other managerial incentives. I find a nonlinear and U-shape relationship between *ex-ante* and *ex-post* conservatism. *Ex-ante* conservatism constrains the level of *ex-post* conservatism, and the attenuation effect reaches to the maximum level when a firm's decile ranking of *ex-ante* conservatism is 5. Then the attenuation effect decreases and approaches zero when the decile ranking of *ex-ante* conservatism reaches the top of 10. The result suggests that *ex-ante* conservatism can restrict but cannot fully eliminate *ex-post* conservatism because *ex-post* conservatism has a unique information role that firms cannot achieve using *ex-ante* conservatism (Basu, 2005). Regarding other managerial incentives, I find that *ex-post* conservatism is constrained by the income smoothing incentive, the incentive to inflate financial strength ratio, and high exposures to strict rate regulation.

In the third step, I examine whether P&L insurers are moderately or overly *ex-post* conservative. The overuse of *ex-post* conservatism may make insurers to reserve expected losses that will not occur in the future. I use the loss reserve error as the dependent variable so that I can compare the change in the incurred losses reported in the calendar year t and the change in the incurred losses ultimately reported in the calendar year t+5. The latter contains both current and future revisions in losses. The null hypothesis is that the currently reported incurred losses are increased less than or equal to the ultimately reported incurred losses for a unit reduction in net cash flows in bad-news years. The statistical test cannot reject the null hypothesis. Thus, I do not find evidence of P&L insurers being overly *ex-post* conservative.

At the end of the empirical analysis, I calculate the back-of-the-envelope estimate of the opportunity cost of *ex-ante* and *ex-post* conservatism. I define opportunity cost as the cost of holding more reserves due to being conservative in reserving. The back-of-the-envelope estimates show that the opportunity cost of *ex-ante* conservatism for the industry average insurer is $4.15 million, and the opportunity cost of *ex-post* conservatism ranges from 2.4 to 4.7 million dollars. However, both types of opportunity costs are modest, only accounting for 2% of net income and less than 1% of the total admitted assets of the industry average insurer.

This chapter contributes to the literature in three ways. It is the first study to distinguish the two types of accounting conservatism in the insurance industry. Separating *ex-ante* and *ex-post* conservatism helps understand insurers' reserving behavior and the incentives behind the behavior related to different types of accounting conservatism. *Ex-post* conservatism may constrain opportunistic managerial behavior because it increases loss reserves when bad news happens and thus may offset some understatement of loss reserves led by opportunistic behavior. However, *ex-ante* conservatism is unlikely to have such an effect because the increase in loss reserves under *ex-ante* conservatism is pre-determined. Managers can manage loss reserves oppositely afterward to remove the impact of *ex-ante* conservatism.

Second, I find a nonlinear relationship between *ex-ante* and *ex-post* conservatism that has not been documented in the previous literature. Prior studies often focus on the substitute effect, i.e., how *ex-ante* conservatism constrains the implementation of *ex-post* conservatism (e.g., Pope and Walker, 2003; Beaver and Ryan, 2005; Gassen et al., 2006). My result indicates that the initial cushion that insurers have in reserves cannot fully eliminate the probability of *ex-post* conservatism because there is also a complementary effect.

Different types of accounting conservatism can be used to achieve different goals (Basu, 2005). *Ex-ante* conservatism creates a cushion against losses, but *ex-post* conservatism serves to reduce information asymmetry. This chapter also constructs a cleaner measure of *ex-ante* conservatism, as compared to the market-to-book (MTB) ratio, because I can observe the timeline of accrual development.

Finally, I provide some empirical evidence regarding the opportunity cost of being conservative. There is a growing debate in the literature about the opportunity cost of being *ex-post* conservative. For example, Gigler et al. (2009) discuss the case where over-using *ex-post* conservatism may falsely trigger a debt default. Caskey and Laux (2016) analyze the case for corporate governance that being highly *ex-post* conservative may forgo some investments that would have succeeded. However, the opportunity cost has rarely been estimated empirically. In this chapter, I define opportunity cost as the cost of holding more reserves than needed under accounting conservatism. My back-of-the-envelope estimates indicate that insurers are not overly conservative in reserving under strict insolvency regulation; their activities of accounting conservatism do not generate significant costs for holding more reserves and capital.

2.2 Literature Review

2.2.1 Existence of Conservatism in the Insurance Industry

My analysis of accounting conservatism focuses on a specific type of loss accruals, which is loss reserves. Loss reserves are the most critical accruals for the P&L insurance companies.[4] First, loss reserves are the most significant liability on a P&L insurer's balance sheet. Second, the estimation of loss reserves encounters significant uncertainty.

[4] Another type of reserve is unearned premiums reserves. However, the estimation of unearned premiums reserves is mechanical and needs little managerial discretion.

Accounting conservatism generally refers to the understatement of assets or the overstatement of liabilities (Watts, 2003a). Accounting conservatism is naturally adopted at the industry level. Accounting standard setters mandate the P&L insurance industry to file statutory financial reports following Statutory Accounting Principles (SAP), which have more stringent rules for reporting loss reserves than Generally Accepted Accounting Principles (GAAP).[5]

Prior studies find that on average, the incurred losses reported at an early stage are often higher than the incurred losses of the same policies reported later when more information becomes available (e.g., Beaver et al., 2003; Gaver and Paterson, 2004; Grace and Leverty, 2010, 2012). This finding provides evidence for insurance companies engaging in additional accounting conservatism beyond SAP since the difference in the two estimates of incurred losses cannot be explained by the accounting rules.

However, accounting conservatism can be broken into two distinct types: *ex-ante* and *ex-post* conservatism. *Ex-post* conservatism, also called news-dependent or *conditional* conservatism, means that insurers reserve expected losses more quickly than expected gains during loss development periods (Ball and Shivakumar, 2005). In contrast, *ex-ante* conservatism (news-independent and *unconditional*) means that insurers simply over-report loss reserves without considering any information of future periods (Beaver and Ryan, 2005). Hence, an interesting question arises – which type of conservatism insurers are engaging: *ex-ante* or *ex-post*?

[5] For example, insurers are required to report the non-discounted value of loss reserves under SAP, whereas the value of loss reserves reported under GAAP is discounted. The accounting conservatism imposed by SAP is *ex-ante* (unconditional) conservatism because insurers must follow the accounting rules regardless of the outside conditions.

The focus of this chapter is to test whether P&L insurers engage in *ex-ante* and *ex-post* conservatism separately. Distinguishing the two types of accounting conservatism is important because the managerial incentives of adopting them are different (Basu, 2005). The goal of *ex-ante* conservatism is to have a *cushion* against future losses, whereas and the goal of *ex-post* conservatism is to reduce the *information asymmetry* and agency costs between the firm and outside parties, especially regulators for the P&L insurance industry.[6] However, the previous insurance literature has not examined the existence of the two types of accounting conservatism. This chapter fills this gap.

2.2.2 Measures of Ex-Ante and Ex-Post Conservatism

The financial accounting literature has an agreed method to test for the existence of *ex-post* conservatism. It is a regression coefficient called *asymmetric timeliness coefficient* and indicates whether firms have asymmetrical responses to good and bad news (Basu, 1997; Ball and Shivakumar, 2005; Gassen et al., 2006). For example, Basu (1997) measures *ex-post* conservatism as asymmetrical timeliness of earnings in reflecting bad and good news. He defines news as the one-year abnormal stock return. Ball and Shivakumar (2005) develop Basu's model for private firms. They measure *ex-post* conservatism as the asymmetrical timeliness of accruals in recognizing expected losses and gains.

This chapter follows the model in Ball and Shivakumar (2005) since a significant portion of P&L insurers are private firms. However, in addition to the news predictor of current net cash flows from operations used by Ball and Shivakumar, I also explore other

[6] *Ex-post* conservatism may also have a cushion effect since insurers report expected losses early, but this is not the primary incentive for *ex-post* conservatism because the cushion is random (Biddle et al., 2016). The size of cushion is determined by how expected losses are predicted and how quickly expected losses are recognized.

news predictors using premiums and investment gains. These predictors may also be informative regarding future situations under the insurance industry setting.

There is no agreed measure for *ex-ante* conservatism in the financial accounting literature. Pope and Walker (2003) and Gassen et al. (2006) use the MTB ratio as the measure of *ex-ante* conservatism. However, Gassen et al. (2006) have documented that the MTB ratio actually measures the sum of *ex-ante* and *ex-post* conservatism. They assume in line with Ryan (2006) that *ex-ante* conservatism contributes significantly more than *ex-post* conservatism to the overall level of accounting conservatism. The conjecture made by Ryan (2006) is based on the observation that "asymmetric timeliness is negatively correlated with most measures of overall conservatism, such as the market-to-book ratio" (p. 516). In this chapter, I propose a new method that directly looks at if an insurer's initial estimate of loss reserve accruals is greater than its "true value."

2.2.3 Relation Between Ex-Ante and Ex-Post Conservatism

A lively discussion in the financial accounting literature is about whether *ex-ante* conservatism constrains the adoption of *ex-post* conservatism. The model in Beaver and Ryan (2005) shows that *ex-ante* conservatism preempts *ex-post* conservatism because firms do not need to respond to bad news until the slack created by *ex-ante* conservatism is used up. Using MTB ratio as the measure of *ex-ante* conservatism, Pope and Walker (2003) and Gassen et al. (2006) find that firms with a high MTB ratio have low timeliness asymmetry in reflecting good and bad news. However, Basu (2005) argues that *ex-ante* and *ex-post* conservatism can complement each other since firms can use them to achieve different goals. *Ex-ante* conservatism has no relation with information, whereas *ex-post* conservatism serves as an efficient mechanism to improve contracting efficiency.

This chapter also offers an analysis regarding the relationship between *ex-ante* and *ex-post* conservatism in the insurance industry. Compared to previous studies, my analysis has two advantages. First, I can track the development of loss reserves over time and, thus, observe how loss reserves are initially estimated and further developed based on new information. I can have cleaner measures of *ex-ante* and *ex-post* conservatism compared to previous studies. Second, I are focusing on a specific type of accruals so that both *ex-ante* and *ex-post* conservatism decisions are made regarding shocks to loss payments. In comparison, a normal firm in the non-financial industry has accruals like receivables, payables, inventory, and depreciation. My analysis has a cleaner setting to test for the tradeoff between the two types of conservatism.

2.3 Hypotheses

2.3.1 Existence of Ex-Ante and Ex-Post Conservatism

I define that an insurer is *ex-ante* conservative if the firm initially over-report its loss reserve accruals. In the insurance industry, I can observe the development of loss reserve accruals from the year when insurance policies were underwritten to nine years later, in total over ten years. Thus, more specifically, I can access *ex-ante* conservatism by looking at if an insurer over-reports its initial estimate of incurred losses in the policy year.

I assume that the reserve estimate in the policy year is based on limited information and thus mainly determined by *ex-ante* conservatism. Although property-liability insurance usually provides coverage for one year, the claim reporting and settlement can take more than one year because not all claims are reported during the coverage period. The insurance literature documents that most insurance claims are settled within five years (e.g., Gaver and Patterson, 2004; Grace and Leverty, 2012). Hence, the information regarding future losses available to insurers in the policy year should be much more limited compared to the information available in future development years.

> **H1:** P&L insurers on average over-report the initial estimate of incurred losses (prevalence of *ex-ante* conservatism).

I define that an insurer is *ex-post* conservative if it recognizes expected losses more quickly than expected gains. In other words, when the insurer expects bad news, it increases loss reserves immediately to recognize future expected losses; however, when the insurer expects good news, it is reluctant to reduce loss reserves. The expected gains are recognized slowly or not recognized until the true reduction in loss payments occurs. The asymmetric timeliness of loss reserves in reflecting good and bad news is realized when insurers require lower verifiability standards for recognizing losses than gains.

To assess *ex-post* conservatism, I focus on the incurred losses reported in the second to the fifth development years and explicitly exclude the initially reported incurred losses in the policy year to avoid the effect of *ex-ante* conservatism.

> **H2:** P&L insurers increase incurred losses more quickly when bad news is expected than they decrease incurred losses when good news is expected (prevalence of *ex-post* conservatism).

2.3.2 Relation Between Ex-Ante and Ex-Post Conservatism

There are two trends of views regarding the relationship between *ex-ante* and *ex-post* conservatism. Beaver and Ryan (2005) show through their model that *ex-ante* conservatism can constrain the adoption of *ex-post* conservatism. Firms do not need to respond to bad news quickly when they are *ex-ante* conservative because they have slack in accruals. *Ex-post* conservatism kicks in when the slack is used up. Roychowdhury and Watts (2007) provide empirical evidence supporting this prediction. They find that the measure of *ex-post* conservatism negatively relates to the MTB ratio before the implementation of *ex-post* conservatism but positively relates to the MTB ratio after that. Since the MTB ratio reflects both *ex-ante* and *ex-post* conservatism, the finding by Roychowdhury and Watts indicates that when *ex-post* conservatism is not included, the MTB ratio which measures *ex-ante* conservatism is negatively related to *ex-post* conservatism.

Basu (2005), however, offers a different argument. He states that *ex-post* conservatism can be a complement to *ex-ante* conservatism since firms can use them to achieve different goals. *Ex-ante* conservatism has no relation with information and is "mandated by accounting standard-setters or induced by income taxation and product market regulation" (Basu, 2005, p. 314). In contrast, *ex-post* conservatism serves utilizes, and thus reveals, the information of future periods (Basu, 2005). Previous studies have explored the role of *ex-post* conservatism in improving management contracting efficiency, debt covenant, and corporate governance (e.g., Basu, 1997, 2005; Ball, 2000; Watts, 2003; Nikolaev, 2010), and reducing bankruptcy risk (Biddle et al., 2016).

Based on the two trends of views, I propose a *nonlinear* relationship between *ex-ante* and *ex-post* conservatism. When insurers are not or moderately *ex-ante* conservative, a substitute effect dominates: increasing *ex-ante* conservatism can create slack in reserves against future losses and thus constrain the space for *ex-post* conservatism. When insurers are highly *ex-ante* conservative, a complementary effect kicks in: being more *ex-ante* conservative does not further constrain *ex-post* conservatism. Instead, insurers start using *ex-post* conservatism to achieve the goal of reducing information asymmetry and agency problems.

H3: There is a nonlinear relation between *ex-ante* and *ex-post* conservatism which is in a U-shape.

2.3.3 Relations Between Ex-Post Conservatism and Other Managerial Incentives

Smoothing Income

Ex-post conservatism and income smoothing are different accounting practices. I can easily interpret their relationship using the distribution of net income following Gassen et al. (2006). *Ex-post* conservatism makes the distribution of net income more left-skewed since losses are more quickly recognized than gains. Income smoothing, however, reduces the variance of the distribution. The effect of *ex-post* conservatism on income smoothing is unclear because it increases the variance of net income when it is negative but decreases the variance when it is positive (Gassen et al., 2006). Alternatively, income smoothing can decrease the level of *ex-post* conservatism because, as the distribution of net income gathers toward a moderately positive number, the likelihood of reporting a loss is decreased.

Intuitively, I also expect that insurers with an incentive for income smoothing are less likely to engage in *ex-post* conservatism because these two practices are associated with opposite adjustments in loss reserves in bad-news years. When bad news is expected, insurers that want to smooth income tend to under-report loss reserves to inflate net income and make net income less volatile. However, insurers that engage in *ex-post* conservatism tend to increase loss reserves to report expected losses quickly. Therefore, I predict a negative relationship between income smoothing and *ex-post* conservatism.

> **H4.1**: *Ex-post* conservatism is negatively related to the managerial incentive for smoothing income.

Inflating Financial Strength Ratio

The relationship between *ex-post* conservatism and managerial incentive to inflate financial strength ratio is complicated. Prior studies have found that *ex-post* conservatism can help reduce bankruptcy risk. Biddle et al. (2016) find that *ex-post* conservatism helps reduce the likelihood of technical debt default for nonfinancial institutions. In Chapter 3, I find that a higher level of *ex-post* conservatism helps increase the financial strength rating and reduce the likelihood of regulatory action for P&L insurers. Notably, *ex-post* conservatism comes at an opportunity cost because *ex-post* conservative insurers reserve future losses quickly and holding more reserves on their balance sheet. When reserves increase, insurers need to hold more capital to maintain the solvency level. The capital cost is more burdensome to financially weak firms. Based on a cost-and-benefit analysis, as the opportunity cost is higher for financially weak firms, these firms should be less likely to engage in *ex-post* conservatism.

However, the incentive for boosting the financial strength ratio in this chapter refers to managerial manipulation of loss reserves to inflate financial strength ratio or other regulatory ratios. For example, Gaver and Paterson (2004) find that financially weak firms tend to under-report loss reserves to improve the Insurance Regulatory Information Systems (IRIS) ratios.[7] This practice is opposite to *ex-post* conservatism because it is associated with under-statement of future liabilities rather than quick recognition of expected losses. Moreover, this practice is an opportunistic behavior since the insurer withholds loss information that may adversely impact its reported financial ratios. In comparison, *ex-post* conservatism leads to timely loss recognition and disclosure. Insurers

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[7] IRIS ratios are one type of regulatory ratios used by regulators to monitor and evaluate insolvency risk. Insurers that violate four or more IRIS ratios are deemed problematic firms.

engage in *ex-post* conservatism to build a reputation and reduce the information asymmetry and agency cost between the firm and regulators.

Therefore, I assume that the incentive for inflating the financial strength ratio restricts the practice of *ex-post* conservatism. This relation should be strong for insurers that have a low rank of financial strength ratio and are urgent to improve the ratio. For insurers that are financially strong and do not need to inflate its financial strength ratio, this relation should be trivial.

> **H4.2:** *Ex-post* conservatism is negatively related to the managerial incentive for inflating the financial strength ratio, and the relationship is stronger for insurers that are more urgent to improve the financial strength ratio.

Taxation

Accounting conservatism can help firms defer the tax payments since current liabilities are over-reported. Nevertheless, the taxation incentive is mainly achieved through *ex-ante* rather than *ex-post* conservatism (Watts, 2003). The increase in loss reserves due to *ex-ante* conservatism is deterministic; thus, managers can leverage on *ex-ante* conservatism to achieve a particular tax goal. However, *ex-post* conservatism creates a random increase in loss reserves depending on whether bad news is expected and how quickly firms recognize expected losses (Beaver and Ryan, 2005). Consequently, it is hard to use *ex-post* conservatism to realize a specific tax goal. Hence, I assume that *ex-post* conservatism is not related to the tax incentive.

H4.3: *Ex-post* conservatism is not related to the taxation incentive.

Rate Regulation

Rate regulation means that insurers must obtain approval from state regulators before they increase the insurance rate, and the increase must within a certain range prescribed by the regulators. When insurers have a high proportion of businesses exposed to rate regulation, they are charging suppressed insurance rates. Their profit margin should be lower than insurers that have low exposures to rate regulation. Due to the opportunity cost of *ex-post* conservatism, insurers with higher exposures to rate regulation should have a lower capacity to use *ex-post* conservatism. Hence, I predict that *ex-post* conservatism is negatively related to insurers' exposures to rate regulation.

> **H4.4:** *Ex-post* conservatism is negatively related to an insurer's exposure to rate regulation.

2.4 Data and Statistics

2.4.1 Data

I study affiliated and unaffiliated single P&L insurance companies domiciled in the U.S. The data of P&L insurance companies are extracted from the National Association of Insurance Commissioners (NAIC) Property-Casualty Annual Statements from 1993 to 2017. The firm-year level data regarding loss reserve development come from the Schedule P, Part 2 Summary table.

I keep observations that have non-missing values for variables in regressions. Since I study insurers' reserving behavior, I employ a careful screening process for incurred losses and loss reserve errors. I examine the 1% and 99% tails of these variables and only drop the observations which have total admitted assets smaller than $5 million.[8] I also trim the outliers of other continuous variables at the 1% and 99% levels, including *Rein_usage*, *Leverage*, *Growth*, *NetCFO,* and Δ*NetCFO*.

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[8] I do not want to drop extreme incurred losses and loss reserve error values due to insurers having an aggressive reserving strategy. Hence, I only drop small insurers that have assets below $5 million. These small firms may be startup companies that have unusual business activities.

The final sample has 2,291 firms and 23,562 firm-year observations. The sample accounts for 81 percent of unpaid losses and loss adjustment expenses and 72 percent of direct premiums written during the sample period.[9] Since I require lagged data to calculate the standard deviation of some variables and five-years of leading data to calculate the loss reserve error, the sample period is from 1996 to 2012.

2.4.2 Variables Related to Loss Reserves

To create variables using the Schedule P, Part 2 table, I first need to explain terminologies in the table. *Accident year* refers to the year when policies were underwritten and coverages were provided. Insurers are financially responsible for all covered events incurred during the accident year. However, not all claims are reported during the accident year. The claim settlement can take several years. The calendar years in which losses are developed to the ultimate value are called *development years*.

Under SAP, insurers update their estimate of incurred losses of a given accident year for ten development years, as more information becomes available with time. This process is called *loss development*. The loss development of incurred net losses and defense and cost containment expense is disclosed in Schedule P, Part 2 of the NAIC statutory annual statement. Table 2-1 provides an example of Schedule P, Part 2 of the State Farm Fire and Casualty Company (State Farm). The rows represent *accident years*. Incurred losses of each accident year are developed over ten *calendar years*, indicated by the columns.[10]

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[9] Regarding the 19 percent unpaid losses dropped by the sample, 14 percent is due to dropping missing values and 5 percent is due to trimming outliers *Smooth* and *Z-score* have significant missing values because they require multiple lagged years to calculate the standard deviation.

[10] To convert a calendar year to a development year, for example, the calendar year 2012 is the third development year for the accident year 2010.

Table 2-1: An Example of Schedule P, Part 2

NAIC Property-Liability 2015 Annual Statement of State Farm Fire and Casualty Company
NAIC Code = 25143

NAIC Property-Liability 2015 Annual Statement: Schedule P Part 2

Years in Which Losses Were Incurred	Incurred Net Losses and Defense and Cost Containment Expenses Reported at Year End ($000 omitted)										
	Calendar Year (CY)										
(Accident Year, AY)	2006	2007	2008	2009	**2010**	2011	2012	2013	2014	2015	
1. Prior	2,395,092	2,704,096	2,881,522	2,844,794	2,810,188	2,791,499	2,793,401	2,788,616	2,779,553	2,794,209	**Loss Reserve Error**
2. 2006	***6,599,473***	6,783,676	6,780,749	6,775,569	**6,727,376**	6,717,142	6,716,491	6,716,593	6,708,627	***6,703,333***	**24,043** =6,727,376-6,703,333 ($lre_{t-4,t}$)
3. 2007		***6,666,271***	6,901,592	6,837,562	**6,810,922**	6,784,961	6,760,744	6,759,620	6,750,801	***6,748,448***	**62,474** =6,810,922-6,748,448 ($lre_{t-3,t}$)
4. 2008			***9,888,250***	9,968,863	**9,901,880**	9,816,922	9,792,742	9,769,787	9,762,255	***9,761,725***	**140,155** =9,901,880-9,761,725 ($lre_{t-2,t}$)
5. 2009				***8,968,209***	**9,006,416**	8,910,348	8,889,776	8,860,652	8,860,924	***8,860,481***	**145,935** =9,006,416-8,860,481 ($lre_{t-1,t}$)
6. 2010					9,368,065	9,303,217	9,292,717	9,268,661	9,267,658	9,262,612	
7. 2011						11,545,977	11,439,107	11,395,923	11,382,854	11,373,336	
8. 2012							9,624,533	9,381,798	9,306,122	9,252,886	
9. 2013								8,351,972	8,330,482	8,330,994	
10. 2014									8,803,909	8,949,186	
11. 2015										7,910,034	***Ex-Ante* Conservatism**
Total		**32,122,203**			**32,446,594**					**32,073,987**	**48,216** =32,122,203-32,073,987
					($incurredloss_t$)						($initialdev_t$)

Note: This table is the Schedule P, Part 2 of the NAIC annual statement of State Farm Fire and Casualty Company.

Incurred losses are the total amount of losses incurred for providing insurance coverage. Incurred losses consist of two parts: *paid losses*, which are losses of claims that have been settled and paid off as of the evaluation date, and *loss reserves*, which are unpaid losses of claims that are reported but not settled (case reserves) or incurred but not reported (IBNR reserves) as of the evaluation date. Paid losses are reported on a cash-basis, whereas loss reserves are accruals and subject to uncertainty. I create variables using incurred losses rather than loss reserves because I focus on the change in the total amount of losses. Loss reserves can decrease when more claims are paid under the natural loss settlement process.

I define $x_{t,j}$ to be the incurred losses for the accident year j as reported in the calendar year t. Using this notation, I calculate the total incurred losses of the accident years t-4 through t-1 (i.e., previous four accident years) reported in the calendar year t as:

$$incurredloss_t = \sum_{j=t-4}^{t-1} x_{j,t} \qquad \textbf{(2.1)}$$

The total incurred losses reported in the calendar year t is the dependent variable in the regression of measuring *ex-post* conservatism. To facilitate the cross-sectional comparability and reduce the effect of firm size, I scale the total incurred losses by the total admitted assets at the end of the prior year (e.g., Beaver, McNichols, and Nelson, 2003; Grace and Leverty, 2010, 2012). That is, $IncurredLoss_t = incurredloss_t / A_{t-1}$, where A_{t-1} is the total admitted assets at the end of the calendar year t-1.

Another dependent variable used in the regression is the loss reserve error, which is the incurred losses minus its developed value reported five years later. Loss reserve error arises because insurers do not know all information about unpaid losses as of the evaluation date. I choose a development lag of 5 years to calculate the loss reserve error, consistent with the recent literature (e.g., Gaver and Patterson, 2004; Grace and Leverty, 2012).

The *single-year loss reserve error* for a given accident year j is defined as the incurred losses reported in the calendar year t minus its developed estimate reported in the calendar year t + 5 (e.g., Weiss, 1985).[11] A positive loss reserve error indicates that the reported incurred losses in year t are greater than its "true value," and *vice versa*.

$$lre_{j,t} = x_{j,t} - x_{j,t+5} \tag{2.2}$$

where $lre_{j,t}$ = loss reserve error for incurred losses of the accident year j reported in the calendar year t with a development lag of 5 years,

$x_{j,t}$ = incurred losses of the accident year j as reported in the calendar year t, and

$x_{j,t+5}$ = incurred losses of the accident year j as reported in the calendar year t+5.

Again, I scale the loss reserve error to improve the cross-sectional comparability, i.e., $LRE_{j,t} = lre_{j,t} / A_{t-1}$.

For the regression, I focus on the loss reserve error of the four accident years used to calculate $IncurredLoss_t$ and their total. The loss reserve error variables used in the regressions are $LRE_{t-1,t}$, $LRE_{t-2,t}$, $LRE_{t-3,t}$, $LRE_{t-4,t}$, and $LRE_{total,t}$.[12] They represent the loss reserve error of the accident years t-1 through t-4, and their sum value, respectively.

[11] These variables are intended to apply to specific insurers, but the unit subscript has been suppressed for notational simplicity. The choice of development lag is based on a tradeoff between allowing enough time for losses to develop and not eliminating too many years in the sample period.

[12] That is, $LRE_{total,t} = LRE_{t-1,t} + LRE_{t-2,t} + LRE_{t-3,t} + LRE_{t-4,t}$.

2.4.3 Measure of Ex-Ante Conservatism

I use the incurred losses in the first development year to create a firm-year level measure of *ex-ante* conservatism. More specifically, an insurer is defined as being *ex-ante* conservative if its initial estimate of incurred losses is larger than the "true value." Similar to calculating the loss reserve error, the "true value" is proxied by the incurred losses reported in the last development year in the Schedule P, Part 2 table. For example, in the example of Table 2-1, the incurred losses reported in the calendar year 2015 are used as the proxy for the "true value." Since my analysis only focuses on the previous four accident years, i.e., the accident years 2006 through 2009 in Table 2-1, the time lag between the year of the initial estimate of incurred losses and the year of the "true value" is always greater than five years. For each firm *i* (the subscript is omitted for simplicity) and year *t*, the deviation of the initially reported incurred losses from its ultimately reported value is defined below:

$$\begin{aligned} initialdev_t &= (x_{t-4,t-4} - x_{t-4,t+5}) + (x_{t-3,t-3} - x_{t-3,t+5}) + (x_{t-2,t-2} - x_{t-2,t+5}) + (x_{t-1,t-1} - x_{t-1,t+5}) \\ &= \underbrace{(x_{t-4,t-4} + x_{t-3,t-3} + x_{t-2,t-2} + x_{t-1,t-1})}_{\substack{\text{sum of initially reported incurred losses} \\ \text{of AYs t-1 through t-4}}} - \underbrace{(x_{t-4,t+5} + x_{t-3,t+5} + x_{t-2,t+5} + x_{t-1,t+5})}_{\substack{\text{sum of incurred losses of AYs t-1 through t-4} \\ \text{ultimately reported in CY t+5}}} \end{aligned} \tag{2.3}$$

I scale the initial loss reserve deviation by the prior year's total admitted assets and obtain $InitialDev_t = initialdev_t / A_{t-1}$. I define $Ex\text{-}AnteCons_t$ as the decile ranking of the scaled initial loss reserve deviation, i.e., $Ex\text{-}AnteCons_t = Rank(InitialDev_t)$. Since *ex-ante* conservatism leads to a positive deviation, a higher ranking of the initial loss reserve deviation indicates a higher level of *ex-ante* conservatism.

I provide an example for calculating $IncurredLoss_t$, $LRE_{t-1,t}$, $LRE_{t-4,t}$, and $InitialDev_t$ respectively using the example in Table 2-1. Notably, Table 2-1 shows the Schedule P, Part 2 table of the financial reporting year 2015; however, I use it to calculate variables for the calendar year 2010 because I need estimates after five years to proxy the "true value" of incurred losses. Hence, the calendar year t = 2010. $IncurredLoss_t$ is the sum of incurred losses of accident years 2006 through 2009 (i.e., AYs t-1 through t-4) reported in the calendar year 2010, scaled by the total admitted assets at the end of the calendar year 2009, which is 26.42 billion dollars. $IncurredLoss_t = 32{,}446{,}594 * 1{,}000 / (26.42 * 10^9) = 1.23$.

$LRE_{t-1,t}$ and $LRE_{t-4,t}$ are the loss reserve error of the accident year 2009 and 2006 respectively for their incurred losses reported in the calendar year 2010. After I plug in the numbers, $LRE_{t-1,t} = 145{,}935 * 1{,}000 / (26.42 * 10^9) = 0.006$ and $LRE_{t-4,t} = 24{,}043 * 1{,}000 / (26.42 * 10^9) = 0.001$.

The level of *ex-ante* conservatism is evaluated by the $InitialDev_t$ which is the sum of the initial estimates of incurred losses of accident years 2006 through 2009 minus the sum of their ultimate estimates reported in the calendar year 2015. $InitialDev_t = 48{,}216 * 1{,}000 / (26.42 * 10^9) = 0.002$. $Ex\text{-}AnteCons_t$ is the decile ranking of $InitialDev_t$ across all firms in 2010.

2.4.4 Summary Statistics

The summary statistics are shown in Table 2-2. The mean total admitted asset is $799 million, and the median is $91 million. The average incurred losses reported in the current calendar year is 83 percent of total admitted assets. The mean values of all loss

Table 2-2: Summary Statistics (1996-2012)

Variables	Mean	Median	Std. Dev.	Min	Max
$IncurredLoss_t$	0.842	0.725	0.883	0.000	53.517
$LRE_{t-1,t}$	0.004	0.004	0.046	-3.370	3.013
$LRE_{t-2,t}$	0.003	0.002	0.026	-0.943	0.538
$LRE_{t-3,t}$	0.002	0.001	0.022	-1.303	0.595
$LRE_{t-4,t}$	0.001	0.000	0.019	-1.084	1.321
$InitialDev_t$	0.037	0.033	0.154	-5.066	5.671
$NetCFO_t$	0.051	0.044	0.096	-0.325	0.511
$DNetCFO_t$	0.228	0.000	0.419	0.000	1.000
$\Delta NetCFO_t$	0.004	0.001	0.104	-0.457	0.588
$D\Delta NetCFO_t$	0.493	0.000	0.500	0.000	1.000
$NetCFOdev_t$	0.010	0.004	0.094	-0.380	0.488
$DNetCFOdev_t$	0.471	0.000	0.499	0.000	1.000
$\Delta PaidLoss_t$	-0.013	-0.009	0.097	-1.609	1.593
$D\Delta PaidLoss_t$	0.602	1.000	0.489	0.000	1.000
$\Delta Premium_t$	0.026	0.012	0.115	-1.608	1.829
$D\Delta Premium_t$	0.369	0.000	0.482	0.000	1.000
$\Delta NetInvGain_t$	0.001	0.001	0.028	-0.868	0.758
$D\Delta NetInvGain_t$	0.434	0.000	0.496	0.000	1.000
$Group_t$	0.683	1.000	0.465	0.000	1.000
$Stock_t$	0.679	1.000	0.467	0.000	1.000
$Other\_OrgForm_t$	0.054	0.000	0.226	0.000	1.000
NOL_t	0.198	0.000	0.398	0.000	1.000
$Smooth_t$	5.127	5.000	2.695	1.000	10.000
$RateReg_t$	0.060	0.000	0.129	0.000	0.995
$Z\text{-}score_{t-1}$	2.900	2.893	1.003	-5.023	16.321
$Rein\_usage_t$	0.395	0.340	0.282	0.000	1.000
$Leverage_{t-1}$	1.023	0.902	0.690	0.007	3.457
$Growth_t$	0.092	0.040	0.399	-1.113	4.394
$GHHI_t$	0.399	0.389	0.102	0.067	1.000
$PHHI_t$	0.504	0.407	0.300	0.080	1.000
$LossProp\_lp_{t-1}$	0.309	0.160	0.329	0.000	1.000
$LossProp\_lc_{t-1}$	0.443	0.338	0.413	0.000	1.000
$LossProp\_sc_{t-1}$	0.160	0.041	0.277	0.000	1.000
$Asset_t$ *(billion)*	0.799	0.091	3.997	0.000	127.341
# of Firm-Year Observations (# of Firms)					23,562 (2,291)
% of *DPW* Represented by Sample					0.723
% of *Loss Reserves* Represented by Sample					0.809
T-test of $H_0 : mean(InitialDev_t) <= 0$					
t statistic = 36.84			*p-value* = 0.000		

Note: This table reports the summary statistics of variables. A list of variable definitions is provided in Appendix A.

reserve error variables are positive, indicating that the incurred losses reported in the calendar year t are, on average, over-reported.

The mean of net cash flows from underwriting is 5 percent of total admitted assets, and 23 percent of observations have negative net cash flows. The average change in net cash flows from insurance is only 0.4 percent of total admitted assets, but the minimum and maximum values of net cash flow change are non-trivial. About 50 percent of observations experience net cash flow decrease. The average deviation of net cash flows from the industry median is positive, and 1 percent of total admitted assets, but 47 percent of observations have their net cash flows below the level of industry median. The average changes in net premiums written and net investment gains are 3 percent and 0.1 percent of total admitted assets. Moreover, there are 37 percent and 43 percent of observations that face a decrease in net premiums written and a decrease in net investment gains, respectively. The pairwise correlations between the five news predictors are displayed in Table 2-3. I find that all predictors are positively and significantly related to each other, except that the change in net investment gains is weakly related to others.

Table 2-3: Pairwise Correlations Between Various News Predictors

Variables	$NetCFO_t$	$\Delta NetCFO_t$	$NetCFOdev_t$	$\Delta PaidLoss_t$	$\Delta Premium_t$	$\Delta NetInvGain_t$
$NetCFO_t$	1.000					
$\Delta NetCFO_t$	0.569*	1.000				
$NetCFOdev_t$	0.989*	0.572*	1.000			
$\Delta PaidLoss_t$	0.026*	0.395*	0.022*	1.000		
$\Delta Premium_t$	0.460*	0.226*	0.455*	-0.451*	1.000	
$\Delta NetInvGain_t$	0.102*	0.008	0.099*	-0.073*	0.083*	1.000

Note: * shows statistical significance at 5% level.

Regarding other firm characteristics, 68 percent of observations are affiliated with a group, 68 percent are stock firms, and 27 percent are mutuals or reciprocals. Only 5 percent of observations are in other organizational forms, such as Lloyd's of London. Insurers, on average, cede 40 percent of gross premiums to reinsurers and have a 9 percent growth rate in net premiums written. The average proportions of incurred losses in long-tail and private, long-tail and commercial, and short-tail and commercial lines are 31 percent, 44 percent, and 16 percent, respectively. The remaining incurred losses are in short-tail and private lines. The average premium-to-surplus ratio (leverage) is 1.02 and the maximum is 3.46. The average geographical and product line Herfindahl Indexes are 0.40 and 0.50, respectively. Insurers, on average, have 8 percent of total premiums exposed to strict rate regulation. The mean of the log value of the Z-score is 2.90, which is consistent with the mean of 2.88 reported by Laeven and Levine (2009). A net operating loss carryforward is present in 20 percent of observations.

2.5 Regression Models

2.5.1 Existence of Ex-Post Conservatism

Following Ball and Shivakumar (2005), I model *ex-post* conservatism as an *asymmetric* and negative correlation between the incurred losses and the current net cash flows from underwriting. Managers may update their expectations of future loss payments based on the current loss payments because a loss shock may affect multiple periods (Ball and Shivakumar, 2005). Hence, the current net cash flows from underwriting can be a predictor for expected revisions in future cash flows. Negative net cash flows indicate high loss payments in the current period and thus positive revisions in future expected losses. The expected loss increase is defined as *bad news*. Alternatively, positive net cash flows indicate that insurers experience favorable loss shocks. The expected decrease in future losses is defined as *good news*.

In addition to the current net cash flows from underwriting, I also run the regression using two different net cash flow predictors following Ball and Shivakumar (2006). The first one is the change in *NetCFO* from t-1 to t, $\Delta NetCFO_t$. The second predictor is the deviation of an insurer's *NetCFO* from the industry median, denoted by $NetCFOdev_t$. The corresponding indicators of bad news are equal to 1 if the predictors are negative, indicating whether net cash flows are decreased or whether the firm's net cash flows are below the industry median level. One thing to note is that $NetCFOdev_t$ cannot capture industry-level loss shocks.

The net cash flow from underwriting mixes cash inflows of premiums (premiums collected net of reinsurance) and cash outflows of losses (benefits and loss related payments) and expenses (commission expenses and income taxes). In addition to the net cash flows, I also use the change in net premiums written and the change in paid losses as additional news predictors. However, premium or loss payment by itself is partial information. They can increase as the business size increases. Although loss payment directly links to loss experience, the net cash flows can provide a complete picture and tease out the increase in loss payment purely due to the size effect.

I include the change in loss payments ($\Delta PaidLoss_t$) as a news predictor. To be consistent with other predictors that a negative value of the predictor indicates bad news, I use the inverse difference of paid losses, i.e., the loss related payments of the year t-1 minus the loss related payments of the year t. The associated dummy variable for bad news is $D\Delta PaidLoss_t = 1$ if $\Delta PaidLoss_t < 0$, which means that the paid losses are increased in year

t. I also include the change in net premiums written ($\Delta Premium_t$) and its associated dummy variable for bad news, $D\Delta Premium_t = 1$ if $\Delta Premium_t < 0$. The bad news dummy indicates whether the premiums collected in year t is decreased compared to year t-1. The net premiums written measures the sales of insurance products.[13] The decrease in premiums means that a firm's market size is shrinking. In this case, agents and employees of the insurers are likely to be less selective in underwriting and underwrite more bad customers to expand the business size. As a result, the insurer may expect future loss increases since bad customers can cause more losses. Hence, the decrease in premiums written may also predict positive revisions in future expected losses.

The last news predictor I include is the change in net investment gains, $\Delta NetInvGain_t$. The net investment gains in Income Statement include net investment income and net realized capital gains after tax and are important sources of profit for insurance companies. When the net investment gains decrease, the insurer becomes less profitable, has fewer capital infusions, and has fewer resources to cover future losses. Even though the decrease in net investment gains is not a predictor for expected loss increase *per se*, it implies adverse shocks to an insurer's ability to pay off future liabilities. Hence, *ex-post* conservative insurers should become more sensitive to future losses and reserve more expected losses when the net investment gains decrease.

The model to test the existence of *ex-post* conservatism is:

$$\begin{aligned} IncurredLoss_{it} &= \alpha + \beta_1 Dbadnews_{it} + \beta_2 NewsPredictor_{it} \\ &\quad + \beta_3 Dbadnews_{it} * NewsPredictor_{it} + \mathbf{X}_{it}\gamma + y_t + c_i + \varepsilon_{it} \end{aligned} \qquad \textbf{(2.4)}$$

[13] A similar term is premiums earned, which measures the revenues of underwriting and is reported in the Income statement. The results using premiums earned as the news predictor is qualitatively and quantitatively consistent with the results using net premiums written. I do not report premiums earned for space limitations.

where $IncurredLoss_{it}$ = the total incurred losses of insurer i evaluated in the calendar year t, scaled by the total admitted assets at the end of year t-1,

$NewsPredictor_{it}$ = one of the following six news predictors: $NetCFO_{it}$, $\Delta NetCFO_t$, $NetCFOdev_t$, $\Delta PaidLoss_t$, $\Delta Premium_t$, or $\Delta NetInvGain_t$; all predictors are scaled by the total admitted assets of year t-1,

$Dbadnews_{it}$ = the dummy variable for bad news, equal to 1 if $NewsPredictor_{it} < 0$,

$\mathbf{X}_{it}$ = time-varying control variables of insurer i, including four managerial incentive variables of taxation (*NOL*), income smoothing (*Smooth*), rate regulation (*RateReg*), and financial strength (*Z-score*), and a set of firm characteristics of *Group* dummy, *Stock* dummy, a dummy for organizational form other than stock and mutual (*Other_OrgForm*), usage of reinsurance (*Rein_usage*), *Leverage*, premium growth rate (*Growth*), Product and Geographic Herfindahl Index (*PHHI* and *GHHI*), and loss proportions in different types of product lines.

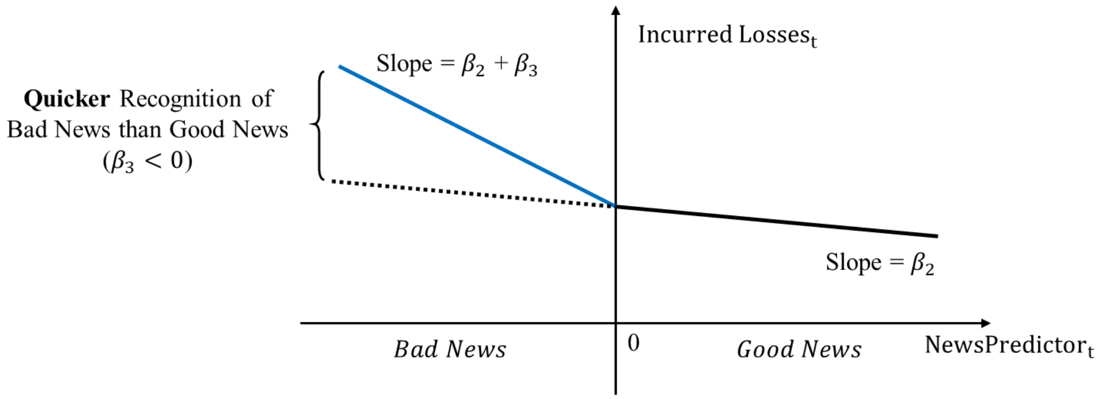
y_t = year-fixed effects,

c_i = firm-fixed effects, and

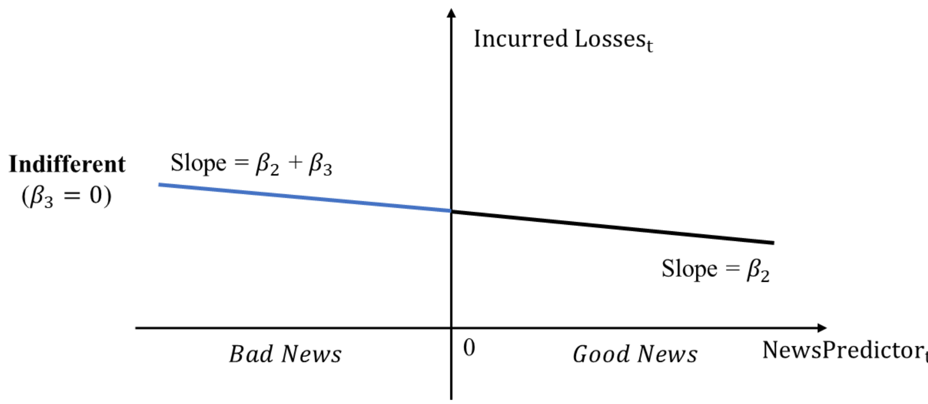
ε_{it} = zero-mean random error.

I rely on the Panel A of Figure 2 to interpret the coefficients. Using the *NetCFO* as an example, when good news is expected $(DNetCFO_{it} = 0)$, the change in incurred losses for an increase in *NetCFO* is β_2 and shown by the solid black line. I predict that β_2 may be slightly negative. The estimate of incurred losses may go slightly downward when *NetCFO* is positive and increases because insurers are experiencing favorable loss shocks. They may release some reserves as few claims are paid than expected.

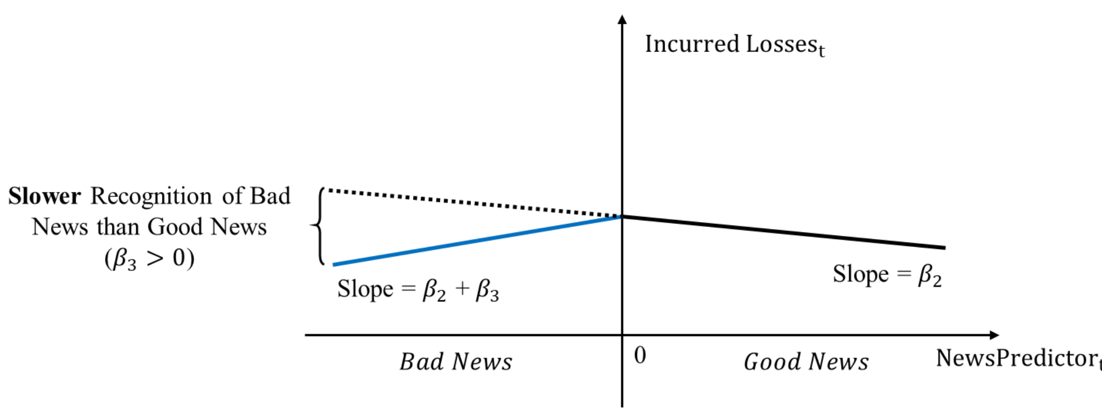
When bad news is expected $(DNetCFO_{it} = 1)$, the change in incurred losses for a unit decrease in *NetCFO* is $\beta_2 + \beta_3$ and shown by the solid blue line. Under *ex-post* conservatism, the estimate of incurred losses significantly increases when *NetCFO* is



Panel A: *Ex-Post* Conservative Reserving



Panel B: Mechanically Reserving (Indifferent to Good and Bad News)



Panel C: *Ex-Post* Anti-Conservative Reserving

Figure 2: Existence of *Ex-Post* Conservatism, Three Situations

negative and decreases. Insurers reserve not only current loss increases but also expected loss increases due to adverse loss shocks. The existence of *ex-post* conservatism predicts a negative incremental coefficient β_3, indicating that the expected loss increase is recognized more quickly than the expected loss decrease. β_3 is also called the *asymmetric timeliness coefficient*.

I also plot two alternative situations in Panels B and C of Figure 2. Panel B displays the case when insurers are mechanically reserving. When insurers are indifferent to bad and good news, they have the same adjustment in incurred losses. Panel C shows the case when insurers are *ex-post* anti-conservative. In this situation, insurers are more reluctant to report bad news than good news.

The *IncurredLoss* extracted from Schedule P, Part 2 has information overlap with *NetCFO* or Δ*PaidLoss*. The cash flows paying for losses attributable to the accident years t-1 through t-4 in the calendar year t are included in *IncurredLoss* as well as *NetCFO* or Δ*PaidLoss*. I do not expect that this overlap would significantly impact my results since old accident years usually generate fewer loss payments after loss development. As a robustness check, I replace the *IncurredLoss* with the *LossReserves* as the dependent variable. I extract data on cumulative paid losses for each accident year from Schedule P, Part 3 and subtract them from the corresponding incurred losses to obtain the loss reserves. The results for *LossReserves* are qualitatively consistent.

Control Variables

Several variables are included to control for other managerial incentives related to loss reserve management, including the incentives to inflate financial strength ratio (*Z-*

score), to deter tax payments (*NOL*), to smooth income (*Smooth*), and to lighten rate regulation (*RateReg*).

I use the natural logarithm of Z-score to measure financial strength. Z-score is the sum of the return on asset (ROA) and the capital-to-asset ratio, divided by the standard deviation of ROA during the past five years (Laeven and Levine, 2009). A high value of the Z-score indicates strong financial conditions. The previous literature finds that financially weak firms are likely to under-report loss reserves to improve regulatory ratios (Gaver and Paterson, 2004; Grace and Leverty, 2012). Hence, I predict a positive coefficient for Z-score. I use the lagged value $Z\text{-}score_{t-1}$ in the regression so that it is not affected by loss reserves reported in the current year.

Following Gassen et al. (2006), I measure income smoothing as the standard deviation of net income divided by the standard deviation of cash flows during the past five years, both scaled by the total admitted assets. I use the decile ranking of income smoothing, $Rank(Smooth)_t$. A higher rank indicates smoother net income. The relationship between income smoothing and the loss reserves is not uniform. Beaver, McNichols, and Nelson (2003) find that insurers with small losses tend to under-report loss reserves to avoid reporting a loss, whereas insurers with large profits tend to over-report loss reserves to smooth net income. Therefore, I do not predict a sign for income smoothing variable.

Taxation incentive is measured by the net operating loss carryforward dummy, NOL_t, which is equal to 1 if the insurer's previous year's net income is negative, and 0 otherwise. Insurers with NOL equal to 0 have stronger incentives to over-estimate loss reserves and defer tax payments than insurers with NOL equal to 1. Hence, I predict a negative coefficient for NOL.

Rate regulation, denoted as $RateReg_t$, measures an insurer's proportion of direct premiums written exposed to strict rate regulation. For the insurer *i* in year *t* operating in state *s* and line *l*:

$$RateReg_{it} = \frac{\sum_{s,l}(DPW_{i,s,l,t} * Strict_{s,l,t})}{\sum_{s,l} DPW_{i,s,l,t}} \qquad \textbf{(2.5)}$$

where $Strict_{s,l,t}$ = a dummy equal to 1 if line *l* is strictly regulated in state *s*, and 0 otherwise.

The data on strictly rate-regulated lines of each state are obtained from multiple sources, including Harrington (2002) and NAIC Auto Database Reports (2005-2017). A state has strict rate regulation if the insurance rate is state-made or prior-approval. I consider private passenger auto liability and physical damage lines as rate-regulated lines in this chapter. Since rate regulation often suppresses insurance rates, insurers operating in strict rate regulation states tend to inflate loss reserves to signal that the current rate regulation is too strict and that the premium rate is inadequate (Grace and Leverty, 2010). Thus, I predict a positive sign for rate regulation.

I also control for other time-varying firm characteristics. $Group_t$ is a dummy equal to 1 if an insurer is affiliated with an insurance group. $Stock_t$ and $Other\_OrgForm_t$ are two organizational form dummies, indicating whether an insurer is a stock form, or whether an insurer is neither stock nor mutual. The omitted category is mutual (or reciprocal). $Rein\_usage_t$ is the ratio of premiums ceded to the sum of direct premiums written and premiums assumed. *Leverage* is the ratio of net premiums written to surplus. I use lagged value $Leverage_{t-1}$ since the surplus is affected by loss reserves. $Growth_t$ is a one-year growth ratio of net premiums written from t-1 to t. $GHHI_t$ and $PHHI_t$ is the Herfindahl-Hirschman Index of direct premiums written over geographical areas and product lines. *LossProp_lp, LossProp_lc, LossProp_sc* are the proportion of incurred losses in long-tail and private lines, long-tail and commercial lines, and short-tail and comer lines (Grace and Leverty, 2012).[14] The omitted category is short-tail and private lines. Again, I use the lagged values of these three variables to avoid the effect of loss reserve change.

2.5.2 Relations Between Ex-Post Conservatism and Other Managerial Incentives

To investigate the effects of *ex-ante* conservatism and other managerial incentives on *ex-post* conservatism, I multiply the interaction term with various impacting factors. I investigate five impacting factors, including *ex-ante* conservatism $(Ex\text{-}AnteCons_{it})$, the incentive for smoothing income $(Rank(Smooth)_{it-1})$, the incentive for inflating the financial strength ratio $(Rank(Z\text{-}score)_{it-2})$, the taxation incentive (NOL_{it}), and the premium exposures to rate regulation $(Rank(RateReg)_{it})$. All factors are decile rankings with the exception of *NOL* which is a dummy variable. I try to evaluate these factors based on lagged information so that they are not affected by the management of loss reserves reported in the current year, except rate regulation which solely depends on premiums.

I include the second-order term of $Ex\text{-}AnteCons_t$ to test for the nonlinear relationship between *ex-ante* and *ex-post* conservatism predicted by H3. The regression model is:

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[14] The tail refers to the length of the loss payout period. Using data from the Schedule P of NAIC statutory financial statements, long-tail lines refer to those with 10 accident years reported, and short-tail lines refer to those with only two accident years reported (Cummins and Xie, 2013). A list of product lines is shown in Appendix C.

$$\begin{aligned} IncurredLoss_{it} = {} & \alpha + \beta_1 Dbadnews_{it} + \beta_2 NewsPredictor_{it} \\ & + \beta_3 Dbadnews_{it} * NewsPredictor_{it} \\ & + \beta_4 Dbadnews_{it} * NewsPredictor_{it} * Ex\text{-}AnteCons_{it} \\ & + \beta_5 Dbadnews_{it} * NewsPredictor_{it} * (Ex\text{-}AnteCons_{it})^2 \\ & + \mathbf{X}_{it}\gamma + y_t + c_i + \varepsilon_{it} \end{aligned} \qquad \textbf{(2.6)}$$

where $Ex\text{-}AnteCons_{it}$ = The level of *ex-ante* conservatism measured by the decile ranking of initial loss reserve deviation, $InitialDev_t$.

The marginal effect of *ex-ante* conservatism on *ex-post* conservatism is defined as:

$$\begin{aligned} \text{Marginal Effect} & = \frac{\partial(IncurredLosses)}{\partial(Dbadnews * NewsPredictor)} \\ & = \beta_3 + \beta_4 * Ex\text{-}AnteCons + \beta_5 Ex\text{-}AnteCons^2 \end{aligned} \qquad \textbf{(2.7)}$$

The coefficients of interests are β_3, β_4, and β_5. *Ex-post* conservatism implies a negative β_3. I predict a positive β_4 and a negative β_5, indicating a nonlinear and U-shape relationship between *ex-ante* and *ex-post* conservatism. Since conditional conservatism implies a negative interaction coefficient, the marginal effect indicated by the interaction coefficient is in a reverse U-shape.

I test a linear relationship between *ex-post* conservatism and other four factors which correspond to hypotheses H4.1 to H4.4:

$$\begin{aligned} IncurredLoss_{it} = {} & \alpha + \beta_1 Dbadnews_{it} + \beta_2 NewsPredictor_{it} \\ & + \beta_3 Dbadnews_{it} * NewsPredictor_{it} \\ & + \beta_4 Dbadnews_{it} * NewsPredictor_{it} * Factor \\ & + \mathbf{X}_{it}\gamma + y_t + c_i + \varepsilon_{it} \end{aligned} \qquad \textbf{(2.8)}$$

where $Factor$ = One of the four factors, $Rank(Smooth)_{it-1}$, $Rank(Z\text{-}score)_{it-2}$, NOL_{it}, or $Rank(RateReg)_{it}$.

The coefficients of interests are β_3 and β_4. The coefficient β_3 represents the level of *ex-post* conservatism when the impacting factor is zero, and the coefficient β_4

represents the change in the level of *ex-post* conservatism when the impacting factor increases by one unit. Since *ex-post* conservatism predicts a negative β_3, a positive β_4 means that the impacting factor attenuates the level of *ex-post* conservatism as the overall interaction coefficient becomes less negative.

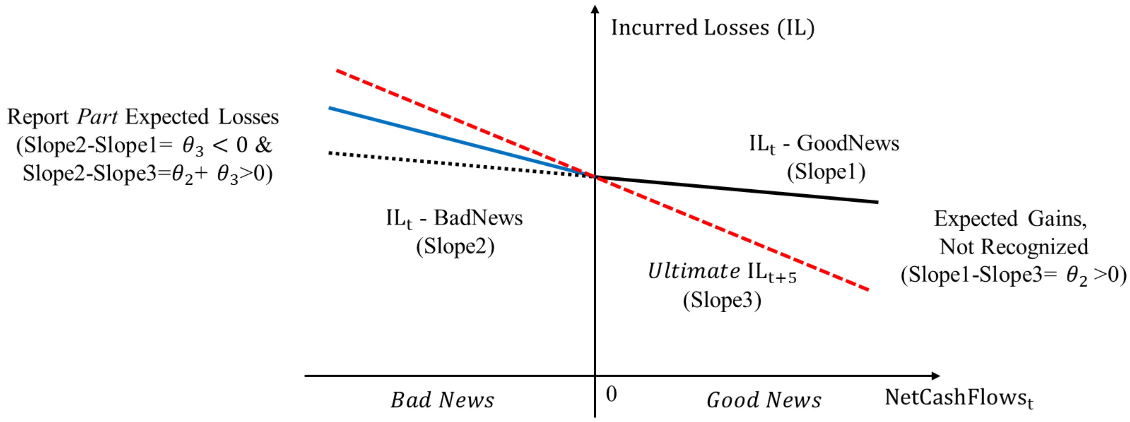
2.5.3 Overuse of Ex-Post Conservatism

The main regression model for the existence of *ex-post* conservatism can be further extended to test how much the expected loss increases are recognized, given the existence of *ex-post* conservatism. The magnitude of β_3 in the main regression model can measure the level of *ex-post* conservatism and reflects the difference in the timeliness of reporting bad and good news. The extended model, however, measures the level of *ex-post* conservatism differently. I modify the main regression model and replace the dependent variable with the loss reserve errors:

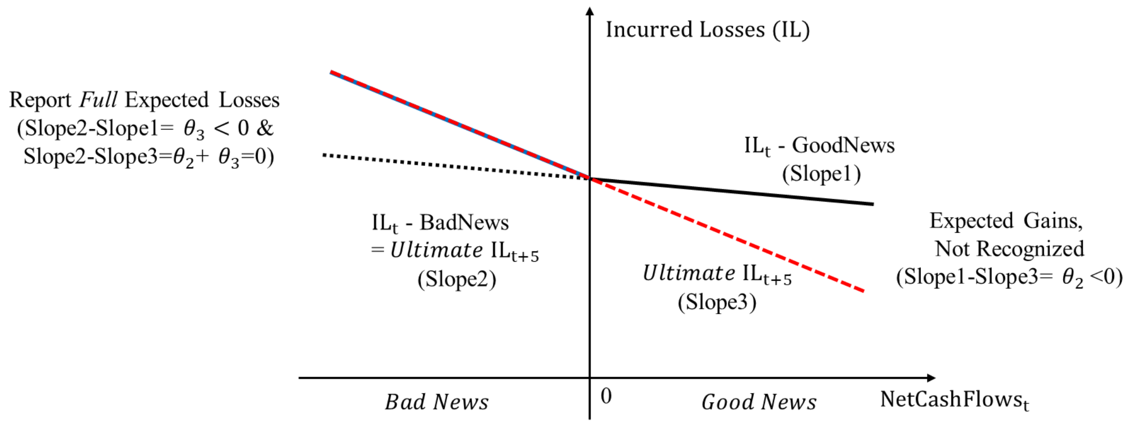
$$\begin{aligned} LRE_{it} &= \alpha + \theta_1 DNetCFO_{it} + \theta_2 NetCFO_{it} + \theta_3 DNetCFO_{it} * NetCFO_{it} \\ &\quad + \mathbf{X}_{it}\gamma + y_t + c_i + \varepsilon_{it} \end{aligned} \tag{2.9}$$

where LRE_{it} can be either $LRE_{i,t-1,t}$, $LRE_{i,t-2,t}$, $LRE_{i,t-3,t}$, $LRE_{i,t-4,t}$, or $LRE_{i,total,t}$.

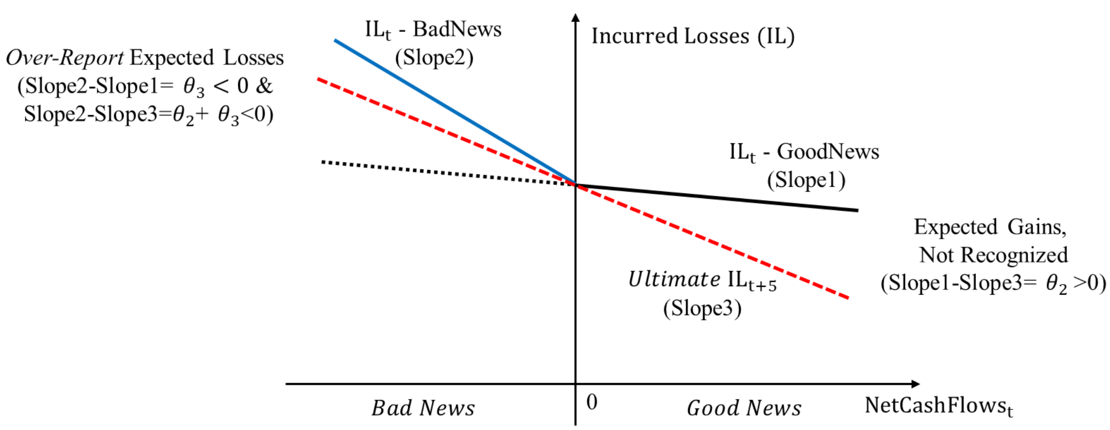
Figure 3 decomposes the loss reserve error into the incurred losses reported in the calendar year t (IL_t) and the incurred losses ultimately reported in the calendar year t+5 (IL_{t+5}), and plots both of their distributions over the net cash flows from underwriting. The distribution of IL_t is similar to Panel A of Figure 2. The bad-news part is depicted by the solid blue line, and the good-news part is depicted by the solid black line. The distribution of IL_{t+5} is represented by the dash red line and proxies for the distribution of the ultimate



Panel A: Moderate Level of *Ex-Post* Conservatism



Panel B: High Level of *Ex-Post* Conservatism



Panel C: Extremely High Level of *Ex-Post* Conservatism

Figure 3: Level of *Ex-Post* Conservatism, Three Situations

value of incurred losses. For simplicity, I assume that there is one loss shock that can be favorable or adverse and impacts both current and future loss payments.[15]

I offer three predictions on the coefficients for this model. First, θ_2 is positive if expected loss decreases are not quickly recognized. When expected loss decreases (i.e., expected gains) are expected $(DNetCFO_{it} = 0)$, the change in loss reserve error is θ_2, which equals the change in IL_t (slope1) minus the change in IL_{t+5} (slope3). The change in ultimate losses reflects not only current loss reduction but also future loss reductions due to the favorable loss shock. If the change in IL_t is less than the change in ultimate losses, then it means that expected gains are not quickly recognized.

The second prediction is that θ_3 is negative if expected loss increases (expected losses) are recognized more quickly than expected loss decreases (expected gains). When expected loss increases are expected $(DNetCFO_{it} = 1)$, the change in loss reserve error is $\theta_2 + \theta_3$, which equals the change in IL_t (slope2) minus the change in IL_{t+5} (slope3) in the bad-news domain. If insurers report expected losses more quickly than expected gains, then IL_t should approach IL_{t+5} more quickly in the bad-news domain than it does in the good-news domain. Therefore, a negative θ_3 indicates quicker recognition of expected losses than expected gains, namely the existence of *ex-post* conservatism. The rationales behind θ_3 and the β_3 in the main regression model are the same.

[15] To relax this assumption, I assume there are independent loss shocks occurring in the future and only affect the ultimate losses. If future loss shocks are favorable, then the ultimate losses are lower than I predicted. This may over-estimate the amount of expected losses recognized in current year and thus the level of *ex-post* conservatism. If future loss shocks are adverse, then the ultimate losses are higher than I predicted, and the level of *ex-post* conservatism is underestimated.

The third prediction is about how much the expected losses are reported in the current year t. Given the existence of *ex-post* conservatism ($\beta_3 < 0$), insurers may report part of expected loss increases (Panel A), full expected loss increases (Panel B), or over-report expected loss increases (Panel C). Insurers engaging in a moderate level of *ex-post* conservatism do not fully report expected loss increases; hence, for a unit decrease in current net cash flows, the increase in IL_t is smaller than the increase in IL_{t+5}, which predicts $\theta_2 + \theta_3 = Slope2 - Slope3 > 0$. When insurers fully recognize expected loss increases, the changes in IL_t and IL_{t+5} are the same, which predicts $\theta_2 + \theta_3 = 0$. Alternatively, insurers may be *ex-post* extremely conservative, and over-report expected losses. In this case, the change in IL_t is greater than the change in ultimate losses because some losses reserved by the insurer may not occur in the future. In sum, $\theta_2 + \theta_3$ reflects whether the expected loss increases that are recognized in the current year are more than the "true value" of these loss revisions or not.

All fixed-effect estimators are estimated via the demeaned method. Throughout this chapter, I report the overall R-squareds that quantify the overall effect of both explanatory variables and fixed effects on the fit of the model. In addition, I cluster the standard errors by firms to address the autocorrelation of observations over time.

2.6 Empirical Results

2.6.1 Existence of Ex-Ante and Ex-Post Conservatism

There are 16,715 firm-year observations, approximately 71% of 23,562 observations, that have a positive initial loss reserve deviation $InitialDev_t$. I conduct a t-test on the null hypothesis that the initial loss reserve deviation is zero or negative (

$H_0 : mean(InitialDev_t) <= 0$). The t-statistic and *p-value* are reported at the bottom of Table 2-2. I can reject the null hypothesis and state that the average initial loss reserve deviation is significantly positive. This suggests that *ex-ante* conservatism, on average, significantly exists in the P&L insurance industry.

Table 2-4 reports the results of testing for the existence of *ex-post* conservatism. I employ six news predictors, and their results are displayed in columns (1) through (6), respectively. *Ex-post* conservatism exists if $\beta_3 < 0$. The coefficients of the news predictor and the interaction term are reported at the top of the table. I find that the interaction coefficient is statistically significant and negative for any news predictor that I use. For example, the coefficients in column (1) indicate that when bad news is expected (*DNetCFO=1*), a reduction of $100 in net cash flows from underwriting is associated with $67.7 increase in the incurred loss reported in the current year; however, when good news is expected (*DNetCFO=0*), I do not find a significant adjustment of currently reported incurred losses in response to an increase in net cash flows from underwriting.

If I predict future losses using $\Delta NetCFO$, the interpretation of coefficients is not straightforward because β_2 is significantly positive. When $\Delta NetCFO$ is positive and increases by $100, I find that insurers on average increase currently reported incurred losses by $67. When $\Delta NetCFO$ is negative and decreases by $100, insurers on average decrease currently reported incurred losses by $35 (0.67 + (-0.32) = 0.35). In the absence of *ex-post* conservatism ($\beta_3 = 0$), insurers might have reduced currently reported incurred losses by $67; however, there is an additional increment in currently reported incurred losses of $32 due to *ex-post* conservatism. Therefore, I observe the net decrease in currently reported incurred losses to be $35. A positive β_2 may exist due to opportunistic

Table 2-4: Prevalence of *Ex-Post* Conservatism

Dependent Var =	Predicted Sign	(1) $IncurredLoss_t$	(2) $IncurredLoss_t$	(3) $IncurredLoss_t$	(4) $IncurredLoss_t$	(5) $IncurredLoss_t$	(6) $IncurredLoss_t$
News Predictor=		$\boldsymbol{NetCFO_t}$	$\boldsymbol{\Delta NetCFO_t}$	$\boldsymbol{NetCFOdev_t}$	$\boldsymbol{\Delta PaidLoss_t}$	$\boldsymbol{\Delta Premium_t}$	$\boldsymbol{\Delta NetInvGain_t}$
Asymmetric Timeliness Coefficients:							
Dbadnews		0.003	0.023	0.002	-0.016	-0.005	0.016
		(0.013)	(0.015)	(0.009)	(0.016)	(0.017)	(0.011)
News Predictor	-	-0.127	0.670***	-0.045	0.753***	0.298*	0.595
		(0.094)	(0.083)	(0.096)	(0.120)	(0.174)	(0.470)
Dbadnews * News Predictor	-	**-0.677*** **	**-0.317** **	**-0.660*** **	**-0.394*** **	**-0.577*** **	**-1.902*** **
		(0.249)	(0.157)	(0.225)	(0.147)	(0.212)	(0.700)
Controlling Other Managerial Incentives:							
NOL_t	-	0.031***	0.028***	0.030***	0.033***	0.034***	0.040***
		(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
$Rank(Smooth)_t$	+/-	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
		(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$RateReg_t$	+	0.003	0.007	0.004	0.010	-0.009	0.000
		(0.094)	(0.095)	(0.094)	(0.093)	(0.094)	(0.094)
$Z\text{-}score_{t-1}$	+	-0.009	-0.010	-0.009	-0.009	-0.012	-0.014
		(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Controlling Firm characteristics:							
$Group_t$		-0.014	-0.015	-0.014	-0.013	-0.014	-0.014
		(0.025)	(0.026)	(0.025)	(0.025)	(0.026)	(0.026)
$Stock_t$		-0.133***	-0.148***	-0.131***	-0.146***	-0.145***	-0.138***
		(0.047)	(0.047)	(0.047)	(0.048)	(0.048)	(0.047)
$Other\_OrgForm_t$		0.001	-0.013	0.003	-0.009	-0.012	-0.008
		(0.073)	(0.075)	(0.073)	(0.075)	(0.073)	(0.071)

Table 2-4. Prevalence of *Ex-Post* Conservatism (continued)

Dependent Var =	Predicted Sign	(1) *IncurredLoss$_t$*	(2) *IncurredLoss$_t$*	(3) *IncurredLoss$_t$*	(4) *IncurredLoss$_t$*	(5) *IncurredLoss$_t$*	(6) *IncurredLoss$_t$*
News Predictor=		***NetCFO$_t$***	**Δ*NetCFO$_t$***	***NetCFOdev$_t$***	***ΔPaidLoss$_t$***	***ΔPremium$_t$***	***ΔNetInvGain$_t$***
Rein_usage$_t$		-0.037	-0.024	-0.038	-0.050	-0.028	-0.018
		(0.131)	(0.132)	(0.131)	(0.135)	(0.134)	(0.135)
Leverage$_{t-1}$		0.156***	0.158***	0.157***	0.160***	0.140***	0.152***
		(0.026)	(0.026)	(0.025)	(0.025)	(0.027)	(0.025)
Growth$_t$		-0.074**	-0.131***	-0.074**	-0.073**	-0.129**	-0.094***
		(0.034)	(0.034)	(0.034)	(0.033)	(0.058)	(0.033)
PHHI$_t$		-0.019	-0.026	-0.019	-0.030	-0.025	-0.016
		(0.121)	(0.122)	(0.121)	(0.123)	(0.122)	(0.123)
GHHI$_t$		0.120	0.113	0.119	0.113	0.118	0.118
		(0.390)	(0.391)	(0.390)	(0.392)	(0.390)	(0.391)
LossProp_lp$_{t-1}$		-0.014	-0.034	-0.017	-0.054	-0.013	-0.024
		(0.111)	(0.110)	(0.111)	(0.112)	(0.111)	(0.111)
LossProp_lc$_{t-1}$		-0.033	-0.040	-0.036	-0.054	-0.033	-0.042
		(0.104)	(0.103)	(0.104)	(0.105)	(0.105)	(0.104)
LossProp_sc$_{t-1}$		-0.174	-0.193*	-0.178*	-0.214*	-0.181*	-0.189*
		(0.108)	(0.107)	(0.108)	(0.109)	(0.109)	(0.108)
Constant		0.924***	0.938***	0.909***	0.987***	0.956***	0.939***
		(0.146)	(0.151)	(0.148)	(0.154)	(0.149)	(0.146)
Observations		23,562	23,562	23,562	23,562	23,562	23,562
Overall R-squared		0.409	0.410	0.409	0.412	0.408	0.409
Year FE		Yes	Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes	Yes

Note: This table reports the result of examining the existence of *ex-post* conservatism. Standard errors in parentheses are clustered by companies. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The dependent variable is the total incurred losses reported in the calendar year t. The key explanatory variables are the news predictor and its interaction with the bad-news dummy variable. The definitions of all variables are provided in Appendix A.

managerial behavior of under-reporting losses in bad-news years, but a negative β_3 implies that *ex-post* conservatism offset the opportunistic manipulation of loss reserves to some extent. Overall, I find evidence showing that *ex-post* conservatism significantly exists in the P&L insurance industry.

Regarding the coefficients of other managerial incentive variables, only NOL has statistically significant coefficients, but the sign is opposite to my prediction. Nevertheless, these managerial incentive variables are control variables and not the focus of this chapter.

2.6.2 Relations Between Ex-Post Conservatism and Other Factors

Table 2-5 reports the results when the interaction term in the main regression model is further multiplied with various impacting factors. Columns (1) through (5) show the results of *ex-ante* conservatism, income smoothing, financial strength ratio, taxation, and rate regulation, respectively.

The test on *ex-ante* conservatism shows a nonlinear relationship, supporting the hypothesis of H3. The nonlinear relationship is also found using other three news predictors, but the results are not tabulated for space limit. I plot the marginal effect of *ex-ante* conservatism for *all* news predictors in Figure 4. I observe that the overall interaction coefficient at the left and right tails are similar and negative, but it goes above zero in the center. At the left tail, insurers are not *ex-ante* conservative, but are responsive to bad news. In the middle decile, insurers are *ex-ante* conservative but not responsive to bad news. However, at the right tail, insurers are conservative in both ways. I also find that the extremely conservative insurers in the deciles 8 to 10 are characterized by slightly smaller mean assets than the decile of 5. The upward trend in interaction coefficient from the left tail to the middle indicates a substitution effect – *ex-ante* conservatism preempts the need

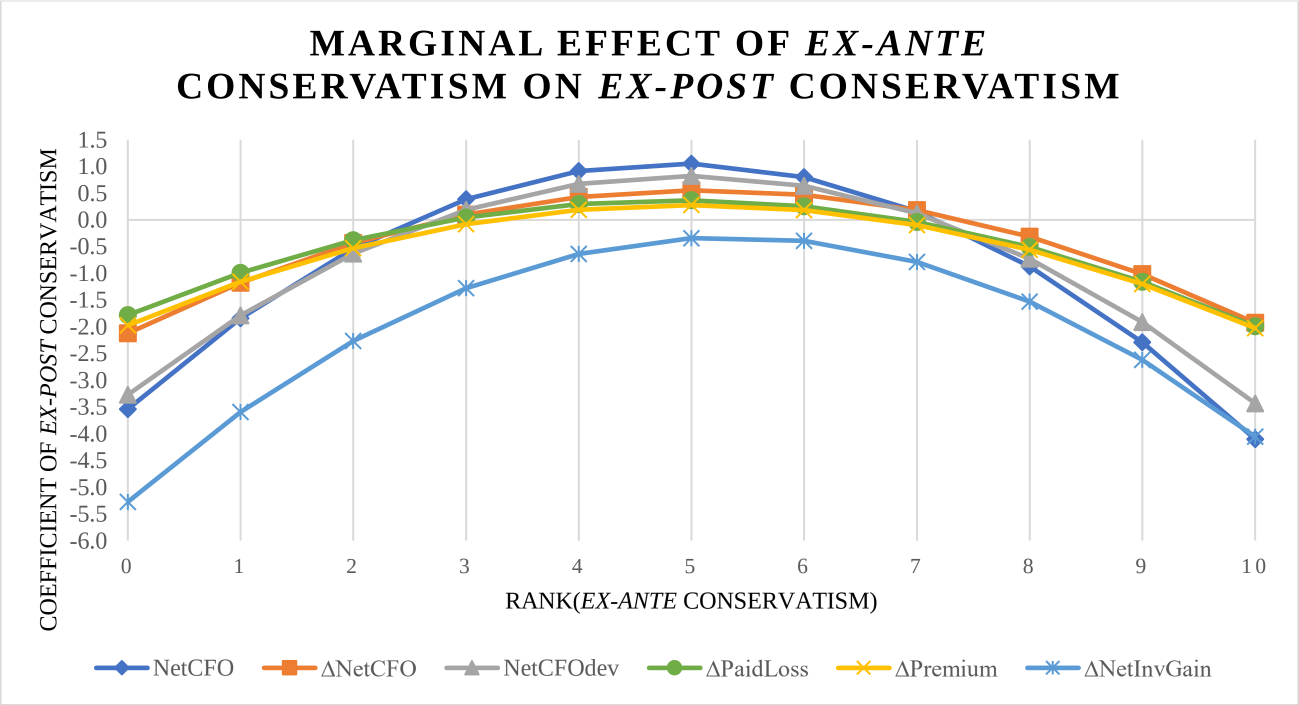


Figure 4: Marginal Effect of *Ex-Ante* Conservatism on *Ex-Post* Conservatism

Note: The x-axis is the decile rank of *ex-ante* conservatism. The y-axis is the asymmetric timeliness coefficient which is negative when *ex-post* conservatism presents. The marginal effect is to attenuate the level of *ex-post* conservatism if the coefficient becomes less negative.

Table 2-5: Relations Between *Ex-Post* Conservatism and Other Managerial Incentives

	(1)	(2)	(3)	(4)	(5)
Dependent Var =	$IncurredLoss_t$	$IncurredLoss_t$	$IncurredLoss_t$	$IncurredLoss_t$	$IncurredLoss_t$
Factor =	***Ex-AnteCons$_t$***	***Rank(Smooth)$_{t-1}$***	***Rank(Z-score)$_{t-2}$***	***NOL$_t$***	***Rank(RateReg)$_t$***
Predicted Effect on Interaction Coefficient	Nonlinear	Attenuate	Attenuate	NA	Attenuate
$DNetCFO_t$*$NetCFO_t$	-3.542***	-1.041***	-0.974***	-0.632*	-0.902**
	(0.656)	(0.321)	(0.263)	(0.330)	(0.414)
$DNetCFO_t$***$NetCFO_t$*Factor**	**1.894*** **	**0.129*** **	**0.144*** **	**-0.110**	**0.056**
	(0.428)	(0.048)	(0.039)	(0.339)	(0.055)
$DNetCFO_t$***$NetCFO_t$*Factor^2**	**-0.195*** **				
	(0.053)				
Observations	23,562	20,428	20,428	23,562	23,562
Overall R-squared	0.413	0.474	0.474	0.409	0.409
$D\Delta NetCFO_t$*$\Delta NetCFO_t$	-2.122***	-0.550***	-0.669***	-0.532***	-0.668***
	(0.508)	(0.180)	(0.189)	(0.201)	(0.242)
$D\Delta NetCFO_t$***$\Delta NetCFO_t$*Factor**	**1.050*** **	**0.014**	**0.041***	**0.774*** **	**0.090*** **
	(0.272)	(0.025)	(0.023)	(0.255)	(0.029)
$D\Delta NetCFO_t$***$\Delta NetCFO_t$*Factor^2**	**-0.103*** **				
	(0.029)				
Observations	23,562	20,428	20,428	23,562	23,562
Overall R-squared	0.413	0.476	0.476	0.411	0.411
$DNetCFOdev_t$*$NetCFOdev_t$	-3.272***	-0.837***	-0.920***	-0.640**	-0.848**
	(0.531)	(0.229)	(0.213)	(0.285)	(0.365)
$DNetCFOdev_t$***$NetCFOdev_t$*Factor**	**1.654*** **	**0.086*** **	**0.118*** **	**-0.054**	**0.047**
	(0.317)	(0.033)	(0.029)	(0.262)	(0.044)
$DNetCFOdev_t$***$NetCFOdev_t$*Factor^2**	**-0.167*** **				
	(0.038)				
Observations	23,562	20,428	20,428	23,562	23,562
Overall R-squared	0.414	0.474	0.474	0.409	0.409
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes

Note: This table reports the regression results regarding the relations between *ex-post* conservatism and other managerial incentives. Standard errors in parentheses are clustered by companies. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The same control variables are used as in Table 2-4 and omitted from reporting for space limitations. “Attenuate” means that the factor has a positive effect on the interaction coefficient and makes it less negative. The definitions of all variables are provided in Appendix A.

Table 2-6: Relations Between *Ex-Post* Conservatism and Inflating Financial Strength Ratio

	(1)	(2)	(3)
Dependent Var =	$IncurredLoss_t$	$IncurredLoss_t$	$IncurredLoss_t$
Factor =	***Rank(Z-score)$_{t-2}$***	***Rank(Z-score)$_{t-2}$***	***Rank(Z-score)$_{t-2}$***
Ranking Group	Rank = 1 to 3	Rank = 4 to 7	Rank = 8 to 10
$DNetCFO_t$*$NetCFO_t$	-1.106**	-1.366	-1.155
	(0.533)	(0.899)	(2.082)
$DNetCFO_t$***$NetCFO_t$*Rank(Z-score)$_{t-2}$**	**0.381**	**0.210**	**0.164**
	(0.311)	(0.140)	(0.227)
Observations	5,919	8,271	6,238
Overall R-squared	0.702	0.428	0.848
$D\Delta NetCFO_t$*$\Delta NetCFO_t$	-0.690**	-1.868*	-0.288
	(0.340)	(0.982)	(1.117)
$D\Delta NetCFO_t$***$\Delta NetCFO_t$*Rank(Z-score)$_{t-2}$**	**0.238***	**0.239**	**0.052**
	(0.129)	(0.149)	(0.131)
Observations	5,919	8,271	6,238
Overall R-squared	0.706	0.429	0.850
$DNetCFOdev_t$*$NetCFOdev_t$	-1.130***	-1.233	-0.276
	(0.391)	(0.879)	(1.371)
$DNetCFOdev_t$***$NetCFOdev_t$*Rank(Z-score)$_{t-2}$**	**0.389***	**0.180**	**0.034**
	(0.211)	(0.131)	(0.153)
Observations	5,919	8,271	6,238
Overall R-squared	0.703	0.428	0.848
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Note: This table reports the regression results regarding the relation between *ex-post* conservatism and managerial incentive for inflating financial strength ratio by the decile rank of Z-score. Standard errors in parentheses are clustered by companies. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The same control variables are used as in Table 2-4 and omitted from reporting for space limitations. The definitions of all variables are provided in Appendix A.

for *ex-post* conservatism. However, the downward change from the middle to the right tail suggests that *ex-ante* and *ex-post* can be compliments and increase with each other, since companies can use them for different purposes. *Ex-ante* conservatism creates a cushion whereas *ex-post* conservatism can reduce information asymmetry and agency costs.

For other managerial incentives, I find that income smoothing incentive makes the interaction coefficient less negative. The attenuation effect is statistically significant for all news predictors except Δ*NetCFO*. The timeliness asymmetry diminishes to 0 only when the firm falls into the top ranking of income smoothing incentive. Regarding the incentive for inflating financial strength ratio, I find that insurers that had low Z-score values in the past generally have a less asymmetric response to good and bad news. The incentive for inflating financial strength ratio constrains the practice of *ex-post* conservatism.

To further test the hypothesis of H4.2, I divide the sample into three parts – firms with a ranking of lagged Z-score between 1 and 3, firms with a ranking of lagged Z-score between 4 and 7, and firms with a ranking of lagged Z-score between 8 and 10. I redo the regression analysis in column 3 of Table 2-5 on each subsample and report the results in Table 2-6. I find that the magnitude of the attenuation effect is high for firms with low ranks of lagged Z-score but low for firms with high ranks of lagged Z-score.[16] This finding suggests that the effect that inflating financial strength ratio constrains *ex-post* conservatism is more significant to financially weak firms that are urgent to improve its reported financial ratios.

[16] Although the incremental coefficients of *Rank(Z-score)* are not very statistically significant, the trend in the magnitude of coefficient is consistent for all three news predictors. The statistical significance is weak possibly due to the reduced sample size.

Column 4 shows that the tax incentive does not consistently affect the results estimated by different news predictors. As stated before, I do not expect *ex-post* conservatism significantly related to tax incentive. The decile ranking of rate regulation exposures has positive incremental coefficients that make the asymmetric timeliness coefficient less negative. I find this attenuation effect for all three predictors of news, but only the effect with $\Delta NetCFO$ is statistically significant. The results in column (5) weakly support the hypothesis that insurers with high exposures to strict rate regulation have a limited capacity of adopting *ex-post* conservatism. Generally, the four hypotheses of H4.1 through H4.4 are supported by the empirical results.

2.6.3 Overuse of Ex-Post Conservatism

The regression results using the loss reserve error as dependent variables are reported in Table 2-7. Column 1 reports the result for the total loss reserve error. I further decompose the total loss reserve error into four pieces for the accident years t-1 through t-4, and their results are reported in columns 2 through 5. Table 2-7 provides limited evidence for the existence of *ex-post* conservatism. Only the interaction coefficients of *NetCFO* and *NetCFOdev* in column 2 for $LRE_{t-1,t}$ are statistically significant and negative. Compared to earlier accident years of t-2, t-3, and t-4, the incurred losses of the accident year t-1 has been developed for the shortest time and may have the largest space for *ex-post* conservatism. Moreover, the regressions using the loss reserve error provides less evidence than the regressions using the total incurred losses reported in the calendar year t possibly because other loss shocks occur after year t, impacting the ultimate losses and the loss reserve error and distorting the regression results.

Table 2-7: Overuse of *Ex-Post* Conservatism

Dependent Var =	Predicted Sign	(1) $LRE_{total,\ t}$	(2) $LRE_{t-1,t}$	(3) $LRE_{t-2,t}$	(4) $LRE_{t-3,t}$	(5) $LRE_{t-4,t}$
News Predictor = Net Cash Flows from Underwriting:						
$DNetCFO_t$		-0.002	-0.000	0.000	-0.001	-0.000
		(0.002)	(0.001)	(0.001)	(0.001)	(0.000)
$NetCFO_t$ (θ_2)	+	0.018*	0.017***	0.007*	-0.002	-0.004
		(0.011)	(0.005)	(0.004)	(0.003)	(0.002)
$DNetCFO_t$ $*NetCFO_t$ (θ_3)	**-**	-0.024	**-0.025****	0.002	0.003	-0.005
		(0.025)	(0.012)	(0.010)	(0.007)	(0.005)
H_0: $(\theta_2+\theta_3)\geq 0$		0.380	**0.196**	0.124	0.436	0.025**
Observations		23,562	23,562	23,562	23,562	23,562
Overall R-squared		0.411	0.222	0.399	0.300	0.187
News Predictor = Change in Net Cash Flows from Underwriting:						
$D\Delta NetCFO_t$		-0.002	-0.002***	-0.000	0.000	0.000
		(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
$\Delta NetCFO_t$ (θ_2)	+	-0.006	-0.004	-0.001	-0.000	0.001
		(0.010)	(0.005)	(0.005)	(0.004)	(0.005)
$D\Delta NetCFO_t$ $*\Delta NetCFO_t$ (θ_3)	-	-0.005	-0.003	0.001	0.001	-0.004
		(0.017)	(0.008)	(0.006)	(0.005)	(0.006)
H_0: $(\theta_2+\theta_3)\geq 0$		0.139	0.159	0.450	0.462	0.051*
Observations		23,562	23,562	23,562	23,562	23,562
Overall R-squared		0.411	0.222	0.398	0.300	0.187
News Predictor = Net Cash Flows from Underwriting – Industry Median:						
$NetCFOdev_t$		0.001	0.001	0.000	0.000	-0.001*
		(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
$NetCFOdev_t$ (θ_2)	+	0.024*	0.023***	0.008	-0.001	-0.006**
		(0.013)	(0.007)	(0.005)	(0.003)	(0.003)
$DNetCFOdev_t$ $*NetCFOdev_t$ (θ_3)	-	-0.016	**-0.024*****	0.002	0.007	-0.001
		(0.020)	(0.009)	(0.008)	(0.005)	(0.004)
H_0: $(\theta_2+\theta_3)\geq 0$		0.271	**0.436**	0.040**	0.067*	0.028**
Observations		23,562	23,562	23,562	23,562	23,562
Overall R-squared		0.411	0.222	0.399	0.300	0.187
Year FE		Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes

Note: This table reports the regression result regarding whether *ex-post* conservatism is overused. Standard errors in parentheses are clustered by companies. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The dependent variables are the single-year loss reserve error for the accident years t-1 through t-4 (columns 2 through 5), respectively, and their total in column 1. The same control variables are used as in Table 2-4 and omitted from reporting for space limitations. I conduct t-test on the null hypothesis that $(\theta_2+\theta_3)\geq 0$. The *p-value* is reported in the table. The definitions of all variables are provided in Appendix A.

Given the existence of *ex-post* conservatism, I examine how much the expected losses are reserved in the current year t. I conduct a t-test on the regression coefficients with the null hypothesis that expected losses are not over-reported, i.e., $\theta_2 + \theta_3 \geq 0$. The *p-value* of the t-test is reported in Table 2-7. For the two significant and negative θ_3, the t-test cannot reject the null hypothesis. Hence, I do not find evidence that insurers being *ex-post* extremely conservative and over-report expected losses more than its "true value." The P&L insurers are *ex-post* conservative to a reasonable extent.

I conduct several robustness tests to check if the result in Table 2-4, column (1) holds in different scenarios. The results are reported in Table 2-8. I find that the main regression result is robust when I (1) cluster standard errors by insurance groups, (2) exclude all small insurers that have total admitted asset smaller than $5 million, (3) exclude insurers that have a reinsurance ratio above 0.75, and (4) exclude highly leveraged insurers that have a premium-to-surplus ratio over 3. I also find that when I tease out paid losses from the incurred losses and use the loss reserves as the dependent variable, insurers do have asymmetric adjustments in loss reserves in response to good and bad news. The result is shown in column (5).

2.6.4 Opportunity Cost of Being Conservative

Based on the regression coefficient, I can calculate a back-of-the-envelope estimate of the opportunity cost of being *ex-post* conservative. To do that, I first calculate how much loss reserves are held by insurers on the balance sheet that insurers will not have in the absence of *ex-post* conservatism. Then I convert the additional reserves into capital costs to estimate the opportunity cost. I assume a cost of capital of 9% for the P&L insurance

Table 2-8: Robustness Tests for Existence of *Ex-Post* Conservatism

Dependent Var =	(1) $IncurredLoss_t$	(2) $IncurredLoss_t$	(3) $IncurredLoss_t$	(4) $IncurredLoss_t$	(5) $LossReserves_t$
Scenario:	Clustered Std. Error by Group	Exclude Small Firms	Exclude High *Rein_usage*	Exclude High *Leverage*	Loss Reserves as Dependent Variable
$DNetCFO_t$	0.003	0.003	-0.002	0.004	-0.000
	(0.013)	(0.013)	(0.011)	(0.013)	(0.004)
$NetCFO_t$	-0.127	-0.138	-0.203*	-0.125	0.056**
	(0.104)	(0.101)	(0.108)	(0.094)	(0.024)
$\boldsymbol{DNetCFO_t * NetCFO_t}$	**-0.677*** **	**-0.706*** **	**-0.498** **	**-0.677*** **	**-0.099* **
	(0.256)	(0.269)	(0.215)	(0.244)	(0.051)
Observations	23,562	22,215	19,955	23,309	23,562
Overall R-squared	0.409	0.399	0.489	0.407	0.369
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes

Note: This table reports the robustness tests for measuring the existence of *ex-post* conservatism. Standard errors in parentheses are clustered by companies except column 1 which reports clustered standard errors by insurance groups. ***, **, and * indicate statistical significance at 1%, 5%, and 10% level, respectively. The same control variables are used as in Table 2-4 and omitted from reporting for space limitations. The definitions of all variables are provided in Appendix A.

industry, based on the industry median weighted average cost of capital (WACC) from 2008 to 2012 (A. M. Best, 2019c).

I use the estimates of the asymmetric timeliness coefficient β_3 in the main regression model to calculate how much additional reserves are held under *ex-post* conservatism. I assume that each news predictor decreases by a standard deviation. The average total admitted asset of the sample is $799 million.

My calculation is for an average firm in the industry. The results are shown in Table 2-9. For all six news predictors, I find that the opportunity cost of holding more reserves and more capitals under *ex-post* conservatism varies from 2.4 to 4.7 million dollars.

I also estimate the opportunity cost of being *ex-ante* conservative. The mean of unscaled initial loss reserve deviation, $initialdev_t$, is $18.5 million. This is the amount of loss reserves that insurers hold initially beyond the ultimate value due to being conservative. However, about 29% of observations have a negative initial deviation and is deemed as non-conservative. Hence, it may be more appropriate to estimate the cost only for insurers with a positive initial deviation. The mean of $initialdev_t$ given that $initialdev_t >$ 0 is \$46.1 million, and the corresponding cost of capital is \$4.15 million.

The estimated capital cost of being *ex-ante* and/or *ex-post* conservative are moderate compared to the net income and the total assets of the industry average firm, which are \$22.9 million and \$799 million, respectively. Either type of opportunity cost is about 2% of net income and less than 1% of total assets. Taken together, I find that insurers are not overly engage in accounting conservatism and that the opportunity cost of being conservative in reserving is modest.

2.7 Conclusion

In this chapter, I study two types of accounting conservatism in the P&L insurance industry. *Ex-ante* conservatism is news-independent and creates a cushion against future losses. In contrast, *ex-post* conservatism is news-dependent and used to reduce the information asymmetry between a firm and outside parties.

My empirical tests are based on affiliated and unaffiliated P&L insurance companies. I use data from Schedule P, Part 2 table in the statutory financial reports to measure *ex-ante* and *ex-post* conservatism. *Ex-ante* conservatism is defined to be a positive deviation of an insurer's initial estimates of incurred losses from the "true value" losses, which is proxied by the incurred losses ultimately reported in the last development year in the Schedule P, Part 2 table. To measure *ex-post* conservatism, I use incurred losses reported after the policy year when more information becomes available to insurers so that managers can make predictions about future liabilities.

Table 2-9: Opportunity Cost of *Ex-Post* Conservatism

News Predictor	***NetCFO***	**Δ*NetCFO***	***NetCFOdev***	**Δ*PaidLoss***	**Δ*Premium***	**Δ*NetInvGain***
(1) β_3 Estimate (from Table 2-4)	-0.677	-0.317	-0.66	-0.394	-0.577	-1.902
(2) One Std Dev of News Predictor (from Table 2-2)	0.096	0.104	0.094	0.097	0.115	0.028
(3) Additional Reserves Held ($million) = (1) * [-(2)] * 799	51.929	26.341	49.570	30.536	53.018	42.552
(4) Capital Cost ($million) = (3) * 9%	4.674	2.371	4.461	2.748	4.772	3.830

I employ the asymmetric timeliness model to test for the existence of *ex-post* conservatism. I find that expected losses are reserved more quickly than expected gains. The result is consistent for various new predictors based on net cash flows from underwriting, premium change, and changes in net investment gains. Moreover, the asymmetric timeliness coefficient interacts with other managerial incentives. The results show that the practice of *ex-post* conservatism is constrained by an incentive for income smoothing or for inflating financial strength ratio, and high exposures to strict rate regulation. For *ex-ante* conservatism, I find that it restricts the adoption of *ex-post* conservatism, but the attenuation effect fades away when the decile ranking of *ex-post* conservatism increases from 5 to 10. The result supports the prediction that *ex-ante* and *ex-post* conservatism can be both substitutes and complements since firms can use them to achieve different goals.

Finally, I look at the loss reserve error and investigate whether insurers are overly *ex-post* conservative. My result does not suggest that P&L insurance companies overuse the *ex-post* conservatism strategy. The back-of-the-envelope estimate shows that insurers may face an increase in capital cost by at least $2.4 million due to reserving expected losses quickly in the current period.

CHAPTER 3

CONDITIONAL CONSERVATISM, REGULATION, AND INSOLVENCY RISK

3.1 Introduction

Accounting conservatism affects the estimate of accruals. In general, it refers to the understatement of assets and revenues and overstatement of liabilities and expenses in the financial report (Watts, 2003a). Accounting conservatism can be conditional or unconditional. The critical difference between them is that only conditional conservatism reflects and reveals managerial information about future periods (Basu, 2005; Beaver and Ryan, 2005). In this chapter, I solely focus on conditional conservatism and investigate two questions: (1) whether conditional conservatism decreases the insolvency risk of the property-liability (P&L) insurance companies, and (2) how a change to accounting rules affects conditional conservatism. Since accounting conservatism is realized through accruals, I study the most critical accruals of the P&L insurance companies – loss reserves.

The P&L insurance industry is an excellent laboratory to study conditional conservatism because we have specific and detailed information about accrual development – we can track the evolution of loss reserves for up to ten calendar years in the statutory financial report. Using the firm-specific accrual development information, I construct a new method to measure conditional conservatism at the firm-year level. The new measure is based on the concavity of an insurer's loss development curve, as shown in Figure 5.

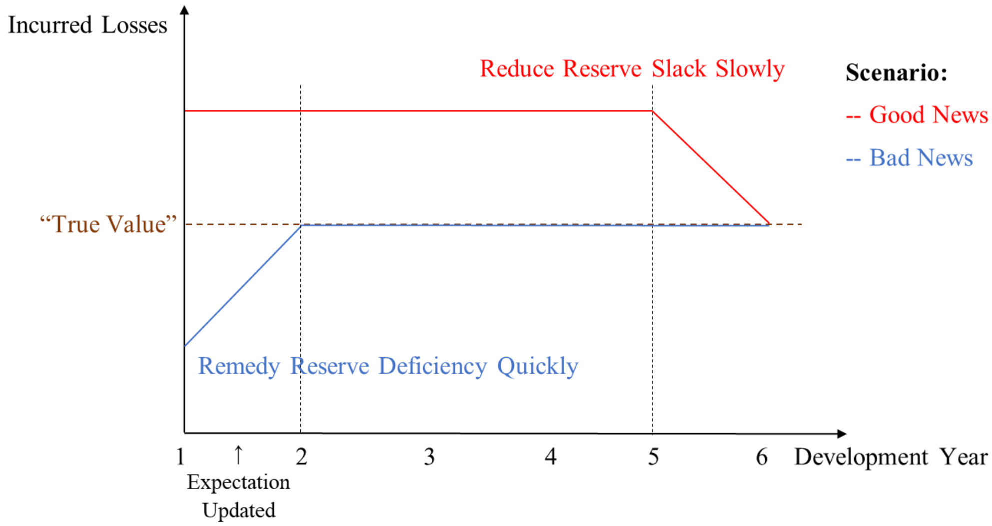


Figure 5: Illustration of New Method of Measuring Conditional Conservatism

Figure 5 shows how incurred losses (y-axis) are developed over time (x-axis) in response to news.[17] There are two possible scenarios. The red line represents the good-news scenario, where insurers initially over-reserve at time 1. This is good news because insurers have slack in reserves and will not be concerned about future loss shocks until the slack is depleted. The blue line represents the bad-news scenario, where insurers are initially under-reserved and have a reserve deficiency. For illustration, I assume that insurers update their expectations to the "true value" of ultimate losses during development year 2, but the information is unverified. As of development year 6, all losses are paid off and the information is verified. In addition, insurers adjust incurred losses to the "true value" in one-shot. Conditional conservatism implies that insurers are reluctant to recognize the good news in year 2. They reduce the reserve slack at the end when the

[17] A development year is the year when the insurer evaluates the estimate of loss reserves based on information in that year. For example, losses incurred in 2010 may be settled and paid off after 2010. For losses attributable to 2011, the accident year 2010 is the first development year, the year 2011 is the second development year, and the year 2019 is the tenth development year. Incurred losses are the sum of loss reserves (unpaid losses) and paid losses. The development of incurred losses due to new information is the same as the development of loss reserves because paid losses are known information.

information is verified. Alternatively, insurers report bad news immediately and remedy the reserve deficiency as soon as they update expectations in year 2. In both scenarios, conditional conservatism leads to a concave loss development curve, suggesting that insurers have asymmetrical responses to good and bad news.

In the P&L insurance industry, I argue that one of the major motivations for insurers to adopt conditional conservatism is to reduce regulation costs. The insolvency of an insurer has a social cost because it can cause significant financial loss to many individuals. The goal of regulators is to protect the benefits for policyholders. At the industry level, state regulators mandate insurers follow the statutory accounting rules (Statutory Accounting Principles, SAP).[18] This results in an increased level of unconditional conservatism in the insurance industry. At the firm level, insurers can engage in conditional conservatism beyond SAP. There is an information asymmetry between insurers and regulators regarding reserving, as insurers always know more information about their actual losses. Timely loss recognition under conditional conservatism can help insurers reduce the financial frictions of dealing with regulators and rating agencies. For example, managers may hide a loss to maximize their compensation (Eckles and Halek, 2010). The quick recognition of expected losses in bad-news years may offset some opportunistic behaviors from management. Hence, regulators and rating agencies may reward conditionally conservative insurers by less regulatory intervention and/or stronger financial strength ratings.

[18] SAP has more stringent rules for reporting loss reserves than Generally Accepted Accounting Principles (GAAP). For example, insurers are required to report the non-discounted value of loss reserves under SAP, whereas the value of loss reserves reported under the GAAP are discounted.

The accounting rule changes of Sarbanes-Oxley Act (SOX) Section 404 and Model Audit Rule (MAR) may affect the usage of conditional conservatism. SOX Section 404 was designed to improve the transparency of financial reporting procedures and increase the executive managers' liabilities for financial misconduct for public firms. In the insurance industry, MAR was released later with rules similar to SOX Section 404 and applied to insurers that were not a SOX entity. The impact of SOX Section 404 and MAR on conditional conservatism can be dichotomous. On the one hand, managers may use conditional conservative to a greater extent after accounting reform as there is a higher personal penalty for financial irregularities. On the other hand, insurers may have lower incentives to use conditional conservatism because SOX Section 404 and MAR provides a safe harbor. Insurers do not have to react to expected losses as quickly as they did before accounting reform since they can convey the properness of their accounting to regulators by following additional disclosure requirements.

My identification strategy to investigate the effect of accounting rule changes on conditional conservatism is a diff-in-diff model. The sample consists of affiliated and unaffiliated P&L insurance companies domiciled in the U.S. from 1995 to 2015. I find that after the enactment of MAR, insurers significantly decrease the usage of conditional conservatism. The enactment of SOX Section 404 also reduces the usage of conditional conservatism; however, the treatment effect is of smaller magnitude and statistically marginally significant.

To examine how conditional conservatism affects insolvency risk, I use a Probit model to study the probability of regulatory action and an Ordered Logit model to study a categorical rating variable. The results show that a unit increase in the decile rank of conditional conservatism can reduce the probability of regulatory intervention by 0.1 percentage points, which is equivalent to a 9% reduction. Also, when a firm's decile rank of conditional conservatism is increased, it is more likely to be rated as A++, A+, and A, and less likely to have a rating below A. There may be an endogeneity issue because the choice of conditional conservatism may be correlated with a firm's financial strength. To address that, I instrument the endogenous conditional conservatism variable using the treatment variables of MAR. I also address the measurement error of conditional conservatism by using weighted regression models. The findings are robust to the endogeneity and measurement error issues.

My results have important policy implications. I observe that to mitigate the regulatory monitoring costs, insurers use less conditional conservatism after they are mandated to follow additional disclosure requirements by SOX Section 404 and MAR. This change essentially increases the transparency and accuracy of financial reports but reduces the level of conditional conservatism in accrual estimation. Both accuracy and conditional conservatism are indicators of financial reporting quality in the financial accounting literature (Dechow et al., 2010); however, in the context of insurance industry, conditional conservatism is more critical than accuracy. Although conditional conservatism leads to inflated reserves and distorts the value of the firm, it equips firms with a buffer against future losses.[19] For insurers, an appropriate estimate of loss reserves should reduce the probability of insolvency. Nevertheless, my results suggest that SOX

[19]The other type of accounting conservatism, i.e., unconditional conservatism, creates a cushion against future losses. Unconditional conservatism can reduce regulation costs by making regulatory interventions less necessary and less severe. Due to the safe harbor effect, the enactment of MAR may also negatively impact the level of unconditional conservatism, but that is not the focus of this chapter. Also, the new measure of conditional conservatism is not affected by the level of unconditional conservatism.

Section 404 and MAR cause insurers to give up solvency credibility for transparency, putting them at greater insolvency risk. This impact should not be the intention of lawmakers of SOX and MAR who wanted companies manage financial risks better after accounting reform.

This chapter contributes to the literature in three ways. First, I propose a new method to measure conditional conservatism. The new method uses firm-specific accrual development information and measures conditional conservatism at the firm-year level. The traditional measure of conditional conservatism in the financial accounting literature is often an industry-wide or market-based indicator which cannot access to the cross-sectional variations. Additionally, the new method has two other advantages. First, it looks at the pattern of *dynamic* accrual adjustments, whereas the traditional measure assesses accrual changes at a static point. Second, the new measures are not constrained by a firm's initial accounting strategy (i.e., unconditional conservatism). I can look at not only how quickly insurers remedy a reserve deficiency but also how slowly insurers release reserve slack. Since the new measures are estimated at the firm-year level, they may have a larger measurement error than the traditional measure that is estimated at the industry level. I conduct a series of tests to confirm that the new measures are not driven by firm-level random shocks and reflect the accounting strategy of conditional conservatism

The second contribution is that I provide new evidence for how accounting reform affects conditional conservatism. In the previous literature, Lobo and Zhou (2010) compare a sample of dual-listed Canadian firms with firms listed only in Canada and find firms subject to SOX report more conditionally conservatively. I study a specific industry setting and my findings are different. I find that insurers use less conditional conservatism after

MAR, but the effect of SOX Section 404 is weak. In my setting, insurers use conditional conservatism to reduce the frictions of dealing with regulators. New accounting rules provide a safe harbor and hence reduce insurers' demand for conditional conservatism. My findings suggest that accounting reform can have different impacts on financial and non-financial institutions.

Finally, I provide the first empirical study on how conditional conservatism affects the bankruptcy risk of financial institutions. I explicitly model and examine how a firm's reserving behavior affects the information and the evaluation of the firm. The results show that conditional conservatism helps reduce the probability of regulatory intervention and improve financial strength ratings. My results provide accountants and actuaries with rationales for using conditional conservatism. In the previous literature, Biddle et al. (2016) study the effect of conditional conservatism on the bankruptcy risk of non-financial firms, but their agency problem is between the firm and debt holders. However, in my setting, the tension is between the firm and regulators (and/or rating agencies).

3.2 Literature Review on Conditional Conservatism

3.2.1 Definitions and Measures

Conditional conservatism means recognizing unrealized losses more quickly than gains.[20] In other words, managers would recognize expected losses immediately but are reluctant to recognize expected gains. The asymmetric timeliness of loss and gain recognition arises because managers use lower verifiability standards for losses than for

[20] The term "unrealized losses" is conceptually consistent with the term "economic losses" used by prior papers (e.g., Ball, 2001; Ball et al., 2003; Ball and Shivakumar, 2005). Realized gains and losses arise from actual transactions and are recognized on cash basis; whereas unrealized gains and losses are due to events that have not occurred yet and thus recognized on accrual basis. Economic losses include unrealized losses in addition to realized losses (Ball, 2001).

gains (Basu, 1997; Watts, 2003a). The difference in the verifiability standards determines the level of conditional conservatism (Watts, 2003a).

The previous financial accounting literature usually measures conditional conservatism as an industry-wide or market-based indicator. It is a regression coefficient and indicates whether firms have asymmetrical responses to good and bad news (Basu, 1997; Ball and Shivakumar, 2005; Gassen et al., 2006). For example, Basu (1997) measures conditional conservatism as asymmetrical timeliness of earnings in reflecting bad and good news. He defines news as the one-year abnormal stock return. Ball and Shivakumar (2005) study a sample of private UK firms. They measure conditional conservatism as the asymmetrical timeliness of accruals in recognizing expected losses and gains.

One disadvantage of the traditional measure is that it cannot explore cross-sectional variations across firms. Some prior papers tried to extend the asymmetric timeliness model to have a firm-specific coefficient. For example, Khan and Watts (2009) model the asymmetric timeliness coefficient as a linear function of firm size, market-to-book ratio, and leverage. Francis et al. (2004) and Gassen et al. (2006) perform the regression for each firm using a ten-year rolling window. In this chapter, I propose a new method for measuring conditional conservatism at the firm-year level based on the concavity of an insurer's loss development curve. In comparison, I follow Ball and Shivakumar (2005) and Gassen et al. (2006) to calculate the traditional measure of conditional conservatism at the firm level using the same sample and a ten-year rolling window.[21]

[21] I employ the model from Ball and Shivakumar (2005) because a significant portion of P&L insurers are private firms. The news indicator is the current net cash flows from underwriting. See Chapter 2 for more details about how to apply the traditional model in the insurance industry.

3.2.2 Economic Roles

Conditional conservatism has a unique information role – it can reduce the information asymmetry between managers and financial report users. In theory, the previous financial accounting literature documents four types of agency problems that can be affected by conditional conservatism: management contracting, debt contracting, corporate governance, and regulation. The empirical evidence of the first three problems has been explored by prior papers. This chapter focuses on the fourth type of agency problem, that is: how do insurers use conditional conservatism to alleviate the tension between the firm and regulators.

Conditional conservatism can be an efficient mechanism to improve the contracting of managers (Basu, 1997; Watts, 2003a; Ball, 2001; Ball et al., 2000). Managers possess valuable private information about the firm that is not available to the owners of the firm. When managerial compensation is linked to accounting measures (e.g., managers receive bonuses if the firm has a profit), managers have incentives to delay or withhold loss information and maximize their compensation. Timely recognition of losses can offset the upward bias in earnings imposed by mangers for obtaining opportunistic payments (Watts, 2003a).

Similarly, debt investors are less informed than the owners of the firm. Debtholders may worry about whether firm owners obtain opportunistic dividend payments by understating losses (Watts, 2003a). Debtholders can exercise debt covenants to restrict actions that opportunistically expropriate debtholders' welfare. The conditions that trigger a debt covenant are often specified in accounting ratios (Watts, 2003a; Nikolaev, 2010). Thus, conditional conservatism can provide a verifiable lower bound value of the equity that triggers debt covenants more quickly than in the absence of conditional conservatism (Watts, 2003a; Ball, 2001; Nikolaev, 2010).

Conditional conservatism can improve corporate governance as well (Watts, 2003a, Ball and Shivakumar, 2005; Ball, 2001; Ball et al., 2000). Conditional conservatism reduces managerial incentives to prolong losing investments (Ball and Shivakumar, 2005; Ball, 2001).[22] Managers may continue losing investments because "subsequent generations of managers will inherit the poor performance of these investments" (Ball, 2001, p139). However, this incentive will be reduced if unrealized losses of investments are charged against income quickly before managers leave, as there is no additional penalty for the current managers to abandon losing investments. Conditional conservatism may also bring in quick pressure and investigations on managers from external directors and large shareholders because such investigation is often triggered by specific accounting ratios (Ball, 2001; Watts, 2003a). As future losses are accrued quickly, the monitoring entities can pull the trigger early to investigate the reasons for losses and to take corrective actions such as discharging the manager (Watts, 2003a).

Regulators may also favor conditional conservatism. Like debt holders, regulators demand timely loss information in the financial report because their reputation is more adversely affected for failing to detect a problematic firm than for mistakenly evaluating a healthy firm (Watts, 2003a). The previous studies often study non-financial institutions, so the prediction of regulation has not been studied by empirical studies. This chapter fills the gap by studying the P&L insurance industry.

[22] Continuing a losing investment is detrimental to the owners of the firm since it reduces the firm value but is more beneficial to managers than abandoning a losing investment because losses due to abandonment can reduce managers' benefits in terms of bonus, reputation, prestige, and reappointment (Ball, 2001).

3.3 Hypotheses

3.3.1 Conditional Conservatism and Insolvency Risk

Regulators can evaluate insolvency risk based on regulatory ratios as well as the quality of financial reporting.[23] In this chapter, I define financial reporting quality as the usefulness of accruals to regulators for evaluating insolvency risk.[24] I argue that conditional conservatism can improve the quality of accruals and reduce insolvency probability.

The goal of regulators is to protect the benefits for policyholders and take action against insolvent insurers. However, there is an information asymmetry between insurers and regulators about loss reserving because insurers always know more information about their losses. Under conditional conservatism, losses are recognized more quickly than gains. The timely loss disclosure should help insurers reduce the information asymmetry. Moreover, a conditionally conservative insurer should be less likely to hide losses in bad-news years than others, as the quick recognition of expected losses can offset some managerial opportunism, such as under-reporting loss reserves to inflate net income and maximize compensation (Watts, 2003a). As a result, conditional conservatism can be an efficient mechanism to reduce the financial frictions between insurers and regulators.

The effect of conditional conservatism may be realized in multiple ways. For example, when regulators prioritize the list of companies for screening, they can put conditionally conservative insurers at the bottom of the list, leading to a lower probability

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[23] State regulators employ several tools for solvency monitoring, including the risk-based capital (RBC), the Financial Analysis Solvency Tools (FAST) System, and financial examination (Klein and Wang, 2009). The FAST system consists of the Insurance Regulatory Information System (IRIS), the Scoring System, the Insurer Profiles System and other report (Klein, 2005).

[24] In this chapter, the quality of financial reporting refers to the quality of accruals, which is similar to the term "earnings quality" in the financial accounting literature. Dechow et al. (2010) define earnings quality as a criterion affecting the usefulness of the information in decision making. The authors reviewed various earnings quality proxies and concluded that there is no single best measure of earnings quality. The definition of "earnings quality" should be contingent on the decision context.

of scrutinizing. Another example is for non-public regulatory action. Conditional conservatism may give an insurer a better position in the negotiation with regulators. With other things equal, regulators may allow conditionally conservative insurers more time than conditionally non-conservative insurers to boost financial conditions before an official regulatory action is taken. This can also result in a lower probability of regulatory intervention.

Similar arguments can apply to the rating agencies that monitor the insolvency risk of insurers and downgrade those that are deemed as financially weak. In addition to reducing information asymmetry, conditional conservatism can also make insurers reserve more future losses, creating a cushion in reserves. Taken together, I assume that conditional conservatism should help reduce the likelihood of regulatory intervention and increase financial strength ratings.

Another way to think about this hypothesis is through a cost-and-benefit analysis. When insurers adopt the conditional conservatism strategy, they are trying to maximize the regulators' benefits. Regulators demand conditional conservatism since their reputation is more adversely affected for failing to detect a problematic firm than for mistakenly evaluating a healthy firm (Watts, 2003a). At the same time, conditional conservatism is a costly strategy. When losses are reserved more quickly, insurers need to hold more capital to maintain the solvency level. As a result, regulators should reward insurers that voluntarily choose to use conditional conservatism by putting less regulatory pressure on them.

> **H1:** Conditional conservatism reduces the probability of regulatory action and improves the financial strength rating.

3.3.2 Accounting Rule Changes and Conditional Conservatism

In this chapter, I look at two financial reporting rule changes: the Sarbanes-Oxley Act (SOX) Section 404 and the Model Audit Rule (MAR). SOX was created to protect investors from fraudulent accounting activities and improve the accuracy and reliability of accounting disclosures. Section 404 of SOX, which was implemented on November 15, 2004, and enforced by the Securities and Exchange Commission (SEC), requires all public companies to "include an internal control report that contains management's assertions regarding the effectiveness of the company's internal control structure and procedures over financial reporting" (Protiviti, 2007, p7). The Section 404(a) required annual manager report on the effectiveness of internal control over financial reporting (ICFR); additionally, the Section 404(b) required that independent auditors opine on the effectiveness of ICFR.[25]

The Model Audit Rule (MAR) was issued by the NAIC in 2010 and mandated CEOs and CFOs sign off in annual reports to certify the adequacy of ICFR over the annual statutory financial statements. Compared to SOX Section 404, MAR is different in three ways: (1) MAR requires nonpublic insurers to comply with the stringent financial reporting requirements, (2) MAR does not have attestation requirement for auditors, and (3) MAR allows small insurers to be exempted from the requirements.

I have two competing hypotheses for the effect of accounting rule changes on conditional conservatism. Firstly, I expect that insurers may have stronger incentives for conditional conservatism after the implementation of SOX Section 404 and MAR. Both

[25] The Section 404(b) is very costly and has been frequently postponed for non-accelerated filers (i.e., small public firms with public float below $75 million). Dodd-Frank Act of 2010 permanently exempted non-accelerated filers from complying with SOX 404b. This chapter focuses on the managerial behavior and my hypothesis is based on how managers trade off their attestation requirements and the conditional conservatism accounting strategy to deal with state solvency regulators. The contents related to the Section 404 (b) regarding independent auditors do not affect my hypothesis. As a result, the Dodd-Frank Act enacted in 2010 do not threaten the diff-in-diff model.

SOX Section 404 and MAR mandate the management certify the effectiveness of ICFR. As personal liability increases, there may be a higher penalty for financial irregularities. Therefore, managers may have stronger incentives to be conditionally conservative in financial reporting.

> **H2a:** Insurers have higher incentives for conditional conservatism after SOX Section 404 and MAR because of the higher penalty for financial irregularities.

Alternatively, I expect that insurers may have weaker incentives for conditional conservatism after the enactment of SOX Section 404 and MAR. The goal of SOX and MAR was to increase the transparency of financial reporting and improve corporate governance. These rules may provide a safe harbor for companies to fulfill the expectations of state commissioners. In other words, the upfront reporting requirements can help insurers convince the state commissioners that their accounting is proper; as a result, insurers do not have to react to expected losses as quickly as they did in the absence of the new rules. Insurers may consider the compliance with SOX Section 404 and MAR and conditional conservatism strategy substitutes to deal with the state commissioners and rating agencies.

> **H2b:** Insurers have lower incentives for conditional conservatism after SOX Section 404 and MAR because these accounting rules provide a safe harbor.

3.4 Data and Statistics

3.4.1 Insurance Data

I study affiliated and unaffiliated single P&L insurance companies domiciled in the U.S. The data of insurers are extracted from the NAIC Property-Casualty Annual Statements from 1993-2015. The Schedule P Part 2 tables of NAIC Annual Statement provide data on how incurred losses of the past ten accident years (tabulated by rows) developed from the policy year to the current calendar year. For each firm-year observation, I estimate the reserve pattern of each accident year separately. For data screening, I drop an accident year (one row) if it has negative incurred losses or its initial estimate of incurred losses is equal to the final estimate.[26]

I merge the NAIC insurers' data with the other two data sources that provide information about insurers' insolvency risk. The first measure of insolvency risk is whether an insurer has a financial impairment. The data on financial impairment in the P&L insurance industry from 1993-2018 are extracted from Best's Impairment Review (A.M. Best, 2013), Best's 2017 Property/Casualty Impairments Update (A.M. Best, 2017), and Best's Impairment Rate and Rating Transition Study (A.M. Best, 2019a).[27] In addition to financial impairment, I also look at an insurer's A.M. Best financial strength rating, and the data come from Best's Key Rating Guide, 1993-2016. I use the NAIC company code to merge data from different sources.

At last, I obtain the information on publicly traded insurance groups from the S&P Global Market Intelligence. I use the Compustat Database to verify the list of public insurance groups and get the IPO year. The data on public insurers are merged with my sample using the NAIC group code.

I drop observations that have non-positive net premiums written or non-positive surplus. All observations of insurers that are affiliated with an insurance group going the

[26] Negative incurred losses may be due to market exit or data errors, both causing the estimated pattern biased. The same initial and final estimate of incurred losses can cause both theoretical and technical problems. Theoretically, when the initial estimate of incurred losses is accurate, the follow-up revisions of loss reserves are likely for managerial manipulation rather than conservative accounting strategy. From the technical perspective, when we standardize the incurred losses, the denominator is the difference between the initial and final estimates, which cannot be zero.

[27] I identify 438 P&L insurers that were financially impaired from 1993 to 2018, but only 141 of them are matched with my data. This is possible because financially impaired firms may stop business and not file financial statement.

initial public offering (IPO) after 2005 are excluded from the regression analysis.[28] To exclude the effects of outliers, I winsorize *Growth*, *Reinsurance_usage,* and *Leverage* at 1% and 99% levels. The sample period spans from 1995 to 2015.[29] The final sample has 2,122 firms and 23,282 firm-year observations, accounting for 74 percent of direct premiums and 73 percent of loss reserves of the whole industry. In the final sample, I identify 45 publicly traded insurance groups and 489 single insurance companies that are affiliated with a public insurance group.

3.4.2 Timeline of Accounting Rules

I examine two accounting rule changes during the sample period: SOX Section 404 and MAR. Section 404 of SOX applied to accelerated filers of U.S. publicly traded firms for fiscal years ending on or after November 15, 2004.[30] For non-accelerated filers, the rule was adopted for fiscal years ending on or after December 15, 2007.[31] I round the treatment years to 2005 and 2008, respectively.

In the insurance industry, the NAIC collaborated with the American Institute of Certified Public Accountants (AICPA) and issued the original version of the Model Audit Rule (MAR, also known as NAIC Model Law #205) in 2006. In January 2010, NAIC issued an amendment to the Model Audit Rule with revisions addressing the independence of auditors, corporate governance, and the Internal Control over Financial Reporting (ICFR). The revised MAR mirrors the requirements of SOX Section 404 in many aspects.

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[28] I do not want the treatment of SOX Section 404 and MAR affected by the IPO. This exclusion drops 55 observations (7 firms), which account for 0.2 percent of the industry's total loss reserves.
[29] I lose two years' insurance data because we use two-year lag data to calculate IRIS ratios.
[30] Accelerated filers of foreign issuers can adopt SOX Section 404 for fiscal years ending on or after July 15, 2006. I conduct robustness checks that have foreign large issuers treated in 2007. The results are very consistent.
[31] Non-accelerated filers are small issuers with less than $75 million in public float (i.e., the value of shares held by the public). I use total float (i.e., the total value of shares) as a proxy to identify accelerated filers.

Effective on January 1, 2010, all insurers, whether publicly traded or not, are required to follow MAR for statutory financial reporting.

An insurer who or whose parent is directly subject to Section 404 can file its or its parent's Section 404 Report in satisfaction of MAR. Thus, MAR primarily affects private insurers only. One difference between SOX Section 404 and MAR is that MAR has an exemption on small insurers, while SOX Section 404 does not. Small insurers who have direct premiums written of less than $1 million in all states of operation are exempted from the requirements of MAR.

I obtained the date when the two types of rule changes were adopted from various sources, including the NAIC Annual Financial Reporting Model Regulation (2015), Protiviti Guide to the Sarbanes-Oxley Act, Internal Controls Reporting Requirements (2007), and state websites for law changes.

Table 3-1 displays the timeline when different firms were subject to the accounting rule changes, the number of observations being treated, and the proportion of loss reserves being treated. Most publicly traded insurance companies started to follow SOX Section 404 from 2005, which accounts for 4,600 observations and 43 percent of total loss reserves of the whole industry. One non-accelerated filer is detected, and it was subject to SOX Section 404 from 2008. A few insurers switched to a publicly traded insurance group from 2006 to 2009, and they are considered as being treated in the year when their group association changed. Insurers being treated by SOX Section 404 after 2005 in total represent 320 observations and 0.3 percent of total loss reserves.

The MAR was adopted by most states in 2010 except for Washington DC, Alaska, and Puerto Rico who adopted MAR in 2011 and New Hampshire who adopted MAR in

Table 3-1: Timeline of Financial Reporting Rules

Treatment	Effective Year	Treated Firms	# of Observations Treated	% of Loss Reserves Treated
Sarbanes-Oxley Act (SOX) Section 404	2005	Publicly traded firms (accelerated filers)	4,600	42.39%
	2008	Publicly traded firms (non-accelerated filers)	28	0.0023%
	Year of group change (2006-2009)	Publicly traded firms (merged to a publicly traded insurance group from 2006 to 2009)	292	0.27%
Model Audit Rule	2010	Private firms (domiciled in states other than DC, AK, PR, and NH)	17,206	55.35%
	2011	Private firms (domiciled in DC, AK, PR)	298	0.17%
	2017	Private firms (domiciled in NH)	229	0.83%
	Exemption	Small insurers having direct premiums written of less than $1 million in all states where they operate the business	508	0.80%

Note: Non-accelerated filers are small issuers with less than $75 million in public float (i.e., the value of shares held by the public). I use total float (i.e., the total value of shares) as a proxy to identify accelerated filers. I only identify one non-accelerated filer in my sample, which is the National Security Group (NAIC group code = 316). A small insurer exemption applies to the Model Audit Rule.

2017. Most private insurers were treated in 2010 and represent 17,206 observations and 55 percent of the industry's loss reserves. The insurers domiciled in DC, AK, PR, and NH were treated after 2010 and represented 527 observations and 1 percent of total loss reserves. Finally, 508 observations (0.8 percent of loss reserves) are exempted from the obligations of MAR.

3.4.3 Summary Statistics

The statistics of the sample for regression analysis are summarized in Table 3-2. The average *Log(Asset)* is 18.7, which is equivalent to 132 million dollars. Regarding the organizational form, 25 percent of observations are mutuals or reciprocals and 75 percent are stock insurers. Further, 75 percent of observations are insurers affiliated with an insurance group, and 19 percent are associated with (or managed by) a publicly traded insurance group. The mean and median reinsurance usage levels are 0.39 and 0.34, respectively. The average and the median ROA are both 0.03. The premium growth rate has a mean of 8 percent and a median of 4 percent.

The leverage, calculated as the ratio of net premiums written to surplus, has a mean and a median of 100 percent and 88 percent, respectively. The maximum value of leverage is 322 percent, which is comparable to the 300 percent upper limit defined by the NAIC IRIS Manual (NAIC, 2016). The average geographical and product HHI are 0.39 and 0.46, respectively. The mean proportion of incurred losses in four categories of product lines (long-tail private, long-tail commercial, short-tail private, and short-tail commercial) are respectively 0.31, 0.45, 0.09, and 0.15. The P&L industry, on average, operates more long-tail than short-tail lines and more commercial than private lines.

Table 3-2: Summary Statistics (1995-2015)

Variables	N	Mean	Median	Std. Dev.	Min	Max
Measures of Conditional Conservatism						
D_concave	23,282	0.109	0.000	0.311	0.000	1.000
Rank_concavity_sum	23,282	5.510	5.400	2.498	1.000	10.000
Rank_concavity_line	21,834	5.111	5.032	2.134	0.000	10.000
Measures of Insolvency Risk						
D_impaired	23,282	0.011	0.000	0.105	0.000	1.000
Rating	23,282	6.372	7.000	1.626	1.000	9.000
Firm Characteristics						
D_group	23,282	0.750	1.000	0.433	0.000	1.000
D_mutual	23,282	0.254	0.000	0.435	0.000	1.000
D_public	23,282	0.188	0.000	0.391	0.000	1.000
Log(Asset)	23,282	18.701	18.590	1.799	13.094	25.841
Reinsurance_usage	23,282	0.393	0.344	0.286	0.000	0.980
ROA	23,282	0.025	0.027	0.056	-1.970	1.778
Growth	23,282	0.083	0.039	0.388	-0.897	2.374
Leverage	23,282	1.000	0.880	0.680	0.013	3.222
GHHI	23,282	0.390	0.372	0.102	0.052	1.000
PHHI	23,282	0.460	0.367	0.285	0.066	1.000
LossProp _long_personal	23,282	0.307	0.178	0.323	0.000	1.000
LossProp_long_commercial	23,282	0.452	0.384	0.399	0.000	1.000
LossProp _short_personal	23,282	0.091	0.000	0.140	0.000	1.000
LossProp _short_commercial	23,282	0.150	0.046	0.254	0.000	1.000

Note: This table reports the summary statistics of variables. A list of variable definitions is provided in Appendix B.

Regarding the measures of conditional conservatism, 11 percent of observations have absolutely concave loss development curves in both good-news and bad-news situations. The overall ranking and the by-line ranking of concavity have a mean of 5.5 and 5.1, respectively. Since the by-line ranking does not include the product lines that only have two-year loss development data, the by-line concavity ranking can be close to zero if a company primarily focuses on these short-tail product lines.

Regarding the measures of insolvency risk, I find that the average probability of financial impairment is 1.1 percent. The mean and median values of the financial strength rating categorical variable are 6.4 and 7.0, respectively, which correspond to "A-" and "A," respectively.

3.5 New Measure of Conditional Conservatism

3.5.1 Loss Reserve Development Process

Loss reserves are the most critical accruals for the P&L insurance companies.[32] On the one hand, loss reserves are the largest liability on a P&L insurer's balance sheet. On the other hand, loss reserve estimation is opaque and encounters significant uncertainty. Thus, I use loss reserve accruals to construct the measures of conditional conservatism.

Property-liability insurance usually provides coverage for a specified period (usually one year). Insurers are financially responsible for all covered events incurred during the specified coverage period, which is called *accident year*. However, claim settlement can take a longer time than the coverage period because not all claims are reported during the coverage period. The reported claims may take years to settle, especially for liability lines which often involves lawsuit during loss settlement. The more

[32] Another type of reserve is unearned premiums reserves. However, the estimation of unearned premiums reserves is mechanical and needs little managerial discretion.

years loss reserves are developed, the more accurate the loss reserve estimate is because insurers know more information about the ultimate or "true" losses. The calendar years in which losses reserves are developed to the ultimate value are called *development years*.

Under SAP, insurers need to update their estimate of incurred losses of a given accident year for ten development years, as more information becomes available with time. This process is called *loss development*. Schedule P, Part 2 of the NAIC statutory annual statement discloses the loss development of incurred net losses and defense and cost containment expense. *Incurred losses* are the total amount of losses for providing a given year's insurance coverage. Incurred losses are the sum of *paid losses* (claims having been paid off) and *loss reserves* (unpaid losses).[33] Paid losses are certain information, whereas the loss reserve estimation is subject to uncertainty and managerial discretion. While deriving the measures of conditional conservatism, I look at the development pattern of incurred losses rather than pure loss reserves because loss reserves will naturally decrease as more losses are paid.

Table 3-3 gives the example of the Schedule P, Part 2 for State Farm for its financial reporting year 2015. Panel A shows the original table (the accounting view) that I observe directly from the statutory financial report. The rows represent *accident years (AY)* and the columns represent *calendar years (CY)*. To examine the pattern of loss reserving, I reorganize the data to a loss triangle, as shown in Panel B. The columns of the loss triangle are called *development years (DY)*.[34]

[33] Loss reserves consist of reserves for the claims that are reported but not settled (case reserves) and reserves for claims incurred but not reported (IBNR reserves).

[34] I do so because development year measures how long the losses have been developed and how much information an insurer has about ultimate losses, whereas calendar year does not contain such information.

Table 3-3: Reorganize the Example of Schedule P Part 2

NAIC Property-Liability 2015 Annual Statement of State Farm Fire and Casualty Company
NAIC Code = 25143

Panel A: Schedule P, Part 2 (Accounting View)

Years in Which Losses Were Incurred **(Accident Year, AY)**	Incurred Net Losses and Defense and Cost Containment Expenses Reported at Year End ($000 omitted) **Calendar Year (CY)**									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1. Prior	2,395,092	2,704,096	2,881,522	2,844,794	2,810,188	2,791,499	2,793,401	2,788,616	2,779,553	2,794,209
2. 2006	6,599,473	6,783,676	6,780,749	6,775,569	6,727,376	6,717,142	6,716,491	6,716,593	6,708,627	6,703,333
3. 2007		6,666,271	6,901,592	6,837,562	6,810,922	6,784,961	6,760,744	6,759,620	6,750,801	6,748,448
4. 2008			9,888,250	9,968,863	9,901,880	9,816,922	9,792,742	9,769,787	9,762,255	9,761,725
5. 2009				8,968,209	9,006,416	8,910,348	8,889,776	8,860,652	8,860,924	8,860,481
6. 2010					9,368,065	9,303,217	9,292,717	9,268,661	9,267,658	9,262,612
7. 2011						11,545,977	11,439,107	11,395,923	11,382,854	11,373,336
8. 2012							9,624,533	9,381,798	9,306,122	9,252,886
9. 2013								8,351,972	8,330,482	8,330,994
10. 2014									8,803,909	8,949,186
11. 2015										7,910,034

Panel B: Loss Development Triangle (Actuarial View)

Years in Which Losses Were Incurred **(Accident Year, AY)**	Incurred Net Losses and Defense and Cost Containment Expenses Reported at Year End ($000 omitted) **Development Year (DY)**									
	1	2	3	4	5	6	7	8	9	10
1. Prior	2,395,092	2,704,096	2,881,522	2,844,794	2,810,188	2,791,499	2,793,401	2,788,616	2,779,553	2,794,209
2. 2006	6,599,473	6,783,676	6,780,749	6,775,569	6,727,376	6,717,142	6,716,491	6,716,593	6,708,627	6,703,333
3. 2007	6,666,271	6,901,592	6,837,562	6,810,922	6,784,961	6,760,744	6,759,620	6,750,801	6,748,448	
4. 2008	9,888,250	9,968,863	9,901,880	9,816,922	9,792,742	9,769,787	9,762,255	9,761,725		
5. 2009	8,968,209	9,006,416	8,910,348	8,889,776	8,860,652	8,860,924	8,860,481			
6. 2010	9,368,065	9,303,217	9,292,717	9,268,661	9,267,658	9,262,612				
7. 2011	11,545,977	11,439,107	11,395,923	11,382,854	11,373,336					
8. 2012	9,624,533	9,381,798	9,306,122	9,252,886						
9. 2013	8,351,972	8,330,482	8,330,994							
10. 2014	8,803,909	8,949,186								
11. 2015	7,910,034									

Note: This table is the Schedule P, Part 2 of the NAIC annual statement of State Farm Fire and Casualty Company. The data of Panel A and B are the same but displayed in different forms. Incurred losses are aligned by calendar years in Panel A and by development years in Panel B.

3.5.2 New Measurement Method

The new measure of conditional conservatism is based on the concavity of an insurer's loss development curve. Before I construct the measure, I first estimate the concavity of the loss development curve for each firm-year observation using data in Schedule P Part 2. For each firm-year, there are ten accident years in Schedule P Part 2 table. The estimation only uses the first five accident years (in bold in the example of Table 3-3) whose losses have been developed for at least six development years. There are two reasons to make this choice: (1) previous literature argues that most losses can be paid off within five years (e.g., Weiss, 1985); (2) these accident years have at least six data points to estimate the shape of the curve. I estimate the concavity of the loss development curve for each accident year (AY, each row) separately. Then, I average the concavity coefficients across accident years.

At the firm-year-AY level, I conduct a quadratic regression to obtain the curvature coefficient:

$$IncurLossDev_t = \alpha + \beta_1 t + \beta_2 t^2 + \upsilon_t \qquad \textbf{(3.1)}$$

where t = development years from 1 to T (T = 6, 7, …, 10), and

$IncurLossDev_t$ = standardized incurred losses at time t during loss development.

I standardize the incurred losses to improve the cross-sectional comparison. The standardized incurred losses always start from 1 (initially over-reserved) or -1 (initially under-reserved) in the first development year and end at 0 in the last development year. The standardized incurred losses are (accident year subscript is omitted for simplicity):

$$IncurLossDev_t = \frac{IncurredLosses_t - IncurredLosses_T}{abs(IncurredLosses_1 - IncurredLosses_T)} \qquad \textbf{(3.2)}$$

where $IncurredLosses_t$ = the incurred losses evaluated at the end of development year t,

$IncurredLosses_1$ = the incurred losses initially evaluated at the end of development year 1 (i.e., the policy year), and

$IncurredLosses_T$ = the ultimately developed incurred losses evaluated at the end of development year T (6 to 10).

Based on the formula (2), the standardized incurred losses actually represent a moving reserve error from the initial to the ultimate development years. Regarding the geometric meaning of the coefficients of the quadratic model, β_1 captures the tendency of the curve. A positive β_1 indicates that the loss development curve is going upward, which is considered as a bad-news scenario, and vice versa. β_2 determines the curvature of the estimated curve, which is the coefficient of interest. A negative β_2 implies a concave development curve.

I average β_2 for accident years in good-news and bad-news scenarios separately because I need to observe a firm's reserving behavior in both scenarios:

$$\begin{cases} \text{Good-news AYs: } \overline{\beta}_{2GN} = \sum_{AY \in \{y|\beta_{1,y}<0\}} \beta_{2,AY} / N_{GN} \\ \text{Bad-news AYs: } \overline{\beta}_{2BN} = \sum_{AY \in \{y|\beta_{1,y}>0\}} \beta_{2,AY} / N_{BN} \end{cases} \qquad \textbf{(3.3)}$$

where N_{GN} and N_{BN} represent the number of accident years in good-news and bad-news scenarios, respectively.

Based on $\overline{\beta}_{2GN}$ and $\overline{\beta}_{2BN}$, I can construct three conditional conservatism measures. First, I create a dummy variable *D_concave*, which equals 1 if both $\overline{\beta}_{2GN}$ and $\overline{\beta}_{2BN}$ are negative. That means the insurer has a concave loss development curve in both good-news and bad-news scenarios.

$$D\_concave = I[\overline{\beta}_{2GN} < 0 \cap \overline{\beta}_{2BN} < 0] \quad \textbf{(3.4)}$$

In addition to the dummy variable, I also measure conditional conservatism by the ranking of concavity because firms can engage in different levels of conditional conservatism.[35] The second measure is the overall decile ranking of concavity based on insurers' total incurred losses reported in Schedule P, Part 2 Summary. I use decile ranking so that the result is not affected by the number of observations. Since a negative β_2 implies concavity, the ranking of concavity is essentially the inverse ranking of β_2. The overall concavity ranking is denoted by *Rank_concavity_sum*. The decile ranking of concavity is not a categorical variable but rather a continuous variable from 1 to 10.

For each firm-year observation:

$$Rank\_concavity\_sum = 11 - \frac{DecileRank(\overline{\beta}_{2GN}) * N_{GN} + DecileRank(\overline{\beta}_{2BN}) * N_{BN}}{N_{GN} + N_{BN}} \quad \textbf{(3.5)}$$

A major issue with the overall ranking is the line mix. For example, I may compare an auto insurance company with a medical malpractice company. The former collects loss information quickly, whereas the latter takes a long time to settle claims. In this case, the difference in the shape of the loss development curve between these two companies is affected by the difference in the natural loss settlement process of different product lines.

To address the line mix issue, I construct a third measure of conditional conservatism, which is the weighted average ranking of concavity by product lines, denoted by *Rank_concavity_line*. I use the information on incurred losses of different

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[35] The level of conditional conservatism is determined by the difference in the verifiability standards required for recognizing losses and gains.

product categories reported in Schedule P, Part 2A through 2H, and 2R. Those tables have ten-year loss development data like Schedule P, Part 2 Summary, but represent incurred losses of certain product lines.[36] To overcome the line mix issue, I first rank insurers under each product category; then, I average the rankings across product categories. The weight is the proportion of direct premiums written (DPW) in each product category. A list of Schedule P Part 2 categories and the product lines contained in each category is shown in Appendix C. An example of calculation is provided in Appendix E.

For each firm-year observation:

$$\begin{cases} Rank\_concavity\_line = \sum_j (w_j * Rank\_concavity\_j) \\ w_j = \dfrac{DPW_j}{\sum_j DPW_j},\ j = \text{A,B,C,D,E,Fsec1,Fsec2,G,Hsec1,Hsec2,Rsec1,Rsec2} \end{cases} \qquad \textbf{(3.6)}$$

In sum, compared to the traditional asymmetric timeliness measure of conditional conservatism, the new concavity-based measures have three advantages. First, the measures are calculated at the firm-year level and thus can access to both time-series and cross-sectional variations. Second, the new measures reflect the dynamic accrual adjustment (i.e., loss reserve development) in response to news, and aggregates information of multiple calendar years. In contrast, the traditional model looks at the asymmetric adjustment of accruals in response to news at a static time point (e.g., Basu, 1997; Ball and Shivakumar, 2005). Third, my model examines the accrual adjustment for remedying reserve deficiency and reducing reserve slack separately. A high level of unconditional conservatism (i.e., highly over-reported initial loss reserves) does not constrain the new

[36] The Part 2 M, N, O, P tables in Schedule P also have ten-year loss development data, but we do not include them in the by-line ranking of concavity for two reasons. First, these product lines do not have data to calculate premiums weight. Second, international insurance (M) and reinsurance (N, O, P) are not typical P&L product lines.

measures of conditional conservatism because, in this situation, I can look at how slowly an insurer releases its reserve slack. However, the traditional measure of conditional conservatism is constrained by a high level of unconditional conservatism because a firm may be insensitive to bad news when it has slack in accruals.

My measures of conditional conservatism may suffer the following issues: line mix, random shocks, and measurement error. The first two can affect the shape of the loss development curve and the third one can affect the quality of the measure. To address the line mix issue, I construct the by-line ranking of concavity; I also control for the proportion of loss reserves in different product lines in the regression analyses. I run a serial correlation test to show that random shocks do not drive my measures. To address the measurement error, I conduct weighted regression analyses where the weight is proportional to the inverse of the squared average standard errors of β_2 from the quadratic model (see details in Section 6.3). Another thing to note is that the by-line ranking of concavity can have a higher measurement error than the overall ranking because I run more regressions to obtain the by-line ranking.

The two ranking variables of conditional conservatism are relative measures. The dummy variable *D_concave* is an absolute measure indicating whether loss development curves are concave in both situations. However, it contains less information than the ranking variables because firms can engage in various levels of conditional conservatism. Moreover, *D_concave* represents firms that are highly conditionally conservative. Using *D_concave* as a measure of conditional conservation in regression analysis may produce biased results.

The new measures are built on policies underwritten in the past 6th through 10th accident years and the loss development during the past ten calendar years. Hence, they contain lagged information. Therefore, I need to use lagged treatment variables of MAR as instrument variables in the regression analysis.

3.5.3 Properties of New Measures

Correlation with Traditional Measure

I conduct a correlation test to examine whether the new measures of conditional conservatism are positively correlated with the traditional measure. To obtain the traditional measure at the firm-year level, I follow Ball and Shivakumar (2005) and Gassen et al. (2006) and estimate the following regression model for each insurer using a ten-year rolling period:

$$IncurredLosses_{it} = \alpha_0 + \alpha_1 CashFlow_{it} + \alpha_2 D\_negative_{it} * CashFlow_{it} + \varepsilon_{it} \quad \textbf{(3.7)}$$

where $IncurredLosses_{it}$ = the sum of incurred losses of past 2nd to 5th accident years reported in the calendar year t for insurer i,[37]

$CashFlow_{it}$ = news predictor, the net cash flows from underwriting in the calendar year t for insurer i, and

$D\_negative_{it}$ = dummy for bad news, equal to 1 if the net cash flows from underwriting are negative and 0 otherwise.

The interaction coefficient α_2 indicates whether an insurer has an asymmetrical adjustment of loss reserves in response to the bad and good news. Following Gassen et al. (2006), I can convert the coefficient α_2 to an angle that reflects how much more quickly

[37] The calendar year t is the second development year for the AY t-1 and the fifth development year for the AY t-4. I do not include the AY t to exclude the effect of reserving decisions made in the first development year.

insurers respond to bad news than to good news. The idea of angle conversion is shown in the figure in Appendix F.

$$Angle = \arctan(\alpha_1) - \arctan(\alpha_1 + \alpha_2) \qquad \textbf{(3.8)}$$

For the traditional mode, I do not use the same accident years for calculating the new measures (i.e., past 6th through 10th accident years) because these losses have been developed for more than five years and may not be responsive to new information. As I mentioned before, the new measures for financial reporting year t aggregate the information of calendar years *t-9* through *t*, whereas the traditional model only looks at a firm's accrual adjustment behavior in the calendar year *t*. I take the middle point of t-4 and test the correlation of the traditional model with four-year lagged values of the new measures of conditional conservatism.

Table 3-4 shows that the two ranking variables (*Rank_concavity_sum*, *Rank_concavity_line*) are positively correlated with the traditional measure. However, *D_concave* has a negative correlation with the traditional measure. I also tested the correlation of the traditional measure with three-year and five-year lagged values of new measures. The results are consistent and not shown here. In the rest of the chapter, I only focus on the two ranking variables of conditional conservatism because the dummy variable has limited information and is negatively correlated with the traditional measure.

Serial Correlation

The new measures of conditional conservatism may be subject to random shocks since I use granular firm-year-AY level information to estimate a loss development curve. Hence, I conduct an autocorrelation test to investigate if the new measures are positively correlated over time. If the new measures are driven by a firm's accounting policy, then

Table 3-4: Pairwise Correlations Between Traditional and New Measures of Conditional Conservatism

Variables	Angle_trad_model	L4.D_concave	L4.Rank_concavity_sum	L4.Rank_concavity_line
Angle_trad_model	1.000			
L4.D_concave	-0.007	1.000		
L4.Rank_concavity_sum	0.020*	0.435*	1.000	
L4.Rank_concavity_line	0.037*	0.242*	0.574*	1.000

Note: This table reports the correlation matrix between the traditional and new measures of conditional conservatism. * indicates statistical significance at the 5% level. L4. represents the four-year lagged value of the variable. I also tested the correlation of the traditional measure with three-year and five-year lagged values of new measures. The results are consistent and not tabulated. The definitions of variables are given in Appendix B.

Table 3-5: Autocorrelation of New Conditional Conservatism Measures

	(1)	(2)	(3)	(4)	(5)
Panel A: Overall Ranking of Concavity					
Dependent Var =	Rank_concavity_sum	Rank_concavity_sum	Rank_concavity_sum	Rank_concavity_sum	Rank_concavity_sum
L1.Rank_concavity_sum	0.7428***				
	(0.0047)				
L2.Rank_concavity_sum		0.5239***			
		(0.0067)			
L3.Rank_concavity_sum			0.3623***		
			(0.0076)		
L4.Rank_concavity_sum				0.2486***	
				(0.0083)	
L5.Rank_concavity_sum					0.1621***
					(0.0089)
Observations	19,473	16,437	15,328	14,237	13,066
R-squared	0.5541	0.2767	0.1309	0.0603	0.0257
Panel B: By-line Ranking of Concavity					
Dependent Var =	Rank_concavity_line	Rank_concavity_line	Rank_concavity_line	Rank_concavity_line	Rank_concavity_line
L1.Rank_concavity_line	0.7355***				
	(0.0052)				
L2.Rank_concavity_line		0.5176***			
		(0.0072)			
L3.Rank_concavity_line			0.3651***		
			(0.0082)		
L4.Rank_concavity_line				0.2640***	
				(0.0088)	
L5.Rank_concavity_line					0.2049***
					(0.0093)
Observations	18,211	15,371	14,330	13,303	12,186
R-squared	0.5520	0.2770	0.1371	0.0705	0.0429

Note: This table reports the autocorrelation regression results of the new conditional conservatism measure. Robust standard errors in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

they should have a positive serial correlation. The results in Table 3-5 show that both ranking measures of conditional conservatism are positively correlated over time, and the serial correlation decreases as the lag period increases. This indicates that the new measures of conditional conservatism are not significantly affected by random shocks.

Distribution of Conditional Conservatism

I display the distribution of the two rankings variables of conditional conservatism using a boxplot and compare the distributions of different types of firms. The left-top graph of Figure 6 shows that firms with absolutely concave loss development curves (CC = 1) have much higher first quartile, median, and third quartile than other firms (CC = 0). This indicates that *D_concave* is positively associated with the concavity ranking variables.

The other three graphs in Figure 6 display the distributions of concavity rankings across firm size, organizational form, and financial strength rating. I find that compared to the firms in the first quantile of total admitted assets, the firms in the fifth quantile have higher first quartile, median, and third quartile values. Also, firms with a superior rating in the following year have higher first quartile, median, and third quartile than firms with a lower rating. I do not find a difference in the distribution of concavity ranking across organizational forms. To understand the determinants of conditional conservatism, researchers should conduct further analysis to examine the determining factors. This is not the focus of this chapter and left for future study.

Importance of Conditionally Conservative Insurers

The overall and by-line rankings of concavity are continuous variables and range from 1 (or 0 for by-line ranking) to 10. I round the rankings to the nearest integers to divide the sample into separate groups. I display the proportions of direct premiums written and

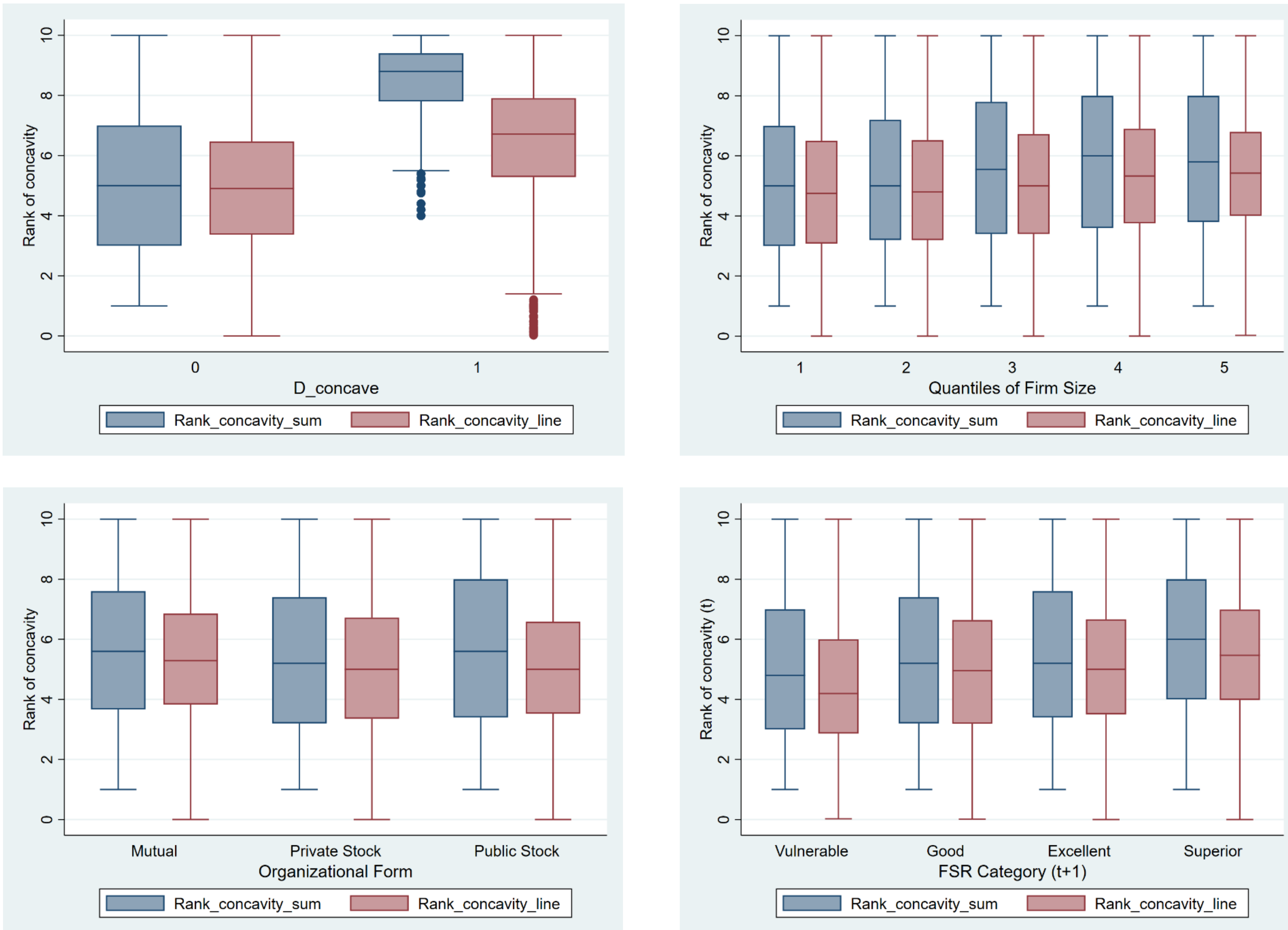
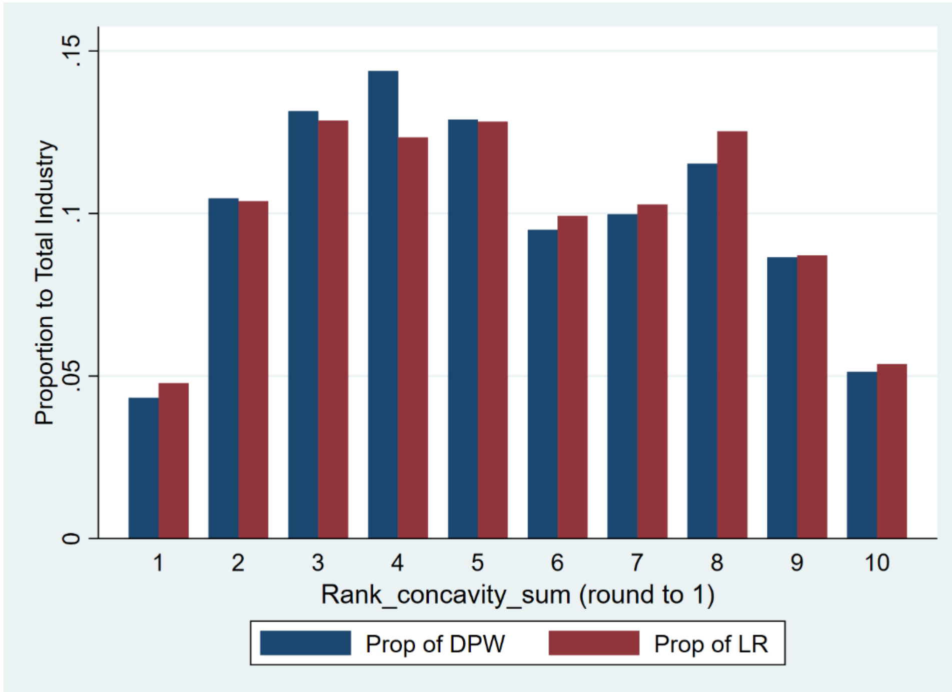


Figure 6: Distribution of Concavity Rankings



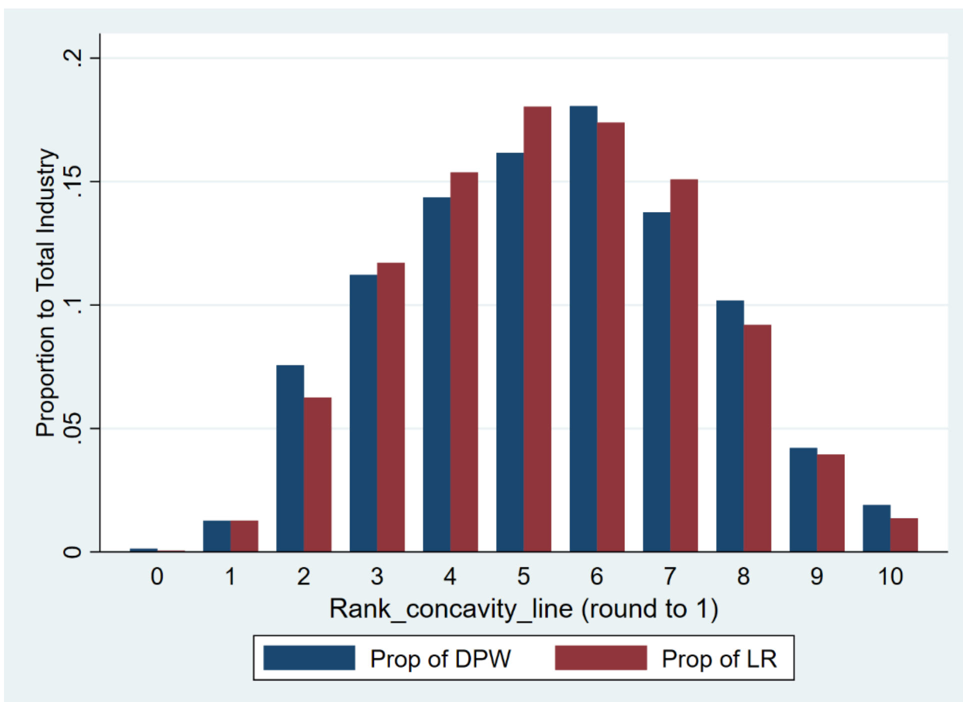


Figure 7: Importance of Firms in Different Deciles of Concavity Rankings

the loss reserves of each group in Figure 7. The purpose of Figure 7 is to show how important the insurers in each ranking category are in terms of the proportions of premiums and losses.

In the top graph, I find that when grouping insurers by the overall ranking of concavity, the proportions of premiums and losses represented by groups 2 to 9 are relatively uniform. Each group represents about 10 percent of the total industry. The two tail groups are less important and each covers about 5 percent of total premiums and losses.

In the bottom graph, I find that when grouping insurers by the by-line ranking of concavity, the proportions of premiums and losses represented by each group approximate to a normal distribution. Each of the middle four groups (groups 4 to 7) represents about 15 percent of total premiums and losses, whereas the groups 1 and 10 only cover about 1 percent. If I look at the insurers in groups 8, 9, and 10, I find that highly conditionally conservative insurers matter more when I use the overall ranking than when I use the by-line ranking.

In conclusion, I conduct a series of tests to confirm the validity of the new measures of conditional conservatism. Both the overall and by-line rankings of concavity are positively correlated with the traditional measure of conditional conservatism and are not driven by random shocks. Although the two ranking variables are relative measures of conditional conservatism, insurers that have strictly concave loss development curves are ranked much higher than those that do not. Moreover, the by-line ranking of concavity addresses the line mix issue to some extent but leads to less uniform distributions of premiums and losses across groups than the overall ranking.

3.6 Methodology

3.6.1 Diff-in-Diff Regression Model

I now examine how a change to accounting rules affects conditional conservatism. I focus on the enactment of SOX Section 404 and MAR. The identification method is a two-way fixed-effects diff-in-diff model. Since SOX Section 404 and MAR are similar, I first consider them one treatment event (*Treatment*) that occurs at a different time for different types of companies:

$$Rank\_concavity_{it} = \alpha + \lambda Treatment_{it} + \mathbf{X}_{it}\boldsymbol{\delta} + year_t + c_i + \varepsilon_{it} \qquad \textbf{(3.9)}$$

where $Treatment_{it}$ = 1 if year t is in or after the treatment year when insurer i starts following the SOX Section 404 or the MAR, and 0 otherwise,

$Rank\_concavity_{it}$ = Either $Rank\_concavity\_sum_{it}$ or $Rank\_concavity\_line_{it}$,

$\mathbf{X}_{it}$ = A vector of firm-level control variables, including group dummy, mutual dummy, publicly traded dummy, the log of total admitted assets, Reinsurance_usage, PHHI, GHHI, Growth, ROA, and Leverage,

$year_t$ = Year fixed effects, and

c_i = Firm fixed effects.

Alternatively, I also want to know the separate treatment effects of SOX Section 404 and MAR. I account for them as two treatment events (*Treatment_SOX* and *Treatment_MAR*) and test them in a subsample period so that they do not affect each other:

$$Rank\_concavity_{it} = \alpha + \lambda Treatment\_SOX_{it} + \mathbf{X}_{it}\boldsymbol{\delta} + year_t + c_i + \varepsilon_{it} \quad (t \in [1995, 2009]) \qquad \textbf{(3.10)}$$

$$Rank\_concavity_{it} = \alpha + \lambda Treatment\_MAR_{it} + \mathbf{X}_{it}\boldsymbol{\delta} + year_t + c_i + \varepsilon_{it} \quad (t \in [2006, 2015]) \qquad \textbf{(3.11)}$$

where $Treatment\_SOX_{it}$ = 1 if year t is in or after the treatment year when insurer i starts following the SOX Section 404 and 0 otherwise, and

$Treatment\_MAR_{it}$ = 1 if year t is in or after the treatment year when insurer i starts following the MAR, and 0 otherwise,

3.6.2 Discrete Response Models

I measure an insurer's insolvency risk in two ways. First, I look at whether an insurer becomes financially impaired and receives regulatory action. A.M. Best designates an insurer as being financially impaired when the insurer receives the first official regulatory action, including supervision, rehabilitation, liquidation, receivership, conservatorship, cease-and-desist orders, suspension, license revocation, and certain administrative orders (A.M. Best, 2013). I construct a dummy variable for financial impairment and use a Probit model to examine how conditional conservatism affects the probability of regulatory action:[38]

$$D\_impaired_{it+1,t+3} = I[y_{it}^{*} > 0],\ y_{it}^{*} = \alpha + \boldsymbol{\lambda} Rank\_concavity_{it} + \mathbf{Z}_{it}\boldsymbol{\delta} + year_t + \varepsilon_{it} \tag{3.12}$$

where $D\_impaired_{it+1,t+3}$ = A dummy equal to 1 if insurer i receives formal regulatory action in t+1, t+2, or t+3, and 0 otherwise, and

$\mathbf{Z}_{it}$ = A vector of firm-level control variables, including group dummy, mutual dummy, publicly traded dummy, the log of total admitted assets, Reinsurance_usage, PHHI, GHHI, and the reported values of thirteen IRIS ratios.

I also measure insolvency risk using the A.M. Best Financial Strength Rating. A. M. Best is a leading rating agency. The financial strength rating (FSR) issued by A. M. Best is "an independent opinion of an insurer's financial strength and ability to meet its

[38] I do not include firm-fixed effects in the discrete response model because fixed-effect estimator requires variation within a firm. If we drop firms which have never been financially impaired or had a rating change, we may obtain severely biased results.

ongoing insurance policy and contract obligations" (A.M. Best, 2019b). The FSR is a letter rating from A++ to D. I construct a categorical rating variable from 1 to 9, with 9 for A++, 8 for A+, 7 for A, 6 for A-, 5 for B++, 4 for B+, 3 for B, 2 for B-, and 1 for all ratings below B-. I use an ordered logit regression model to examine the effect of conditional conservatism on financial strength rating:

$$\Pr(Rating_{it+1} = k) = \Pr(cut_{k-1} < \mathbf{M}_{it}\boldsymbol{\beta} + \varepsilon_{it} < cut_k) = F(cut_k - \mathbf{M}_{it}\boldsymbol{\beta}) - F(cut_{k-1} - \mathbf{M}_{it}\boldsymbol{\beta})$$
$$\mathbf{M}_{it}\boldsymbol{\beta} = \theta Rank\_concavity_{it} + \mathbf{X}_{it}\boldsymbol{\delta} + year_t$$

(3.13)

where $Rating_{it+1}$ = A. M. Best financial strength rating of insurer i for the year t+1, and

$F(\bullet)$ = A cumulative distribution function of ε_{it} .

Overall, I expect to observe a negative $\boldsymbol{\lambda}$ and a positive θ coefficient for the ranking of concavity, indicating that an increase in the ranking of conditional conservatism decreases the probability of regulatory intervention and improves the financial strength rating.

Both discrete response models include year-fixed effects to control for firm-invariant time-varying factors. However, I do not include firm-fixed effects (FE) in the two discrete response models because the FE estimator will drop all observations that have no variation within the firm over time. In other words, the FE estimator will drop firms with no rating changes or have never been financially impaired. Dropping these firms will cause us to lose considerable information and lead to a biased estimator. I cluster the standard errors by firms to address the autocorrelation of observations over time.

3.6.3 Modified Discrete Response Models

Discrete Response Models with Instrumental Variables

There may be an endogeneity issue in the original discrete response models. As I mentioned before, conditional conservatism is a costly strategy for companies; thus, I may expect that financially stronger firms are more likely to adopt the conditional conservatism strategy. In other words, some unobservable terms that determine an insurer's insolvency risk may also affect the firm's usage of conditional conservatism.

To address the endogeneity issue, I instrument the measures of conditional conservatism using the enactment of MAR. Based on the parallel trend tests, MAR is a cleaner treatment on conditional conservatism than the combined effect. The parallel trend test also shows that the treatment effect of MAR is lagged. It takes several years to realize because the measures of conditional conservatism aggregate historical information. Hence, the instrumental variables (IV) include *Treatment_MAR* and its one-year lagged and two-year lagged values.

I use the ivprobit command in Stata to estimate the Probit model with IV. The ivprobit also reports statistics of a Wald test of the exogeneity of the instrumented variable (conditional conservatism). The test asks whether the error terms in the structural equation and the reduced-form equation for the endogenous variable are correlated. If I reject the null hypothesis of no endogeneity, then I report the results with IV (from ivprobit). However, if the test statistic is not significant, that means there is not sufficient information in the sample to reject the null hypothesis. In this case, I just report the results of the original Probit model.[39]

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[39] If we cannot reject the null hypothesis of no endogeneity, reporting the original results from the Probit model may be more appropriate because those results are likely to have smaller standard errors than the point

There is no standard procedure to include IV in the ordered logit model. Therefore, I use the Control Function (CF) Approach to instrument the endogenous variable in for the ordered logit model. The CF approach, also known as two-state residual inclusion, is a statistical method that corrects for endogeneity problems by modeling the endogeneity in the error term. If the error term of Rating (ε) contains unobservable factors (μ) that also affect the choice of conditional conservatism, then I can estimate μ using the instrumental variables. Then I explicitly include the estimated unobservable factors (μ) in the main ordered logit regression so that the remaining error term ε will no longer correlate with conditional conservatism. I bootstrap the two steps to obtain the standard errors of coefficients.

$$\begin{cases} \text{First step:} \\ Rank\_concavity_{it} = \alpha + \mathbf{Instrument}_{it}\boldsymbol{\lambda} + year_t + c_i + \mu_{it} \\ \text{Second step:} \\ \Pr(Rating_{it+1} = k) = \Pr(cut_{k-1} < \theta Rank\_concavity_{it} + \delta\mu_{it} + year_t + \varepsilon_{it} < cut_k) \\ \varepsilon_{it} = \kappa\mu_{it} + \nu_{it} \end{cases}$$

(3.14)

where $\mathbf{Instrument}_{it}$ = $Treatment\_MAR_{it}$, $Treatment\_MAR_{it-1}$, and $Treatment\_MAR_{it-2}$

The coefficient of μ is similar to the Wald-test statistic and can indicate whether endogeneity exists. If the coefficient of μ is statistically significant, then I report the results of the two-step residual inclusion model. Otherwise, I report the results from the original ordered logit model.

estimates with IV. More discussions can be found in Wooldridge (2002) and online at https://www.stata.com/statalist/archive/2006-01/msg00123.html.

Weighted Discrete Response Models

The measures of conditional conservatism may have measurement errors since *Rank_concavity_sum* and *Rank_concavity_line* are both estimated from regression models. To address the measurement error issue, I construct weighted discrete response models that give more importance to the observations with smaller standard errors of the curvature coefficient β_2. The weight is the inverse of the squared average standard errors of β_2. For the overall ranking of concavity, I simply average the standard errors of β_2 across five accident years. For the by-line ranking, I first obtain the average standard error of β_2 for each product category; then, I average them using premiums as weights. This is similar to calculating *Rank_concavity_line*.

3.7 Empirical Results

3.7.1 Accounting Rule Changes and Conditional Conservatism

Tables 3-6 and 3-7 report the results of the diff-in-diff regressions for the overall and the by-line ranking of concavity separately. For both measures of conditional conservatism, I find that the combined treatment effect and the treatment effect of MAR are statistically significant and negative. However, there is weak evidence for SOX Section 404. The coefficient of treatment SOX is marginally significant only when conditional conservatism is measured by the overall ranking of concavity. The columns (3) in two tables show that after the enactment of MAR, the overall ranking and by-line ranking of conditional conservatism are lowered by 1.2 and 0.6, respectively.

I conduct the parallel trend test to validate the diff-in-diff models. The parallel trend test is a visual inspection method to check whether the difference between the treated and control group is constant before the treatment year. The dot is the average treatment effect

Table 3-6: Diff-in-Diff Regression Results on Overall Ranking of Concavity

	(1) Full sample	(2) 1995 – 2009	(3) 2006-2015
Treatment	-0.666***		
	(0.147)		
Treatment_SOX		-0.312*	
		(0.177)	
Treatment_MAR			-1.165***
			(0.194)
D_group	-0.059	0.047	-0.310
	(0.151)	(0.190)	(0.231)
D_mutual	0.423*	0.263	-0.013
	(0.222)	(0.355)	(0.300)
D_public	0.427**	0.057	0.611
	(0.188)	(0.203)	(0.445)
Log(Asset)	-0.059	-0.074	-0.052
	(0.078)	(0.094)	(0.158)
Reinsurance_usage	-0.174	-0.090	-0.378
	(0.185)	(0.206)	(0.325)
PHHI	-0.201	-0.185	-0.474
	(0.238)	(0.269)	(0.398)
GHHI	0.615*	0.371	0.647
	(0.341)	(0.388)	(0.506)
ROA	2.096***	1.743***	3.432***
	(0.471)	(0.536)	(0.678)
Growth	0.112***	0.100**	0.110
	(0.043)	(0.048)	(0.079)
Leverage	-0.100	-0.066	-0.111
	(0.067)	(0.073)	(0.118)
LossProp_long_commercial	-0.303	-0.529	-1.127*
	(0.396)	(0.416)	(0.651)
LossProp _long_personal	-0.348	-0.265	-1.464**
	(0.423)	(0.428)	(0.667)
LossProp _short_commercial	0.126	-0.248	-0.416
	(0.419)	(0.444)	(0.688)
Constant	6.637***	7.094***	7.626**
	(1.486)	(1.757)	(3.073)
Observations	23,282	16,750	11,178
Overall R-squared	0.358	0.401	0.510
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Note: This table reports the diff-in-diff regression results for the overall ranking of conditional conservatism. Standard errors in parentheses are clustered by companies. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. I report the overall R-squareds that quantify the overall effect of both explanatory variables and fixed effects on the fit of the model.

Table 3-7: Diff-in-Diff Regression Results on By-Line Ranking of Concavity

	(1) Full sample	(2) 1995 – 2009	(3) 2006-2015
Treatment	-0.180*		
	(0.103)		
Treatment_SOX		-0.109	
		(0.122)	
Treatment_MAR			-0.566***
			(0.140)
D_group	-0.047	0.047	-0.417*
	(0.133)	(0.171)	(0.213)
D_mutual	0.642***	0.628**	0.162
	(0.176)	(0.285)	(0.244)
D_public	0.144	0.148	0.339
	(0.172)	(0.174)	(0.340)
Log(Asset)	0.191***	0.138*	0.247*
	(0.071)	(0.078)	(0.147)
Reinsurance_usage	-0.209	-0.115	-0.145
	(0.166)	(0.177)	(0.297)
PHHI	0.763***	0.900***	0.532
	(0.223)	(0.257)	(0.370)
GHHI	1.332***	1.114***	0.801
	(0.342)	(0.379)	(0.551)
ROA	0.931**	0.518	2.119***
	(0.460)	(0.497)	(0.626)
Growth	0.018	0.017	0.042
	(0.043)	(0.046)	(0.076)
Leverage	-0.111*	-0.050	-0.052
	(0.060)	(0.064)	(0.108)
LossProp_long_commercial	-1.331***	-1.382***	-2.555***
	(0.413)	(0.447)	(0.669)
LossProp _long_personal	-1.232***	-1.202**	-2.727***
	(0.457)	(0.477)	(0.741)
LossProp _short_commercial	-0.857**	-0.719	-2.108***
	(0.431)	(0.478)	(0.703)
Constant	1.909	2.730*	2.380
	(1.377)	(1.538)	(2.925)
Observations	21,834	15,647	10,567
Overall R-squared	0.397	0.451	0.518
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes

Note: This table reports the diff-in-diff regression results for the by-line ranking of conditional conservatism. Standard errors in parentheses are clustered by companies. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. I report the overall R-squareds that quantify the overall effect of both explanatory variables and fixed effects on the fit of the model.

and the bars represent the 95th confidence interval. I set the year before the treatment year as a benchmark; thus, I expect to observe that the treatment effect before time t-1 is close to zero. I conduct the parallel trend test for the combined treatment (*Treatment*) and the treatment of MAR (*Treatment_MAR*) since there is no evidence for SOX Section 404. I also do an additional parallel trend test for MAR for the full sample to investigate whether the result differs from that of the subsample.

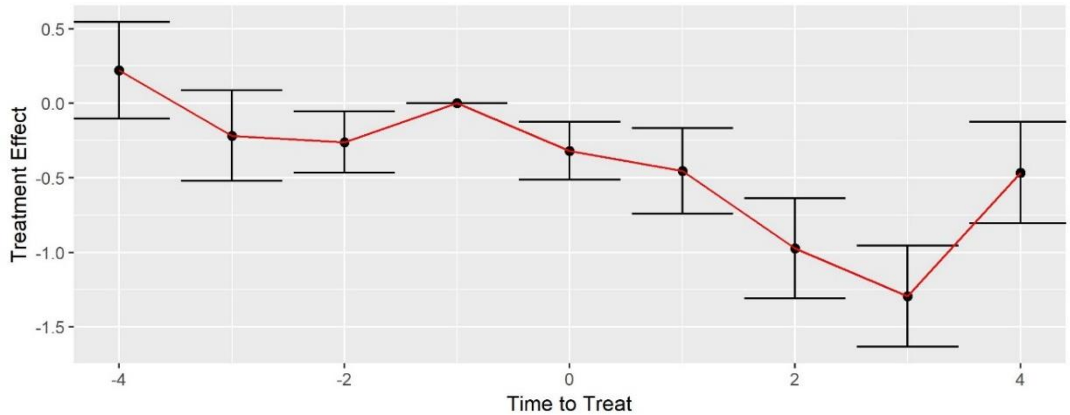
Figure 8 displays the parallel trend figures for the overall ranking of conditional conservatism. I find that the treatment of MAR has a pre-trend close to zero and can pass the parallel trend test in both the subsample and the full sample. However, the combined treatment barely passes the test since the treatment effect at time t-2 is marginally significant and negative.

The parallel trend for the by-line ranking of conditional conservatism is shown in Figure 9. The treatment of MAR marginally passes the parallel trend tests. The treatment effects before time t-1 are negative and marginally significantly different from 0. The combined treatment, however, cannot pass the test.

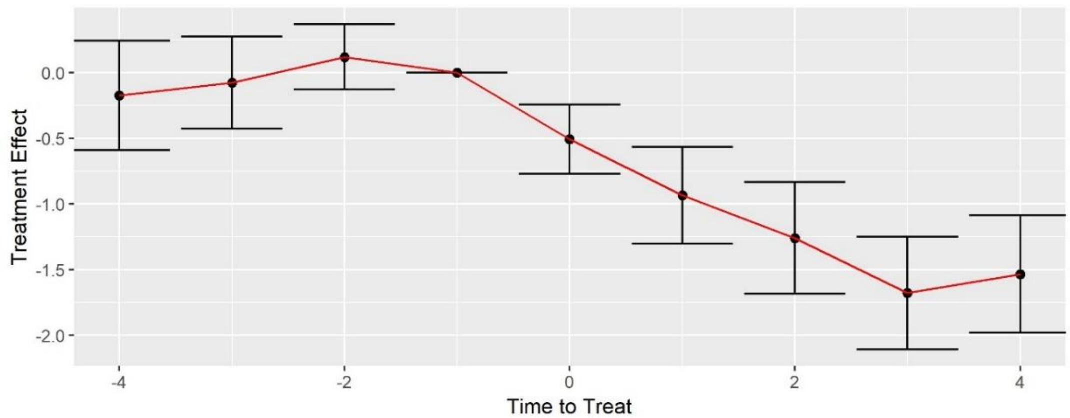
There are two takeaways from the parallel trend tests. First, the treatment of MAR is cleaner than the combined treatment and can pass most parallel trend tests. Second, the enactment of MAR has lagged treatment effects since the treatment effect becomes deeper and deeper after the treatment year. The treatment effect lags because the conditional conservatism measure aggregates historical information of past calendar years. For example, the conditional conservatism measure of 2010 is estimated based on the loss reserve development from the calendar year 2001 to 2010. However, only losses reported in 2010 are subject to the effect of MAR. In comparison, the conditional conservatism measure of 2012 has three calendar years subject to MAR: 2010, 2011, and 2012. Hence, the treatment effect at time t+2 is more significant than that at time t.

For robustness checks, I conduct the diff-in-diff model using the traditional method to measure conditional conservatism. The traditional measure is an asymmetric timeliness coefficient that indicates expected loss increases are reserved more quickly expected loss decreases (Ball and Shivakumar, 2005). I multiply the coefficient with treatment variables and include firm- and year-fixed effects to control for the differences between treated and control groups before treatment and the differences over time. The results show that the enactment of MAR makes the asymmetric timeliness coefficient less negative, indicating a lower level of conditional conservatism. Also, the effect of SOX Section 404 is statistically insignificant. The results of traditional model are consistent to the findings using new measures.

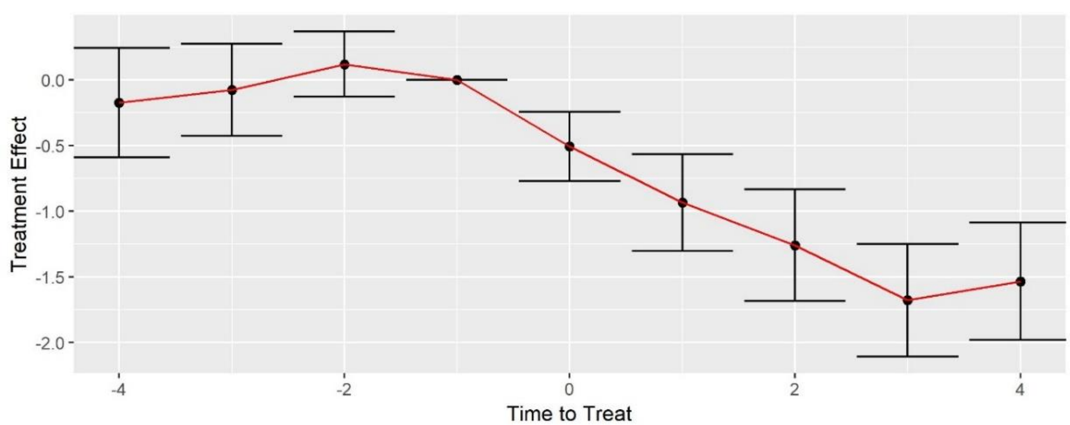
My findings relate to some prior studies. Lobo and Zhou (2010) compare a sample of dual-listed Canadian firms with firms listed only in Canada. They use the time-series test of conditional conservatism following Ball and Shivakumar (2005) and find firms subject to SOX report more conservatively. My finding is opposite, possibly because I only focus on the Section 404 of SOX or I look at a different industry setting where regulatory friction is a major cause for conditional conservatism. In the P&L insurance industry, Ma and Pope (2020) examine the total loss reserve error which reflects the overall level of accounting conservatism. Their diff-in-diff model shows that the treatment effect of SOX on the total loss reserve error is statistically insignificant. My finding that SOX Section 404 does not significantly impact conditional conservatism is qualitatively consistent with the findings of Ma and Pope (2020).



Panel A: Parallel Trend Test, Combined Treatment, *Rank_concavity_sum*

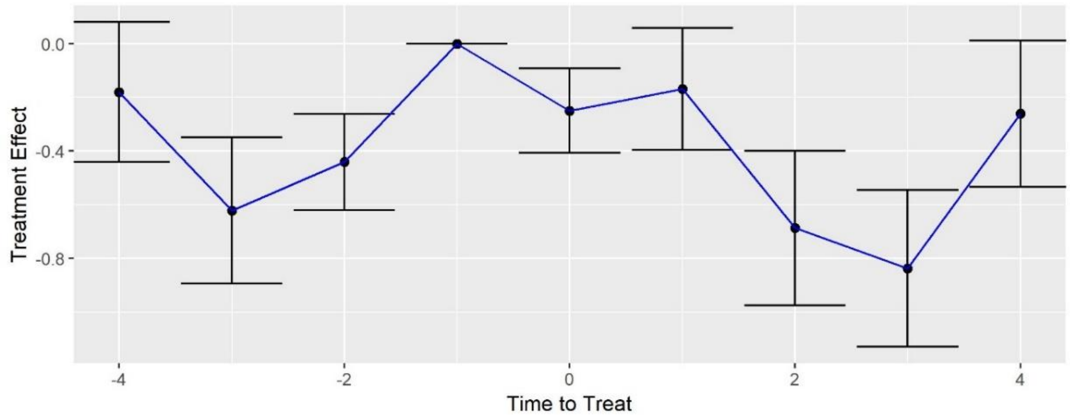


Panel B: Parallel Trend Test, Treatment of MAR, *Rank_concavity_sum* (subsample after 2005)

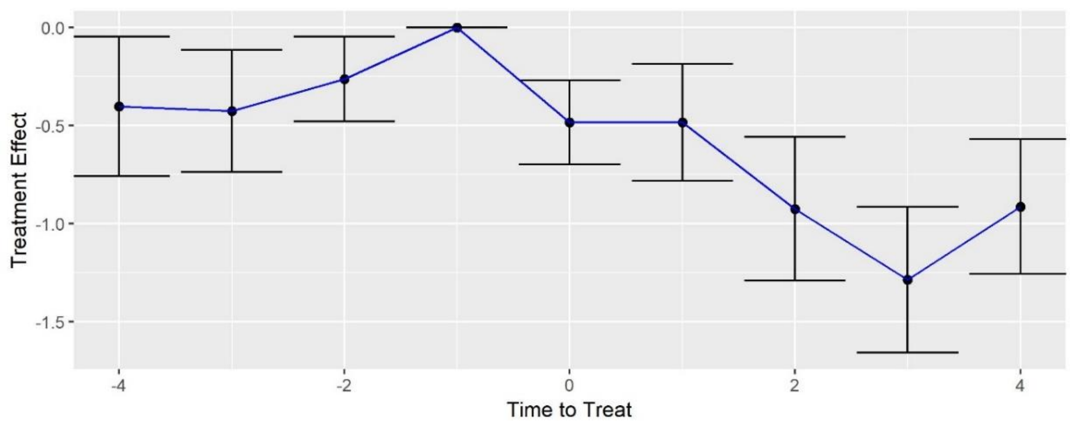


Panel C: Parallel Trend Test, Treatment of MAR, *Rank_concavity_sum* (full sample)

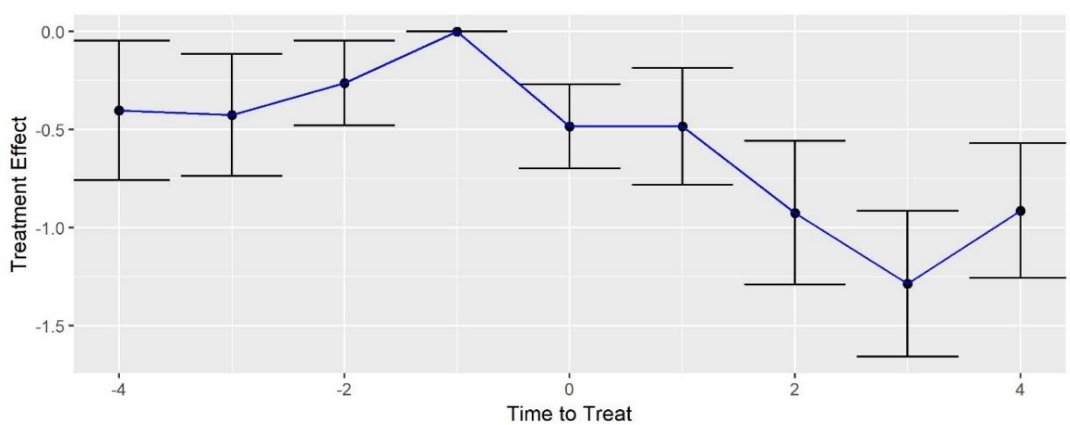
Figure 8: Parallel Trend Tests of Treatment Effect on Overall Concavity Ranking



Panel A: Parallel Trend Test, Combined Treatment, *Rank_concavity_line*



Panel B: Parallel Trend Test, Treatment of MAR, *Rank_concavity_line* (subsample after 2005)



Panel C: Parallel Trend Test, Treatment of MAR, *Rank_concavity_line* (full sample)

Figure 9: Parallel Trend Tests of Treatment Effect on By-Line Concavity Ranking

3.7.2 Conditional Conservatism and Insolvency Risk

Table 3-8 displays the results of the Probit model for regulatory intervention. Since the statistics of the Wald tests for the exogeneity of both conditional conservatism measures are not significant, I cannot reject the null hypothesis of exogeneity. Thus, I report the results from the original Probit model without instrumental variables.

The coefficients of both ranking variables are negative, consistent with my prediction. The overall concavity ranking's coefficient is not statistically significant, but the by-line concavity ranking's coefficient is significant at the 5% level. I interpret the results using the marginal effects. The average marginal effect in Column (4) means that for one-unit increase in the by-line ranking of conditional conservatism (i.e., *Rank_concavity_line*), there is a 0.1 percentage points decrease in the probability of regulatory intervention, with other things constant. As the mean of D_impaired is 0.011, one-unit increase in *Rank_concavity_line* reduces the average probability of financial impairment of the insurance industry from 0.011 to 0.010, which is equivalent to a 9% reduction.

Table 3-9 shows the regression coefficients of the ordered logit model. Since the coefficient of the residual μ is statistically significant, I report the results from the two-step residual inclusion model for *Rank_concavity_line*. I find consistent results for the two ranking variables of conditional conservatism. If I look at Column (2), the coefficient indicates that for one unit increase in the by-line ranking of conditional conservatism, there is a 0.13 increase in the log odds of being in a higher level of financial strength rating, given all other variables in the model are held constant.

Table 3-8: Probit Regression for Financial Impairment

Dependent Var =	(1) $D\_impaired_{t+1,t+3}$	(2) dy/dx	(3) $D\_impaired_{t+1,t+3}$	(4) dy/dx
Rank_concavity_sum	-0.0171	-0.0004		
	(0.0157)	(0.0004)		
Rank_concavity_line			-0.0473**	-0.0011**
			(0.0208)	(0.0005)
D_group	-0.3296***		-0.2548**	
	(0.1026)		(0.1068)	
D_mutual	-0.4664***		-0.4201***	
	(0.1321)		(0.1343)	
D_public	-1.3745***		-1.3812***	
	(0.4210)		(0.4244)	
Log(Asset)	-0.0770***		-0.0780**	
	(0.0297)		(0.0316)	
Reinsurance_usage	0.0661		0.0084	
	(0.1651)		(0.1759)	
PHHI	0.1374		0.1811	
	(0.1479)		(0.1615)	
GHHI	-0.4918		-0.5105	
	(0.4417)		(0.4704)	
LossProp_long_commercial	0.6609**		0.5887	
	(0.3038)		(0.3635)	
LossProp _long_personal	0.3857		0.2976	
	(0.3989)		(0.4721)	
LossProp _short_commercial	0.0825		0.0592	
	(0.3350)		(0.4346)	
IRIS Ratio1 - Ratio 13	Not tabulated		Not tabulated	
Observations	22,136	22,136	20,759	20,759
Year FE	Yes		Yes	
Firm FE	No		No	
Instrumental Variables	No		No	
Standard Errors	Clustered by firms	Delta-method	Clustered by firms	Delta-method
Exogeneity test Wald chi-squared	2.245		0.353	
Exogeneity test Wald p-value	0.134		0.552	

Note: This table reports the results for the probability of insurers receiving regulatory action. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. Columns 1 and 3 show the *coefficients,* and columns 2 and 4 show the corresponding *average marginal effects*. The Wald exogeneity test is conducted using the current, one-year lagged, and two-year lagged values of the treatment MAR as instrumental variables. A result not rejecting the null hypothesis indicates that there is no evidence for endogeneity and that reporting the original results is more proper.

Table 3-9: Ordered Logit Regression for Financial Strength Rating

Dependent Var =	(1) $Rating_{t+1}$	(2) $Rating_{t+1}$
Rank_concavity_sum	0.0256***	
	(0.0096)	
Rank_concavity_line		0.1323***
		(0.0275)
D_group	0.5752***	0.6403***
	(0.0917)	(0.0983)
D_mutual	-0.0111	-0.0296
	(0.0933)	(0.1002)
D_public	0.6868***	0.7140***
	(0.1032)	(0.1052)
Log(Asset)	0.5448***	0.5115***
	(0.0266)	(0.0283)
Reinsurance_usage	0.6183***	0.5910***
	(0.1413)	(0.1427)
PHHI	-0.5137***	-0.4954***
	(0.1284)	(0.1451)
GHHI	-1.1396***	-1.4115***
	(0.3522)	(0.3894)
ROA	6.6248***	7.1747***
	(0.5062)	(0.5773)
Growth	0.4641***	0.5139***
	(0.0443)	(0.0451)
Leverage	-1.0653***	-1.0997***
	(0.0658)	(0.0649)
LossProp_long_commercial	-1.1591***	-1.2915***
	(0.2691)	(0.3099)
LossProp _long_personal	-0.8072**	-0.9848**
	(0.3306)	(0.3837)
LossProp _short_commercial	-0.7198***	-0.7192**
	(0.2766)	(0.3227)
Observations	23,282	23,282
Year FE	Yes	Yes
Firm FE	No	No
Instrumental Variables	No	Yes
Standard Errors	Clustered by firms	Bootstrapping with 1000 replications based on clusters of firms
μ	-0.0330	-0.1253***
Std. error of μ	(0.0270)	(0.0283)

Note: This table reports the result for the analysis of financial strength rating. I report the *coefficients* of the ordered logit model. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. A significant coefficient of μ indicates that the instrumented variable (i.e., conditional conservatism) is significantly correlated with the error term of financial strength rating.

Table 3-10: Average Marginal Effects of Ordered Logit Model

	(1) dy/dx ***Rank_concavity_sum***	(2) dy/dx ***Rank_concavity_line***
Outcome(1): Below B-	-0.0004***	-0.0019***
	(0.0001)	(0.0004)
Outcome(2): B-	-0.0003***	-0.0014***
	(0.0001)	(0.0003)
Outcome(3): B	-0.0006***	-0.0029***
	(0.0002)	(0.0006)
Outcome(4): B+	-0.0010***	-0.0048***
	(0.0004)	(0.0010)
Outcome(5): B++	-0.0010***	-0.0051***
	(0.0004)	(0.0011)
Outcome(6): A-	-0.0013***	-0.0068***
	(0.0005)	(0.0015)
Outcome(7): A	0.0012***	0.0058***
	(0.0005)	(0.0013)
Outcome(8): A+	0.0020***	0.0104***
	(0.0008)	(0.0022)
Outcome(9): A++	0.0012***	0.0067***
	(0.0005)	(0.0015)
Observations	23,282	21,834
Year FE	Yes	Yes
Firm FE	No	No
Instrumental Variables	No	Yes
Standard Errors	Delta-method	Bootstrapping with 1000 replications based on clusters of firms

Note: This table reports the average marginal effects of the ordered logit model for the effect of conditional conservatism on financial strength rating. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels.

The average marginal effects of the ordered logit model are reported in Table 3-10. I use Column (2) as an example to interpret the results. The average marginal effects indicate that when an insurer's by-line ranking of conditional conservatism increases by one unit, the firm's financial strength rating is 0.7 percentage points more likely to fall in the A++ category, 1 percentage points more likely in the A+ category, 0.6 percentage points more likely in the A category, and less likely falling in a rating category below A. The average marginal effects of the overall ranking of conditional conservatism are similar but of smaller magnitudes.

To investigate whether my results are affected by the measurement error of conditional conservatism, I rerun the regressions in Tables 3-8 and 3-9 by weighting the observations by the inverse of the squared average standard errors of β_2 from the quadratic model. I handle the measurement error by attaching more importance to the data points of high quality (i.e., low standard error of β_2). The results of the weighted Probit model and the weighted ordered logit model are displayed in Tables 3-11 and 3-12. The marginal effects of the weighted ordered logit model are shown in Table 3-13. The coefficients are estimated by weighted regressions, but I do not weigh observations when averaging the marginal effects.

The results of the weighted regression models generally dominate the original results. First, the coefficient of *Rank_concavity_sum* in Column (1) of Table 3-8 becomes statistically significant in Column (1) of Table 3-11. Besides, the coefficients and marginal effects of the weighted regression models have greater magnitudes. For example, a unit increase in *Rank_concavity_line* reduces the average probability of regulatory intervention by 0.5 percentage points, which is higher than the 0.1 percentage points in Table 3-8. Also,

Table 3-11: Weighted Probit Regression for Financial Impairment

	(1)	(2)	(3)	(4)
Dependent Var =	$D\_impaired_{t+1,t+3}$	dy/dx	$D\_impaired_{t+1,t+3}$	dy/dx
Rank_concavity_sum	-0.0795***	-0.0013***		
	(0.0260)	(0.0004)		
Rank_concavity_line			-0.3115***	-0.0047***
			(0.1152)	(0.0015)
D_group	-0.5529***		-1.3837***	
	(0.1707)		(0.3282)	
D_mutual	-0.3675**		0.3869	
	(0.1573)		(0.3751)	
D_public	-1.3447***		-4.3201***	
	(0.4367)		(1.5440)	
Log(Asset)	-0.0770*		-0.2638**	
	(0.0444)		(0.1061)	
Reinsurance_usage	0.2749		-1.1252	
	(0.2499)		(0.7109)	
PHHI	0.3344		-1.6216**	
	(0.2174)		(0.8142)	
GHHI	-0.3217		2.4538**	
	(0.5954)		(0.9733)	
LossProp_long_commercial	0.3832		5.9150***	
	(0.3719)		(1.5022)	
LossProp _long_personal	-0.0836		5.1509***	
	(0.4340)		(1.8631)	
LossProp _short_commercial	-0.3204		1.9416	
	(0.4168)		(1.1914)	
IRIS Ratio1 - Ratio 13	Not tabulated		Not tabulated	
Observations	22,136	22,136	20,759	20,759
Year FE	Yes		Yes	
Firm FE	No		No	
Instrumental Variable	No		No	
Standard Errors	Clustered by firms	Delta-method	Clustered by firms	Delta-method

Note: This table reports the results for the probability of insurers receiving regulatory action. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. Columns 1 and 3 show the *coefficients*, and columns 2 and 4 show the corresponding *average marginal effects*. The weight is the inverse of the squared average standard errors of β_2 from the quadratic model.

Table 3-12: Weighted Ordered Logit Regression for Financial Strength Rating

	(1)	(2)
Dependent Var =	$Rating_{t+1}$	$Rating_{t+1}$
Rank_concavity_sum	0.0699***	
	(0.0218)	
Rank_concavity_line		1.3672*
		(0.7161)
D_group	0.6588***	-1.5119
	(0.1295)	(4.1741)
D_mutual	-0.2919**	-4.2215
	(0.1233)	(3.3972)
D_public	0.3795***	-0.1159
	(0.1452)	(2.8366)
Log(Asset)	0.5483***	2.1267*
	(0.0373)	(1.2676)
Reinsurance_usage	0.8300***	-1.4537
	(0.2058)	(6.3129)
PHHI	-0.4937**	6.2337
	(0.1918)	(5.7343)
GHHI	-2.1574***	-1.7298
	(0.5055)	(12.9661)
ROA	7.3012***	-13.7076
	(1.0380)	(16.9460)
Growth	0.6510***	-2.3864
	(0.0827)	(1.6577)
Leverage	-1.1473***	-4.8724**
	(0.1020)	(2.1324)
LossProp_long_commercial	-1.1425***	5.6262
	(0.3578)	(10.3144)
LossProp _long_personal	-0.5584	0.1600
	(0.4459)	(12.1134)
LossProp _short_commercial	-0.4686	5.6806
	(0.3835)	(10.4429)
Observations	23,282	23,282
Year FE	Yes	Yes
Firm FE	No	No
Instrumental Variables	No	Yes
Standard Errors	Clustered by firms	Bootstrapping with 1000 replications based on clusters of firms
μ	NA	-2.1784**
Std. error of μ	NA	(1.1105)

Note: This table reports the result for the analysis of financial strength rating. I report the *coefficients* of the ordered logit model. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. The weight of the regression model is the inverse of the squared average standard errors of β_2 from the quadratic model. I calculate the average marginal effects without weighting observations.

Table 3-13: Average Marginal Effects of Weighted Ordered Logit Model

	(1) dy/dx ***Rank_concavity_sum***	(2) dy/dx ***Rank_concavity_line***
Outcome(1): Below B-	-0.0006***	-0.0195
	(0.0002)	(0.0122)
Outcome(2): B-	-0.0004***	-0.0001
	(0.0002)	(0.0013)
Outcome(3): B	-0.0009***	-0.0015
	(0.0003)	(0.0033)
Outcome(4): B+	-0.0015***	-0.0018
	(0.0005)	(0.0025)
Outcome(5): B++	-0.0022***	-0.0090
	(0.0007)	(0.0065)
Outcome(6): A-	-0.0052***	-0.0344
	(0.0016)	(0.0216)
Outcome(7): A	0.0002	0.0060
	(0.0003)	(0.0126)
Outcome(8): A+	0.0055***	0.0370*
	(0.0017)	(0.0196)
Outcome(9): A++	0.0052***	0.0234
	(0.0018)	(0.0145)
Observations	23,282	21,834
Year FE	Yes	Yes
Firm FE	No	No
Instrumental Variables	No	Yes
Standard Errors	Delta-method	Bootstrapping with 1000 replications based on clusters of firms

Note: This table reports the average marginal effects of the weighted ordered logit model for the effect of conditional conservatism on financial strength rating. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels. The weight of the regression model is the inverse of the squared average standard errors of β_2 from the quadratic model. I calculate the average marginal effects without weighting observations.

when *Rank_concavity_sum* increases by one unit, the average insurer is 0.5 percentage points more likely to have an A++ rating in Table 3-13, which is higher than the 0.1 percentage points in Table 3-10. An exception is that the average marginal effects of the outcome group A are not statistically significant under the weighted ordered logit model. However, they are significant under the original model in Table 3-10.

3.8 Conclusion

In this chapter, I study how conditional conservatism affects the insolvency risk of P&L insurance companies. I develop a new method to measure conditional conservatism which is based on the concavity of the loss development curve. The new measures are essentially the decile ranking of concavity. In addition to the overall ranking of concavity, I also construct a by-line ranking of concavity to address the line mix issue.

To investigate the effect of conditional conservatism on insolvency risk, I employ two types of discrete response models – Probit and Ordered Logit. I evaluate an insurer's insolvency risk by the probability of regulatory action and the A. M. Best financial strength rating. I find that a higher ranking of conditional conservatism leads to a lower probability of regulatory intervention and a stronger financial strength rating.

I also employ a diff-in-diff model to examine the effect of accounting rule changes on conditional conservatism. I find that insurers reserve less conditionally conservatively after the enactment of MAR. The treatment effect of SOX Section 404 is also negative but not statistically significant. The findings suggest that although SOX Section 404 and MAR put additional disclosure requirements in force to improve the transparency and accuracy of financial reporting, they come at the cost of reducing the level of conditional conservatism.

When conditional conservatism and new accounting rules serve as two different mechanisms for insurers to reduce financial frictions and regulation costs, the former equips insurers with a buffer in reserves, whereas the latter results in more detailed documentation on the financial reporting process. For insurance companies and regulators, a buffer in reserves can be more critical than improvements in documentation and internal control process because a reserve cushion directly determines the resources available for insurers to cover future losses. As a result, SOX Section 404 and MAR leads insurers to have a higher probability of insolvency.

This ramification may not exist in a non-financial industry such as manufactures where financial risk is reduced when financial reporting is more transparent under new accounting rules. However, financial institutions deal with more complex financial risks and face higher uncertainty in accrual estimation. Their financial risk can become higher when financial reporting is more transparent but less conditionally conservative. My findings suggest that financial institutions, especially the insurance industry, should not be excluded from accounting research. They account for a significant portion of gross domestic product and behave differently from non-financial institutions in financial reporting.

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APPENDIX A

VARIABLE DEFINITIONS OF CHAPTER 2

Variable	Definition
$IncurredLoss_t$	The total incurred losses of accident years t-4 through t-1 evaluated in the calendar year t, scaled by the total admitted assets at the end of year t-1.
$LRE_{t-1,t}$	The single-year loss reserve error for the incurred losses of accident year t-1 reported in the calendar year t, scaled by the total admitted assets at the end of year t-1.
$LRE_{t-2,t}$	The single-year loss reserve error for the incurred losses of accident year t-2 reported in the calendar year t, scaled by the total admitted assets at the end of year t-1.
$LRE_{t-3,t}$	The single-year loss reserve error for the incurred losses of accident year t-3 reported in the calendar year t, scaled by the total admitted assets at the end of year t-1.
$LRE_{t-4,t}$	The single-year loss reserve error for the incurred losses of accident year t-4 reported in the calendar year t, scaled by the total admitted assets at the end of year t-1.
$LRE_{total,t}$	The sum of $LRE_{t-1,t}$, $LRE_{t-2,t}$, $LRE_{t-3,t}$, and $LRE_{t-4,t}$.
$Ex\text{-}AnteCons_t$	The level of *ex-ante* conservatism measured by the decile ranking of initial loss reserve deviation. The initial reserve deviation is the sum of initial estimates of incurred losses minus their ultimate values reported in the last development year in Schedule P, Part 2 table.
$NetCFO_t$	Net cash flows from underwriting in the calendar year t, which is the net cash flows from operations in the Cash Flow sheet, scaled by the total admitted assets at the end of year t-1. *DNetCFO* is a dummy equal to 1 if *NetCFO* < 0.
$\Delta NetCFO_t$	The change in net cash flows from underwriting from t-1 to t, scaled by the total admitted assets at the end of year t-1. $D\Delta NetCFO$ is a dummy equal to 1 if $\Delta NetCFO < 0$.
$NetCFOdev_t$	The deviation of an insurer's net cash flows from underwriting from the industry median, i.e., $NetCFO_t - median(NetCFO)_t$, scaled by the total admitted assets at the end of year t-1. *DNetCFOdev* is a dummy equal to 1 if *NetCFOdev* < 0.
$\Delta PaidLoss_t$	The change in cash flows for benefits and loss related payments from t-1 to t. To keep the coefficient prediction the same, the change is the paid losses of year t-1 minus the paid losses of year t, scaled by the total admitted assets at the end of year t-1. $D\Delta PaidLoss$ is a dummy equal to 1 if $\Delta PaidLossI < 0$, i.e., the bad news is an increase in cash flows for loss payments.
$\Delta Premium_t$	The change in net premiums written from t-1 to t, scaled by the total admitted assets at the end of year t-1. $D\Delta Premium$ is a dummy equal to 1 if $\Delta Premium < 0$.
$\Delta NetInvGain_t$	The change in net investment gains in the Income statement from t-1 to t, scaled by the total admitted assets at the end of year t-1. It includes net investment income and net realized capital gains after tax. $D\Delta NetInvGain$ is a dummy equal to 1 if $\Delta NetInvGain < 0$.
$Group_t$	A dummy equal to 1 if the insurer is affiliated within a group and 0 otherwise.

VARIABLE DEFINITIONS OF CHAPTER 2 (continued)

Variable	Definition
$Stock_t$	A dummy equal to 1 if the insurer is a stock company and 0 otherwise.
$Mutual_t$	A dummy equal to 1 if the insurer is a mutual or reciprocal and 0 otherwise. An insurer that is neither stock nor mutual is defined as *Other_OrgForm*, including Lloyd's of London, Risk Retention Group, and US branch of an alien insurer.
NOL_t	A dummy equal to 1 if the insurer has a net operating loss carryforward from the prior year (i.e., the prior year's net income is negative) and 0 otherwise
$Smooth_t$	*Smooth* is the standard deviation of net income divided by the standard deviation of total net cash flows during the past five years, both scaled by the total admitted assets. I use the decile ranking of *Smooth* in this chapter, i.e., *Rank(Smooth)*.
$RateReg_t$	The ratio of the direct premiums written subject to strict rate regulation to the total direct premiums written in the calendar year t. A state has strict rate regulation if the insurance rate is state-made or prior-approval.
$Z\text{-}score_{t-1}$	*Z-score* is the sum of ROA and the surplus-asset ratio divided by the standard deviation of ROA during the past five years. I use the one-year lagged natural logarithm of the Z-score in this chapter.
$Rein\_usage_t$	The ratio of premiums ceded to the gross premiums written in the calendar year t.
$Leverage_{t-1}$	The ratio of net premiums written to surplus evaluated at the end of the calendar year t-1
$Growth_t$	The change in net premiums written from t-1 to t
$PHHI_t$	The Herfindahl-Hirschman Index by direct premiums written across product lines
$GHHI_t$	The Herfindahl-Hirschman Index by direct premiums written across states
$LossProp\_lp_{t-1}$	The percentage of incurred losses in long-tail and private insurance lines at the end of the calendar year t-1
$LossProp\_lc_{t-1}$	The percentage of incurred losses in long-tail and commercial insurance lines at the end of the calendar year t-1
$LossProp\_sc_{t-1}$	The percentage of incurred losses in short-tail and commercial insurance lines at the end of the calendar year t-1
$Asset_t$ *(million)*	Total admitted assets at the end of the calendar year t

APPENDIX B

VARIABLE DEFINITIONS OF CHAPTER 3

Variable	Definition
D_concave	A dummy of conditional conservatism equal to 1 if the insurer's fitted loss development curve is *concave* ($\beta_2 < 0$) for both good-news and bad-news scenarios, and 0 otherwise. Good-news (bad-news) scenario means that insurers initially overstate (understate) incurred losses and have reserve slack (reserve deficiency), which implies that $\beta_1 < 0$ ($\beta_1 > 0$).
Rank_concavity_sum	The decile rank of conditional conservatism across insurers based on the concavity of loss development curve (i.e., the inverse ranking of β_2) and the total incurred losses in Schedule P Part 2 Summary.
Rank_concavity_line	The decile rank of conditional conservatism across insurers based on the concavity of loss development curve (i.e., the inverse ranking of β_2) and the incurred losses of different product lines in Schedule P Part 2A through 2H and 2R. For each firm-year, I average the rankings of conditional conservatism for different product lines using the proportion of direct premiums written as weight. The premiums data of different lines come from State Pages.
Rating	A categorical variable of A.M. Best Financial Strength Rating. The coding is 9 for A++, 8 for A+, 7 for A, 6 for A-, 5 for B++, 4 for B+, 3 for B, 2 for B-, and 1 for all ratings below B-.
D_impaired	A dummy equal to 1 if the insurer becomes financially impaired in t+1, t+2, or t+3. A.M. Best designates an insurer as financially impaired when the insurer receives the first official regulatory action, including supervision, rehabilitation, liquidation, receivership, conservatorship, cease-and-desist orders, suspension, license revocation, and certain administrative orders (A.M. Best, 2013).
Asset	Total admitted assets
Reinsurance_usage	The ratio of premiums ceded to the gross premiums written.
Growth	The one-year percentage change of net premiums written.
Leverage	The ratio of net premiums written to surplus.
PHHI	The Herfindahl-Hirschman index across product lines calculated using direct premiums written.
GHHI	The Herfindahl-Hirschman index by geographical areas calculated using direct premiums written.
LossProp_long_commercial	The percentage of incurred losses (from State Pages) in long-tail and commercial lines.
LossProp_long_personal	The percentage of incurred losses (from State Pages) in long-tail and personal lines.

VARIABLE DEFINITIONS OF CHAPTER 3 (continued)

Variable	Definition
LossProp_short_commercial	The percentage of incurred losses (from State Pages) in short-tail and commercial lines.
LossProp_short_personal	The percentage of incurred losses (from State Pages) in short-tail and personal lines.
D_group	A dummy equal to 1 if the insurer is affiliated within a group and 0 otherwise.
D_mutual	A dummy equal to 1 if the insurer is a mutual or reciprocal company and 0 otherwise.
D_public	A dummy equal to 1 if the insurer's affiliated group is publicly traded and 0 otherwise.
IRIS_ratios	Thirteen ratios calculated following NAIC (2016). See Appendix D for details.
Treatment	A dummy equal to 1 in and after the treatment year when the insurer is required to follow the Sarbanes–Oxley Act (SOX) Section 404 or Model Audit Rule (MAR), and 0 before the treatment year. It averages the effects of *Treatment_SOX* and *Treatment_MAR*.
Treatment_SOX	A dummy equal to 1 in and after the treatment year when the insurer starts being subject to the Sarbanes–Oxley Act (SOX) Section 404 and 0 before the treatment year.
Treatment_MAR	A dummy equal to 1 in and after the treatment year when the insurer starts being subject to the Model Audit Rule (MAR), and 0 before the treatment year.

APPENDIX C

DEFINITIONS OF LONG-TAIL, SHORT-TAIL, PERSONAL, AND COMMERCIAL LINES

Schedule P Line Categories	Long-/Short-tail	Related Lines in State Page
2A-Homeowners/Farmowners	Long-tail	**Personal**: Multiple Peril Crop, Federal Flood, Private Crop, Farmowners Multiple Peril, Homeowners Multiple Peril
2B-Private Passenger Auto Liability/Medical	Long-tail	**Personal**: Private Passenger Auto No-Fault, Other Private Passenger Auto Liability
2C-Commercial Auto/Truck Liability/Medical	Long-tail	**Commercial**: Commercial Auto No-Fault, Other Commercial Auto Liability
2D-Workers' Compensation (Excluding Excess Workers' Compensation)	Long-tail	**Commercial**: Workers' Compensation
2E-Commercial Multiple Peril	Long-tail	**Commercial**: Commercial Multiple Peril (Non-Liability Portion), Commercial Multiple Peril (Liability portion)
2F-Medical Professional Liability	Long-tail	**Commercial**: Medical Professional Liability
2G-Special Liability (Ocean Marine, Aircraft (All Perils), Boiler and Machinery)	Long-tail	**Commercial**: Ocean Marine, Aircraft (all perils), Boiler and Machinery
2H-Other Liability	Long-tail	**Commercial**: Other Liability—Occurrence, Other Liability—Claims-Made, Excess Workers' Compensation
2R-Products Liability	Long-tail	**Commercial**: Products Liability
2I-Special Property (Fire, Allied Lines, Inland Marine, Earthquake, Burglary, and Theft)	Short-tail	**Commercial**: Fire, Allied Lines, Inland Marine, Earthquake, Burglary and Theft
2J-Auto Physical Damage	Short-tail	**Personal:** Private Passenger Auto Physical Damage **Commercial:** Commercial Auto Physical Damage
2K-Fidelity, Surety	Short-tail	**Commercial**: Fidelity, Surety
2L-Other (Including Credit, Accident and Health)	Short-tail	**Commercial**: Credit **Other**: All Accident and Health (A&H) lines
2S-Financial Guaranty/Mortgage Guaranty	Short-tail	**Commercial**: Mortgage Guaranty, Financial Guaranty
2T-Warranty	Short-tail	**Commercial**: Warranty

APPENDIX D

INSURANCE REGULATORY INFORMATION SYSTEM (IRIS) RATIOS' DEFINITIONS, BOUNDS, RELATION TO LOSS RESERVE, AND CALCULATION

Ratio Number	Ratio Name	Lower Bound	Upper Bound	Relation to Loss Reserve	Calculation
1	Gross Premiums Written to Policyholders' Surplus	--	900	Under-reserving improves this ratio by increasing the surplus	Ratio 1 = 100 * (direct premiums written + reinsurance premiums assumed) / policyholders' surplus
2	Net Premiums Written to Policyholders' Surplus	--	300	Under-reserving improves this ratio by increasing the surplus	Ratio 2 = 100 * net premiums written / policyholders' surplus
3	Change in Net Premiums Written	-33	33	None	Ratio 3 = 100 * (net premiums written, current year – net premiums written, prior year) / net premiums written, prior year
4	Surplus Aid to Policyholders' Surplus	--	15	Under-reserving improves this ratio by increasing the surplus	Surplus aid = reinsurance ceded Commissions / reinsurance premiums Ceded * unearned premium – non-affiliates Ratio 4 = 100 * surplus aid / policyholders' surplus
5	Two -Year Overall Operating Ratio	--	100	Under-reserving improves this ratio by decreasing the losses & LAE incurred	Two-year loss ratio = 100 * [losses & LAE incurred (current year + prior year) + policyholder dividends (current year + prior year)] / premiums earned (current year + prior year) Two-year expense ratio = 100 * [other underwriting expenses (current year + prior year) - other income (current year + prior year)] / net premiums written (current year + prior year) Two-year investment income ratio = 100 * investment income earned (current year + prior year) / premiums earned (current year + prior year) Ratio 5 = two-year loss ratio + two-year expense ratio – two-year investment income ratio

INSURANCE REGULATORY INFORMATION SYSTEM (IRIS) RATIOS' DEFINITIONS, BOUNDS, RELATION TO LOSS RESERVE, AND CALCULATION (continued)

Ratio Number	Ratio Name	Lower Bound	Upper Bound	Relation to Loss Reserve	Calculation
6	Investment Yield	3.0	6.5	None	Ratio 6 = 100 * net investment income earned / [(total cash and invested assets (current year + prior year) + investment income due & accrued (current year + prior year) - borrowed money & interest (current year + prior year)) / 2]
7	Gross Change in Policyholders' Surplus	-10	50	Under-reserving increases policyholders' surplus, but the overall impact on this ratio is indeterminate	Ratio 7 = 100 * (policyholders' surplus, current year – policyholders' surplus, prior year) / policyholders' surplus, prior year
8	Change in Adjusted Policyholders' Surplus	-10	25	Under-reserving increases policyholders' surplus, but the overall impact on this ratio is indeterminate	Adjusted policyholders' surplus = policyholders' surplus – change in surplus notes – capital paid-in or transferred – surplus paid-in or transferred – policyholders' surplus, prior year Ratio 8 = 100 * adjusted policyholders' surplus / ABS (policyholders' surplus, prior year)
9	Adjusted Liabilities to Liquid Assets	--	100	Under-reserving improves this ratio by decreasing liabilities	Adjusted liabilities = total liabilities – liabilities equal to deferred agents' balances Liquid assets = bonds + stocks + cash, cash equivalents, & short-term investments + receivable for securities + investment income due & accrued – investments in parent, subsidiaries, & affiliates Ratio 9 = 100 * adjusted liabilities / liquid assets
10	Gross Agents' Balances (in collection) to Policyholders' Surplus	--	40	Under-reserving improves this ratio by increasing the surplus	Ratio 10 = 100 * gross agents' balances in the course of collection / policyholders' surplus

INSURANCE REGULATORY INFORMATION SYSTEM (IRIS) RATIOS' DEFINITIONS, BOUNDS, RELATION TO LOSS RESERVE, AND CALCULATION (continued)

Ratio Number	Ratio Name	Lower Bound	Upper Bound	Relation to Loss Reserve	Calculation
11	One-Year Reserve Development to Policyholders' Surplus	--	20	Under-reserving improves this ratio by decreasing the reserve development and increasing the surplus	Ratio 11 = 100 * one-year loss reserve development / policyholders' surplus, prior year
12	Two-Year Reserve Development to Policyholders' Surplus	--	20	Under-reserving improves this ratio by decreasing the reserve development and increasing the surplus	Ratio 12 = 100 * two-year loss reserve development / policyholders' surplus, second prior year
13	Estimated Current Reserve Deficiency to Policyholders' Surplus	--	25	This ratio provides an estimate on the adequacy of current reserves. In general, under-reserving worsens this ratio	Developed loss & LAE reserves to premium ratio, prior year = (loss & LAE reserves, prior year + one-year loss reserve development) / premiums earned, prior year Developed loss & LAE reserves to premiums ratio, second prior year = (loss & LAE reserves, second prior year + two-year loss reserve development) / premiums earned, second prior year Average ratio of reserves to premiums = (developed loss & LAE reserves to premium ratio, prior year + developed loss & LAE reserves to premiums ratio, second prior year) / 2 Estimated loss & LAE reserve deficiency (redundancy) = premiums earned, current year * average ratio of reserves to premiums – loss & LAE reserves, current year Ratio 13 = 100 * estimated loss & LAE reserve deficiency (redundancy) / policyholders' surplus

Note: The definitions, calculation methods, and boundaries of 13 IRIS ratios follow the NAIC's Insurance Regulatory Information System (IRIS) Ratios Manual (2016 edition), which is available online at http://www.naic.org/prod_serv/UIR-ZB-16_UIR_2016.pdf.

APPENDIX E

EXAMPLE OF CALCULATING NEW MEASURES OF CONDITIONAL CONSERVATISM

AY	$\boldsymbol{\alpha}$	$\boldsymbol{\beta_1}$	$\boldsymbol{\beta_2}$		Average $\boldsymbol{\beta_2}$	Decile Rank of $\overline{\boldsymbol{\beta_2}}$
2006	-1.3	0.09	0.02	Bad News	$N_{BN} = 2$, $\bar{\beta}_{2BN} = 0.005$	3
2007	-1.2	0.3	-0.01	Bad News		
2008	0.9	-0.5	0.08	Good News	$N_{GN} = 3$, $\bar{\beta}_{2GN} = 0.03$	5
2009	0.8	-0.3	0.02	Good News		
2010	2.7	-0.2	-0.01	Good News		

* The coefficients are from an example firm.

Measures of Conditional Conservatism:

- $D\_concave = 0$ because $\overline{\beta}_{2GN} > 0$ and $\overline{\beta}_{2BN} > 0$

- $$Rank\_concavity\_sum = 11 - \frac{DecileRank(\overline{\beta}_{2GN}) * N_{GN} + DecileRank(\overline{\beta}_{2BN}) * N_{BN}}{N_{GN} + N_{BN}}$$
$$= 11 - \frac{5*3+3*2}{5} = 6.8$$

If there are only three product categories A, B, and C, and I find that the rankings of concavity of these three categories are 5, 6.5, and 4.2, respectively, then

- $$Rank\_concavity\_line = \frac{dpw_A}{\sum dpw} * 5 + \frac{dpw_B}{\sum dpw} * 6.5 + \frac{dpw_C}{\sum dpw} * 4.2$$

APPENDIX F

CONVERT REGRESSION COEFFICIENTS TO ANGLE, TRADITIONAL MODEL