Journal of Insurance Regulation

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Too Close for Comfort: Diminished Effectiveness of Ratio-Based Solvency Monitoring When Insurers Are Located Close to Their State Insurance Regulators

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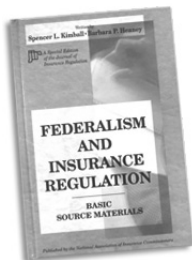
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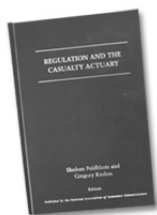
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Too Close for Comfort: Diminished Effectiveness of Ratio-Based Solvency Monitoring When Insurers Are Located Close to Their State Insurance Regulators

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Abstract

Prior research suggests that monitors (e.g., analysts, investors, auditors and regulators) perform better when they are located close to the companies they inspect. The improved performance is generally attributed to a greater availability of soft information about a company's financial condition when companies and monitors are close. We identify a setting where proximity may result in diminished performance. We investigate the effect of proximity between insurers and regulators on insurer earnings management. Insurance regulators use a multistep process to monitor insurer solvency. In the initial phase, regulators compute ratios and prioritize financially weak insurers for more detailed scrutiny. Regulators are more likely to obtain and use soft information about insurers after the initial phase. The ratio-based initial phase gives insurers incentives to under-reserve to improve their financial ratios and potentially avoid prioritization for additional scrutiny.

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Consistent with prior research, we report that financially weak insurers tend to under-reserve. Incremental to prior research, we find that financially weak insurers located close to regulators under-reserve more than weak ones not located near regulators. Our results suggest that a multistep inspection process that begins with ratios may lead to more earnings management among financially weak companies, especially if they are close to their monitor.

Introduction

Prior research reports that analysts, investors, auditors and regulators tend to perform better when they are located close to the firms they monitor. Analysts make more accurate earnings forecasts (Malloy, 2005; Bae, Stulz and Tan 2008; Jennings, Lee and Matsumoto, 2017), investors generate higher returns (Coval and Moskowitz, 1999, 2001; Ivkovic and Weisbenner, 2005; Baik, Kang and Kim, 2010), auditors perform higher quality audits and deter more client earnings management (Choi, Kim, Qui and Zang, 2012; Jensen, Kim and Yi, 2015; DeFond, Francis and Hallman, 2018), and regulators more effectively constrain aggressive financial reporting (Kedia and Rajgopal, 2011; Chhaochharia, Kumar and Niessen-Ruenzi, 2012). The improved performance is generally attributed to a greater availability and use of soft information about the firm being monitored.

We identify a setting where geographical proximity may result in a diminished performance by monitors rather than improved performance. A unique feature of the property/casualty (P/C) insurance industry is its multistep solvency monitoring process. In the initial phase of examination, personnel working for the National Association of Insurance Commissioners (NAIC) compute ratios belonging to the Insurance Regulatory Information System (IRIS).[1] NAIC examiner teams review insurers' ratios looking for unusual and unexpected results that might be a red flag about a given insurer's financial condition. They prioritize insurers for more detailed scrutiny and give their recommendations to state insurance departments for their consideration.[2] Soft information about an insurer is more likely to be available to and used by regulators when state insurance regulators conduct their investigations of insurers. Therefore, financially weak insurers have incentives to manage their annual report data in a manner that improves the ratios regulators use to prioritize them for further scrutiny. Prior research provides evidence that financially weak insurers, measured relative to IRIS ratios, engage in earnings management in manners that portray their financial positions more favorably (Petroni 1992; Gaver and Paterson 2004). Specifically, financially weak insurers under-reserve for losses, which overstates their reported earnings and policyholders' surplus while understating their liabilities and losses. Regulators attempt to reduce insurer under-reserving. We extend this line of research by investigating the effect of the geographical proximity between insurers and regulators on insurer earnings management.

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1. Insurance regulators use a variety of tools, including risk-based solvency surveillance (Klein, 2009). For reasons explained in section 2.1, we focus on the Insurance Regulatory Information System (IRIS) ratios.

2. The initial phase is largely performed by analyst teams that include financial examiners representing all zones of the National Association of Insurance Commissioners (NAIC). After the initial phase, regulatory scrutiny is performed by state insurance regulators, meaning examiners performing the latter phase of analysis are generally more local to the insurer than examiners performing the initial ratio-based analysis.

Soft information, such as information obtained from personal contacts, is more likely to be better and of higher quality when the frequency of contact is greater. Prior research posits that personal contact is more likely to occur (and likely to occur in meaningful manners) when monitors and companies are located in close proximity (Stein, 2002; Liberti and Petersen, 2019; Choi et al., 2012; Tang and Wu, 2012; Jaggi and Tang, 2014). Although soft information may be favorable or unfavorable, soft information is more likely to be unfavorable for financially weak companies. Where unfavorable soft information exists, financially weak insurers have incentives to prevent regulators from obtaining it. In other words, financially weak companies potentially have greater incentives to prevent regulators from benefiting from soft information. We investigate whether financially weak insurers located close to regulators are more likely to under-reserve than financially weak ones not located close to regulators.

Using a large sample of insurers from 1993–2013, we empirically examine the relation between insurers' loss reserve errors and their proximity to their state of domicile's insurance regulator. We report statistically significant evidence that financially weak insurers under-reserve and that under-reserving by financially weak insurers is higher if the insurer is located close to their regulator. In contrast, we find evidence that the location of financially healthy insurers relative to their regulators has little, if any, effect on their financial reporting.

Our study is unique in that we provide evidence that conditions under which insurers operate can lead to proximity hindering the effectiveness of monitoring. We suggest this outcome is an unintended consequence, and it is associated with features of the insurance industry's regulatory environment. Specifically, a multistep solvency evaluation of insurers that begins with using ratios to prioritize firms for subsequent steps of investigation gives companies incentives to manage their ratios. Given that soft information is more likely to be used after the initial ratio-based phase, the multistep process gives companies located close to their regulators a higher incentive to manage their ratios because doing so might help the companies most susceptible to harmful soft information prevent regulators from using it.

We organize our paper in the following manner. Section 2 discusses aspects of the insurance industry's regulatory environment and summarizes prior research that investigates the effects of monitors being close to companies. Section 3 describes our research hypothesis. Section 4 describes our sample selection process. Section 5 presents our empirical results. Section 6 concludes.

Motivation

Regulatory Environment of P/C Insurers

The P/C insurance industry is a highly regulated industry, and it has been for more than 100 years. State insurance departments, rather than the federal

government, monitor insurers' solvencies.[3] Each state operates its own state insurance department. To encourage uniformity and to promote efficiency among the states, state insurance commissioners jointly created the NAIC. In its initial meeting in 1871, the NAIC adopted a uniform annual statement. All 50 states have adopted that annual statement format. Since its inception, the NAIC has created several model regulations, with states usually adopting them with little, if any, modification.

Insurance company solvency regulation has been rather successful, and it has evolved to address challenging circumstances. After the number of insurer insolvencies increased in the 1980s (AM Best, 1991), the NAIC passed regulatory reforms. These reforms included making independent annual audits mandatory, establishing and operating a financial regulation accreditation program, and instituting risk-based capital (RBC) reporting requirements. All of these measures were designed to improve the solvency monitoring of insurers. More recently (2007–2008), a U.S. stock market crash initiated a financial crisis that involved many large financial institutions. The governmental response to that crisis occurred largely at the federal level. Federal legislation included the federal Dodd-Frank Wall Street Reform and Consumer Protection Act. Despite federal laws affecting insurers, particularly life and health insurers, P/C insurers solvency regulation largely remains regulated by the states.[4]

With states regulating insurance company solvency and each state regulating all of the insurers licensed to conduct business in their states, many insurers are subject to oversight by multiple jurisdictions simultaneously. Because regulators' resources are limited, the regulators in states where an insurer is merely licensed generally rely on the insurer's state of domicile regulator to monitor the insurer's solvency and inform them of insurers' poor financial conditions.[5] The regulator in the insurer's state of domicile is considered to be the primary regulator. To further increase the cost efficiency and effectiveness of insurer solvency monitoring, the NAIC developed a ratio-based early warning system in the early 1970s. This system is called IRIS. All 50 states have adopted the NAIC's model law for IRIS, and it remains in use nearly five decades later. Virtually all insurers must submit their statutory annual reports to the NAIC, and the NAIC computes each insurer's IRIS ratios based on the insurers' statutory annual reports. (See Appendix A for details

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3. The supremacy of state insurance regulation over federal regulation received support from the U.S. Supreme Court in Paul v. Virginia, 75 U.S. 168 (1869). It was reaffirmed by that passage of the federal McCarran-Ferguson Act in 1945. That Act states that the regulation of the business of insurance shall be by the state governments as a matter of public interest. Further, it states that no federal law should be construed to invalidate, impair or supersede any law enacted by any state government for the purpose of regulating the business of insurance, unless the federal law specifically relates to the business of insurance.

4. Dodd-Frank's Title IV created the Federal Insurance Office (FIO) and chartered it with the responsibility of monitoring all aspects of the insurance industry. Dodd-Frank also created the Financial Stability Oversight Council (FSOC), charging it with monitoring insurers.

5. GAO/GGD-00-198 Insurance Regulation: Scandal Highlights Need for Strengthened Regulatory Oversight.

regarding IRIS ratios.) The NAIC also determines the number of IRIS ratios for each insurer it deems to be unusual, and its analyst teams perform some preliminary analyses and provide this information to state insurance departments with their recommendation for prioritization for additional, detailed regulatory scrutiny to be performed by the state insurance departments.[6] Since 1988, insurers' IRIS results have been published annually (Klein, 2009). The ratios, and their bounds, are well-known by regulators, insurers and others.

Petroni (1992) provides empirical evidence that P/C insurers reporting unusual values for the subset of non-reserve IRIS ratios tend to under-reserve relative to other insurers. Gaver and Paterson (2004) confirm and expand upon her research measuring insurers' IRIS ratios on a pre-managed basis where the effects of insurers' loss-reserve errors have been purged from their annual report data. They examine the full set of IRIS ratios and determine that insurers considered to be financially weak on a pre-managed or ex ante basis tend to under-reserve compared to even ones considered to be financially weak on a post-managed or ex post basis. These results suggest that some insurers appear to avoid prioritization for additional regulatory scrutiny. Despite potential limitations in the early warning system, state insurance regulators continue to use IRIS ratios as part of their insurer solvency monitoring. The NAIC has also placed strong emphasis on enhancing a risk-based approach to regulatory solvency surveillance (Klein, 2009). Hoyt and McCullough (2010) identify a disadvantage associated with using RBC measures to measure insurers' pre-managed or ex ante incentives to engage in earnings management. They note that researchers are unable to adjust the RBC ratio for insurers' reserve errors, making it impossible to identify whether the insurer would have failed the RBC requirements without reserve mis-estimation. In contrast, IRIS ratios can be adjusted to their pre-managed levels for academic research purposes.

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6. From the NAIC's instructions for the Insurance Regulatory Information System (IRIS) instruction manual (italics added):

> *IRIS, developed by state insurance regulators participating in NAIC committees, is intended to assist state insurance departments in targeting resources to those insurers in greatest need of regulatory attention.* IRIS is not intended to replace each state insurance department's own in-depth solvency monitoring efforts, such as financial analyses or examinations. This Manual is designed to assist state insurance departments and the public in understanding two of the key tools within IRIS: the IRIS Ratios and the Analyst Team System.

> One of the most difficult tasks facing insurance regulators is to make effective use of limited resources. All insurers are required to file financial statements with all of the states in which they are licensed to operate. *No state is able to thoroughly review the financial condition of all licensed insurers immediately upon receipt of the financial statements. IRIS helps by providing solvency tools and databases that highlight those insurers that merit the highest priority in the allocation of the regulators' resources, thus directing those resources to the best possible use.*

Prior Research on the Effects of Monitors' Proximity to Companies

An extensive literature has developed examining whether a monitor's proximity to a company it scrutinizes affects the monitor's performance. This body of research investigates the performance of a wide variety of monitors, including analysts, investors, auditors and regulators. Prior research hypothesizes and reports empirical evidence that closer is better. Several studies provide evidence that analysts' forecast errors are smaller for the companies close to them compared to others located farther (e.g., Malloy, 2005; Bae et al., 2008; Jennings et al., 2017). Not only are forecast errors smaller, but analysts' portfolios vary systematically based on their proximity to companies. Analysts monitor a larger number of companies when they are close to the companies they monitor apparently because the cost of staying informed is lower when the companies they monitor are close (Jennings et al. 2017). Similarly, investors benefit from being located close to companies. Individual investors and mutual funds both generate higher investment returns when they are investing in the firms located in their vicinity (Coval and Moskowitz, 1999, 2001; Ivkovic and Weisbenner, 2005; Baik et al., 2010; Ayers, Ramalingegowda and Yeung, 2011). Ayers et al. (2011) also reports that companies exercise less discretion in their financial reporting (measured as less abnormal accruals) when institutional investors are nearby. Auditors produce a similar outcome when they are close. Companies located near their auditors are less likely to engage in earnings management (Choi et al., 2012; Jensen et al., 2015). Similarly, regulators located near the companies they monitor affect those companies' financial reporting (Kedia and Rajgopal, 2011). Kedia and Rajgopal (2011) determine that companies located close to one of the U.S. Securities Exchange Commission's (SEC) offices are less likely to subsequently restate their financial reports. In sum, monitors perform better when they are located close to the firms they monitor, and their performance includes measurable improvements in companies' financial reporting.

The improvements in performance associated with proximity are generally attributed to the availability and use of soft information when companies are located close to the monitor. Soft information tends to be difficult to convey except directly. The person receiving soft information needs to be close to the person who is the source of the information and may require personal observation and face-to-face interactions (Stein, 2002; Liberti and Petersen, 2019). Soft information might be obtained in official meetings with company personnel or informal encounters with firm personnel or others who have personal knowledge about the company's inner workings, prospects, risks and financial conditions (Choi et al., 2012; Tang and Wu, 2012; Jaggi and Tang, 2014). Examples of potentially relevant soft information could include information about the quality of a company's personnel and their morale; changes (and possible changes) in personnel; and changes (and possible changes) in customer relations, supplier relations and creditor relations. Soft information can lead to a better understanding of the company's corporate culture (Tang and Wu, 2012).

Geographical distance is expected to impose significant barriers on the availability of soft information. In fact, there is a common perception that proximity

should be measured using a dummy variable to distinguish whether closeness exists rather than measuring proximity with a continuous measure of distance between a company and its monitor (Coval and Moskowitz, 1999, 2001; Malloy, 2005; Uysal, Kedia and Panchapagesan, 2008; Kedia and Rajgopal, 2011). A common measure of proximity distinguishes whether monitors are within 100 kilometers of the company. Another uses a shorter distance, such as being located in the same metropolitan statistical area. Using either of these measures, prior research examining the effects of distance between monitors and companies suggests that monitors perform better, and attribute it to soft information being more likely to be available to monitors when they are located close to the company and used by them to improve their evaluations, oversight and influence over the companies they monitor. Influence is notable because it suggests monitors' effectiveness affects companies. Investors', auditors' and the SEC's proximity to companies have been associated with less earnings management by the firms being monitored. Those studies suggest that engaging in less earnings management is a rational response when monitors are located close to those companies being monitored because soft information helps monitors identify misreporting, especially when it is occurring in the vicinity.

Hypotheses

We investigate whether P/C insurers' propensities to engage in earnings management are affected by their being headquartered close to their state of domicile's state insurance commissioner's headquarters. Whereas prior research examining the effects of proximity to regulators finds a positive effect to closeness, the settings previously studied involve monitors who use soft information about the companies whenever it is available. In a P/C insurer setting, insurance regulators use ratios to help them prioritize insurers for more detailed scrutiny. Ratios are computed and used rather mechanically. State insurance regulators may be more inclined to use soft information about an insurer's financial condition when performing more detailed additional regulatory scrutiny. Soft information about an insurer's financial condition is likely more readily available to regulators if the insurer is located close to the regulator. In such circumstances, financially weak insurers located close to their regulators may have a larger incentive to engage in earnings management to overstate their ratio results. Improving their reported financial results may delay or avoid additional scrutiny. If the insurer is subject to detailed scrutiny, under-reserving may improve their reported financial results in a manner that helps the insurer withstand initial inspection. The type of earnings management we examine is well-documented among P/C insurance companies: loss reserve mis-estimation. Prior research reports that insurers deemed to be weak due to their IRIS ratios tend to under-reserve (Petroni, 1992; Gaver and Paterson, 2004). An unanswered question is whether financially weak insurers engage in more or less earnings management if they are located close to their state of domicile insurance

regulator. Given prior research examining non-insurers, weak insurers may be less likely to engage in earnings management if they are close to regulators. However, features of the insurance industry's regulatory environment suggest that effect may be mitigated, eliminated and reversed. Rather than impose a restriction on which direction is predicted a priori, we test the following null hypothesis using a two-tailed test.

H1: Financially weak P/C insurer loss reserve errors are not associated with whether they are located close to their state of domicile's insurance regulator.

Data

Sample Section

The initial sample consists of 57,362 P/C insurer firm-year observations collected from years 1993 through 2013.[7] For a firm-year observation to be retained for analysis, we require that the insurer is domiciled within the U.S. and organized as either a stock company or a mutual company. The insurer must have loss reserves subject to managerial discretion. For this reason, we screen observations if the insurer engages in a pooling arrangement or cedes all of its premiums. We also delete observations if the insurer writes more than 25% of premiums for surety and credit or if the insurer writes more than 25% of premiums for reinsurance, accident and health (A&H), or workers' compensation.[8] Finally, we drop observations where the insurer lacks sufficient data to measure variables required by the model we describe and estimate in section 5.[9] We eliminate observations where total adjusted capital (TAC) was below 100% of the authorized control level (ACL). Insurers below this threshold are in a control level (i.e., either the ACL or mandatory control level), and we screen insurers in liquidation or conservatorship. The final sample consists of 18,007 firm-year observations. We summarize our sample selection in Table 1.

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7. Source: National Association of Insurance Commissioners (NAIC), by permission. The NAIC does not endorse any analysis or conclusions based upon the use of its data.

8. We apply these screens for consistency with prior research (e.g., Petroni 1992). Petroni (1992) explains that in a pooling arrangement, an insurer submits all premiums to an affiliate, which then allocates premiums and losses across all insurers in the pool, and dictates reserve levels. Firms that cede all of their premiums do not have reserves. Insurers that specialize in surety and credit, reinsurance, accident and health (A&H), or workers' compensation tend to have less discretion in reporting reserves compared to property/casualty (P/C) insurers.

9. To be included in our sample, data are required for the current year, five-year development data, and data from the two most recent prior years to compute IRIS ratios. Thus, our 1993–2013 investigation period requires data from 1991–2018.

Table 1:
Sample Selection

Property/casualty (P/C) insurance companies filing statutory annual reports with the NAIC in 1993–2013[a]		57,362
Less:		
Insurers domiciled outside of the U.S.	627	
Insurers not organized as stock companies or mutuals	6,060	
Insurers with pooling arrangements	9,320	
Insurers that cede all premiums to other insurers	1,941	
Insurers that write more than 25% of their premiums for surety and credit lines of insurance	1,776	
Insurers that write more than 25% of their premiums for reinsurance, accident and health, or workers' compensation	5,297	
Insurers with insufficient data to estimate equation (1)[b]	14,170	
Insurers with risk-based capital (RBC) in the authorized control level or mandatory control level and insurers receivership or liquidation	164	
		(39,355)
Final Sample		18,007

a.   All 50 states have adopted the NAIC's *Annual Financial Reporting Model Regulation* (#205). Under this regulation, almost all insurers are required to submit statutory annual reports to their state of domicile's state insurance department. Insurers also submit their statutory annual reports to the NAIC, and the NAIC compiles them into a database.

b.   In order to be retained in the sample, data is required for the current year and for two years prior to the current year to compute Insurance Regulatory Information System (IRIS) ratios and five years after the current year to compute ERROR based on a five-year loss reserve development.

Variable Definitions and Descriptive Statistics

For each insurer-year observation, we measure a five-year reserve error or mis-estimation. Our reserve error is the difference between the insurer's original loss reserve and the revised reserve the insurer reports five years after the original year. We gather data for this measure from Schedule P of insurers' statutory annual reports. In Table 2, we provide an example. AIG Casualty Company reported reserves of $4,398,966 in 2018, but it needed to revise its estimated upward. After five years of development, it revised its estimate to $4,804,212. These figures indicate that the insurer under-reserved in 2008 by $405,246. Using a five-year loss reserve development to measure loss reserve errors is consistent with Petroni (1992); Beaver, McNichols and Nelson (2003); Gaver and Paterson (2004); and Grace and Leverty (2010). We scale the five-year loss reserve error by admitted assets as of the end of the year prior to the original loss year in order to control for insurer firm size. The five-year reserve error is positive if the manager initially

under-reserved and subsequently adds to reserves, and it is negative if the manager initially over-reserved and subsequently reduced reserves.

Table 2:
Summary of Estimated Incurred Losses Reported at Year-End, AIG Casualty Company[a]

Estimated incurred losses at year-end

Accident Year	1 2004	2 2005	3 2006	4 2007	5 2008	6 2009	7 2010	8 2011	9 2012	10 2013	
1. Prior	785,070	1,089,688	1,163,224	1,209,354	**1,273,877**	1,378,669	1,536,048	1,556,882	1,563,042	**1,582,417**	$4,804,212
2. 2004	604,198	498,133	490,614	488,231	**476,996**	484,312	494,191	495,052	497,644	**495,851**	
3. 2005		668,478	614,464	603,456	**587,635**	588,634	596,375	593,479	594,676	**599,432**	
4. 2006			700,426	660,691	**636,312**	638,657	652,699	646,773	648,116	**643,080**	
5. 2007				701,632	**686,210**	677,905	711,036	709,818	716,889	**713,727**	
6. 2008					**737,936**	745,124	768,465	759,732	768,329	**769,705**	
7. 2009						586,886	602,740	605,623	608,606	616,628	
8. 2010							503,633	529,306	534,034	524,243	
9. 2011								525,199	538,178	550,220	
10. 2012									488,349	494,861	
11. 2013										415,380	

$4,398,966

a. Excerpted from Schedule P, Part 2, of the 2013 AIG Casualty Company Annual Statement, prepared according to Statutory Accounting Principles. All dollar amounts are in thousands.

In Table 3, we report descriptive statistics for our study's variables, including insurers' scaled five-year reserve errors (*ERROR*). The full sample's mean and median *ERROR* are -0.0167 and -0.0130, respectively. The negative values indicate over-reserving in the original loss year. The mean indicates that insurers initially over-estimated reserves, on average, by 1.67% of lagged admitted assets. The median indicates that the median firm over-reserved by 1.3% of lagged admitted assets. Univariate descriptive statistics (untabulated) indicate that our investigation period includes periods when our sample insurers over-reserved, on average (1993–1999), as well as periods when it under-reserved (2000–2002) and returned to over-reserving (2003–2013). This variation in reserve errors provides a natural control for exogenous industry trends, including cyclicality associated with insurance markets, and allows us to better determine the influence of financial weakness and distance between insurers and regulators on insurers' loss reserve estimates.

We include a measure of insurer financial condition to identify which insurers are most likely to under-reserve. This financial condition measure we use is based on insurers' IRIS ratios. State insurance commissioners use IRIS ratios when they monitor insurer solvency. Insurers can overstate their financial condition by improving their IRIS ratios through under-estimating losses and loss reserves. Since the IRIS ratios and their bounds are known by insurers, and under-reserving tends to improve the reported values for IRIS ratios, financially weak insurers have incentives to under-reserve. Prior research provides evidence that financially weak insurers, as defined by their IRIS ratios, tend to understate their reserves (Petroni, 1992; Gaver and Paterson, 2004). Similar to Gaver and Paterson (2004), we compute insurers' pre-managed IRIS ratios and determine the number of unusual IRIS ratios on a pre-managed basis. We determine this number for each firm-year observation by purging insurers' reported results by their five-year loss reserve

errors and computing IRIS ratios using insurers' purged annual report data. This procedure produces the number of IRIS ratios that the insurer would have reported as unusual if it had reported its original losses equal to the revised losses five years later than the original loss year.[10] We classify an insurer as ex ante financially weak (WEAK) if it has four or more pre-managed IRIS ratios with results outside of the bounds considered normal by the NAIC.[11] We select this cut-off because it usually triggers more detailed regulatory attention by state insurance commissioners (Belth, 1987; Petroni, 1992; NAIC, 1994; Troxel and Bouchie, 1995; Gaver and Paterson, 2004). As shown in Table 3, approximately 17.6% of our sample firm-year observations are coded as financially weak.

Our study primarily focuses on whether proximity between insurers and regulators affects insurers' loss reserve estimates, especially among financially weak insurers. We measure the proximity of insurers and regulators as the distance between the insurer's headquarters and its state of domicile's state insurance regulator's location using their ZIP codes as measures of their location. Prior research suggests that the effect of geographic proximity is nonlinear. Soft information about companies travels most effectively when parties are located within a distance threshold. They claim that relatively little, if any, information transfer occurs beyond the threshold. Coval and Moskowitz (2001) report that information transfers are more likely to occur when agents are located within 100 kilometers of each other (see also Malloy, 2005; Uysal et al., 2008; Kedia and Rajgopal, 2011). Consistent with prior research, we use a dummy variable to distinguish whether companies are close to their monitor. We identify whether insurance companies' headquarters are within 100 kilometers of their monitors (state insurance regulator). Choi et al. (2012) use two dummy variables to measure distance. One measures whether companies and monitors are within 100 kilometers. The other measures whether companies are within the same metropolitan statistical area (MSA). Distances between companies and monitors within the same MSA tend to be less than 100 kilometers. We also use a second measure of distance in our setting. The second measure is based on whether insurers are less than 50 kilometers from their regulators. We refer to our two measures of distance as LOCAL_D50 and LOCAL_D100. We code LOCAL_D50 as one for insurers located less than 50 kilometers from their state's insurance regulator; otherwise, we code it as zero. Alternatively, we use code LOCAL_D100 as one if the insurer is located less than 100 kilometers from its regulator, and we code it as zero otherwise. In our sample,

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10. For example, the 1993 reserve development for GE Mortgage Insurance Company (based on the 1998 developed reserve) is $116.512 million. Understated reserves result in understated losses and liabilities. Thus, we compute the ex ante losses and liabilities of GEMIC by adding $116.512 to the reported amounts. Understated reserves affect policyholder surplus on an after-tax basis. We use the federal tax rate of 35%, which was in place during our investigation period, and compute the ex ante policyholders' surplus by subtracting [$116.512 x (1 – 0.35)] from the reported surplus.

11. Using pre-managed results based on reported results purged of the insurer's five-year loss reserve error enables us to examine all of the IRIS ratios and avoid the selection bias described by Petroni (1992), which caused her to examine only a subset of IRIS ratios.

35% of our insurer firm-year observations are within 50 kilometers of their state insurance commission's office, and 49.6% are within 100 kilometers.

Consistent with prior research, we include several additional control variables in our model. The first two control for aspects of the composition of insurers' underwriting. The first control variable (LENGTH) measures claim loss reserves expressed as a percentage of total liabilities. This variable increases with the length of the insurer's claim cycle. The longer the cycle, the more difficult it is to forecast total claims. Prior research finds that insurers with long-tailed product lines, such as product liability and workers' compensation, tend to over-reserve, which is consistent with being more conservative when uncertainty is high (Petroni and Beasley, 1996; Gaver and Paterson, 2001, 2007). Because ERROR is negative when insurers over-reserve, LENGTH is expected to be negatively associated with ERROR. The second control variable (MEDMAL) measures the percent of net premiums written for malpractice insurance. Petroni (1992), Petroni and Beasley (1996), and Gaver and Paterson (2001, 2007) find that malpractice premiums tend to be negatively associated with reserve development.

Another factor to control for is income smoothing. Smoothing reported earnings reduces its volatility. Prior research suggests that insurers smooth their earnings by adjusting their loss reserves (Forbes, 1970; Balcarek, 1975; Smith, 1980; Weiss, 1985; Grace, 1990; Beaver et al., 2003). We measure it as net income in year t purged of the loss reserve error minus reported net income in year (t-1), divided by the absolute value of reported net income in year (t-1). We expect firms with high (low) pre-managed income to over-reserve (under-reserve). We include SMOOTH in our model, expecting it to have a negative estimated coefficient. We also include two variables to control two aspects of insurers' diversification. We also control for variation in product line diversification (HERF_LINES) and geographical diversification (HERF_GEOG) measured using Herfindahl Indices (Grace and Leverty 2010). Since low levels of diversification are associated with high Herfindahl indices, and low levels of diversification are associated with higher reserve estimates, we expect both of these two control variables to be negatively associated with insurer's loss reserve errors.[12] We also control for the strictness of rate regulations imposed by state insurance regulators (RATE_REG). Prior research is mixed regarding whether the strictness of rate regulations leads to more under-reserving (Nelson, 2000) or more over-reserving (Grace and Leverty, 2012). Other control variables include organizational form (MUTUAL), membership in a consolidated group (GROUP) and firm size (SIZE).

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12. In sum, we select control variables based on prior research. The choice of control variables is a choice between simplicity and completeness. The choice is also influenced by sample size, including the control variable's effect on sample size. For example, some variables reduce the sample size more than others, such as the choice of auditor and actuary. Insurer earnings management studies that include these variables tend to have small samples (Petroni and Beasley, 1996; Gaver and Paterson, 2001).

Table 3:
Descriptive Statistics for Full Sample[a]

Variable[b]	Mean	Std. Dev.	Median	Lower quartile	Upper quartile
ERROR	-0.0167	0.0962	-0.0130	-0.0521	0.0077
WEAK	0.1763	0.3811	0.0000	0.0000	0.0000
LOCAL_D50	0.3505	0.4771	0.0000	0.0000	1.0000
LOCAL_D100	0.4960	0.5000	0.0000	0.0000	1.0000
DISTANCE	3.9238	1.8034	4.1573	2.6247	5.0626
LENGTH	0.4358	0.2426	0.4452	0.2398	0.6143
MAL	0.0577	0.2243	0.0000	0.0000	0.0000
NI_SMOOTH	0.0170	0.1112	0.0166	-0.0267	0.0618
HERF_EP	0.5184	0.2824	0.4712	0.2874	0.7211
HERF_GEO	0.6408	0.3804	0.7914	0.2294	1.0000
RATE_REG	0.0714	0.1384	0.0000	0.0000	0.0842
MUTUAL	0.2925	0.4549	0.0000	0.0000	1.0000
GROUP	0.61657	0.4863	1.0000	0.0000	1.0000
SIZE	17.7393	1.9703	17.6061	16.3674	19.0352

a. The full sample of 18,007 observations consists of insurers domiciled in the U.S., organized as stock companies or mutuals, and meeting certain data requirements for the years 1993–2013.
b. Variable definitions:
c. ERROR in year t is computed by subtracting the original loss reserve reported in year t from the five-year developed reserve reported in year (t+5). The difference is divided by admitted assets at the end of year (t-1).
d. WEAK is a qualitative variable that takes on the value of one if the insurer has four or more unusual IRIS ratios on a pre-managed basis. Pre-managed IRIS ratios are computed using annual statement data that has been purged of the loss reserve bias. Unusual ratios are those that exceed certain bounds specified by the National Association of Insurance Commissioners (NAIC). These bounds are described in Appendix A.
e. LOCAL_D50 is coded as one if the distance between the insurer's headquarters and its state of domicile's state insurance regulator is less than or equal to 50 kilometers, and it is coded as zero otherwise.
f. LOCAL_D100 is coded as one if the distance between the insurer's headquarters and its state of domicile's state insurance regulator is less than or equal to 100 kilometers, and it is coded as zero otherwise.
g. DISTANCE is the log of the distance between the insurer and the state insurance regulator for its state of domicile measured in kilometers.
h. LENGTH is the reported claim loss reserve as a percentage of total liabilities.
i. MAL is the percentage of malpractice premiums written relative to total premiums.
j. NI_SMOOTH is net income in year t purged of the loss reserve error minus reported net income in year (t-1), divided by the absolute value of reported net income in year (t-1).
k. HERF_EP is the Herfindal concentration index calculated across the lines of insurance. It is the sum of the squared percentages of business written in each of the approximately 30 lines of insurance.
l. HERF_GEO is the Herfindal concentration index calculated across the jurisdictions where the insurer underwrites insurance. It is the sum of the squared percentages of business written in each state and the District of Columbia.
m. RATE_REG is the percent of premiums the insurer writes in states with stringent rate regulation defined as state-made rates and prior approval rate regulation.
n. MUTUAL is coded as one if the company is organized as a mutual, and it is coded as zero if it is organized as a stock company.
o. GROUP is coded as one if the insurer belongs to a consolidated group of insurers, and it is coded as zero otherwise.
p. SIZE is the insurers admitted assets at the end of the prior year.
q. Continuous variables are winsorized at 1% and 99%. Continuous variables include ERROR, DISTANCE, LENGTH, MAL, NI_SMOOTH, HERF_EP, HERF_GEO, RATE_REG and SIZE.

To provide preliminary insights into the relation between insurers' loss reserve errors and their proximity to state insurance regulators, we perform a series of univariate analyses. Financially weak insurers are the ones with incentives to under-reserve. Focusing on these insurers leaves 3,174 firm-year observations for comparison between local and nonlocal insurers. We compare the mean of financially weak insurers' five-year loss reserve errors (ERROR) for companies located close to their regulator to those located far from their regulators. We repeat this comparison using each of our two measures of closeness (i.e., LOCAL_D50 and LOCAL_D100). Using a 50-kilometer threshold to distinguish whether insurers are close to their regulator, we find that the mean loss reserve error is 0.0923 for insurers that are close and 0.0722 for insurers that are far from their regulators. (See Table 4.) This result suggests that financially weak insurers close to their regulators under-reserve more than financially weak insurers far from their regulators. The difference in means and medians are statistically significant at 1% levels of significance. We find a qualitatively similar result using the second measure of distance based on 100 kilometers to define local versus nonlocal (LOCAL_D100). Using a 100-kilometer threshold, the loss reserve error means are 0.0914 and 0.0687 for local and nonlocal insurers, respectively. The difference in means and medians are statistically significant at the 1% level of significance. In sum, four univariate test results provide preliminary evidence that insurers' locations relative to their state insurance commissioner affect their earnings management with financially weak insurers under-reserving more if they are located close to their regulator. In order to control for factors other than insurers' financial weakness and their locations relative to their regulators, we perform multivariate analyses.

Table 4:
Loss Reserve Error for Financially Weak Insurers[a,b,c]

	Using Local_D50			Using Local_D100		
	Local (n=1,196)	Nonlocal (n=1,978)	p-value	Local (n=1,550)	Nonlocal (n=1,624)	p-value
Mean	0.0923	0.0722	0.0001	0.0914	0.0687	0.0001
Median	0.0595	0.0413	0.0017	0.0578	0.0409	0.0004
Std. dev.	0.1477	0.1271		0.1442	0.1259	

a.   The full sample of 18,007 firm-year observations includes 3,174 firm-year observations where the insurer is considered to be financially weak measured as having four or more unusual Insurance Regulatory Information System (IRIS) ratio results based on annual report data purged of the company's five-year loss reserve error.

b.   The loss reserve error is computed by subtracting the original loss reserve reported in year t from the five-year developed reserve reported in year (t+5). The difference is divided by admitted assets at the end of year (t-1).

c.   Two alternative definitions are used to determine whether insurers are local to their state of domicile's insurance regulator. The first defines local as less than 50 kilometers. The second defines local as less than 100 kilometers.

Multivariate Evidence of Earnings Management

We perform repeated multivariate analyses of the relation between insurers' loss reserve errors and their locations relative to their regulators by estimating equation (1). We use insurers' scaled five-year loss revere errors as the dependent variable (ERROR). We include a measure of financial weakness (WEAK) and one of the two measures of insurers' closeness to their regulators (LOCAL_D50 or LOCAL_D100). We also include an interaction between financial strength and location (WEAK x LOCAL) to measure the incremental effect of being close to the regulator when the insurer is financially weak. Finally, we include the control variables described in section 4.2. We estimate our regressions using ordinary least squares, and we include fixed effects for firm, year and state of domicile.

$$\begin{aligned} ERROR_{i,t} = {} & \beta_i + \beta_t + \beta_s + \beta_1 WEAK_{i,t} + \beta_2 LOCAL_{i,t} + \beta_3(WEAK_{i,t} \times LOCAL_{i,t}) + \beta_4 LENGTH_{i,t} \\ & + \beta_5 MAL_{i,t} + \beta_6 NI\_SMOOTH_{i,t} + \beta_7 HERF\_EP_{i,t} + \beta_8 HERF\_GEO_{i,t} \\ & + \beta_9 RATE\_REG_{i,t} + \beta_{10} MUTUAL_{i,t} + \beta_{11} GROUP_{i,t} + \beta_{12} SIZE_{i,t} + \varepsilon_{i,t} \quad (1) \end{aligned}$$

Solvency monitoring by insurance regulators focuses on constraining under-reserving, particularly among financially weak insurers. We expect a negative relation between our measure of financial condition (WEAK) and insurers' loss reserve errors (ERROR). Further, insurers located close to regulators are expected to be more likely to obtain and use soft information about insurers' financial conditions if the insurer is located close to the regulator. This gives financially weak insurers an increased risk of incurring costly regulatory scrutiny. Their incentive to avoid or delay detailed regulatory scrutiny may be higher than financially weak insurers located far from regulators. The interaction between WEAK and location (LOCAL_D50 and LOCAL_D100) will be positive if proximity incentivizes financially weak insurers to engage in more under-reserving if they are located close to regulators.

Consistent with expectations, we report in Table 5 that financially weak insurers tend to under-reserve. The estimated coefficient on WEAK is significantly positive regardless of using a 50-kilometer or 100-kilometer threshold to define local. Unique to our study, we provide evidence that financially weak insurers located near their state insurance regulators engage in more under-reserving than their financially weak counterparts located far from regulators. We determine this outcome based on finding a positive estimated coefficient on WEAKxLOCAL for both specifications of location. Using a 50-kilometer threshold for closeness (i.e., WEAK x LOCAL_D50), we find a significantly positive estimated coefficient of 0.0089 (p-value=0.011). When we use a 100-kilometer threshold (i.e., WEAKxLOCAL_D100), we find a significantly positive estimated coefficient of 0.0090 (p-value=0.008). While the positive coefficient on WEAK suggest financially weak insurers under-reserve, the positive coefficient on WEAKxLOCAL indicates that financially weak insurers located close to their regulators under-reserve even more than nonlocal ones located far from their regulators. In contrast, the stand-alone location variable (LOCAL) is not significant

using a 50-kilometer threshold (-0.0003; p-value=0.949) or using a 100 kilometer threshold (0.0060; p-value=0.106). The results for LOCAL suggest the location among financially healthy insurers has little, if any, effect on their reserve misestimations. The adjusted R-square is 0.748 for both regressions, suggesting the overall explanatory power of our model is relatively high. The majority of the model's control variables are also statistically significant with their expected signs.

Table 5:
Estimated Coefficients and p-values From a Regression of Loss Reserve Error on Insurer Financial Condition, Distance to the Regulator and Control Variables[a]

Variable[b]	Expected Sign[c]	Using LOCAL_D50 Coefficient (p-value)	Using LOCAL_D100 Coefficient (p-value)
Intercept		0.0281 (0.502)	0.0293 (0.485)
WEAK	+	0.0465*** (0.001)	0.0455*** (0.001)
LOCAL		-0.0003 (0.949)	0.0060 (0.106)
WEAK×LOCAL		0.0089** (0.011)	0.0090*** (0.008)
LENGTH	-	-0.0474*** (0.001)	-0.0474*** (0.001)
MAL	-	-0.0116 (0.484)	-0.112 (0.496)
NI_SMOOTH	-	-0.5015*** (0.001)	-0.5012*** (0.001)
HERF_EP	-	-0.0132*** (0.001)	-0.0133*** (0.001)
HERF_GEO	-	-0.0099*** (0.010)	-0.0102*** (0.008)
RATE_REG		-0.0027 (0.652)	-0.0028 (0.639)
MUTUAL		0.0065* (0.074)	0.0066* (0.070)
GROUP		0.0007 (0.795)	0.0005 (0.845)
SIZE	-	0.0004 (0.815)	0.0003 (0.819)
Fixed effects for year		Yes	Yes
Fixed effects for firm		Yes	Yes
Fixed effects for state of domicile		Yes	Yes
Sample size		18,007	18,007
Adjusted R^2		0.748	0.748

a.   The full sample of 18,007 observations consists of insurers domiciled in the U.S., organized as stock companies or mutuals, and meeting certain data requirements for the years 1993–2013.
b.   Variable definitions: refer to Table 3.
c.   One-tailed p-values are reported for WEAK, LENGTH, MAL, NI_SMOOTH, HERF_EP, HERF_GEO and SIZE. Two-tailed p-values are reported for LOCAL, WEAK×LOCAL, RATE_REG, MUTUAL, GROUP and the intercept.

In many cases, a continuous measure is considered to be a more powerful measure than a dummy variable based on the same data. In settings examining the potential effects of soft information, the distances literature suggests the opposite: Parties are either close or they are not, and a dummy variable more appropriately captures the potential effects of soft information. Prior research suggests that soft information more easily passes or is more likely to be passed when two parties are located near one another (Ayers et al., 2007; Bae et al., 2008; Baik et al., 2010). Being close or local makes it easier to arrange meetings, makes it less expensive to have meetings, or even makes it more likely that the two parties meet by chance either one another or meet shared contacts located in the same community. Using a continuous measure, however, is consistent with DeFond et al. (2018), and we perform an analysis of proximity using a continuous measure of distance between insurers and their regulators.

In Table 6, we report the results of estimating equation (1) replacing LOCAL with DISTANCE, which is a logarithmic continuous measure of distance between the insurer. Transforming with logs reduces the effects of outliers. In this test, we expect a negative relation between WEAKxDISTANCE because larger distances indicate insurers are farther from their regulator—rather than near or local to them. Given the potential nonlinear relation between our distance measure insurers' loss reserve errors, we include variables with distance squared as additional variables in a second regression. Regardless of whether squared terms are included, our results indicate that financially weak insurers tend to under-reserve (0.0556and 0.0485; p-values are significant at the 1% level). We also report that the estimated coefficient on WEAKxDISTANCE is negative, but it is not statistically significant in regressions with and without squared distance terms (-0.0014; p-value=0.125; -0.034; p-value=0.283, respectively). The interaction between WEAK and DISTANCE square is not statistically significant (-0.0006; p-value=0.139). These results are consistent with the notion that binary variables are more powerful measures than continuous ones when investigating issues associated with soft information being available. Similar to the results reported in Table 5, the majority of the control variables are statistically significant in their predicted directions in Table 6, and the overall explanatory power of the models is high.

Company size can matter. For example, large firms are more likely to be audited by the Internal Revenue Service (IRS) (Hoopes, Mescall, and Pittman 2012; Kubick, Lockhart, Mills, and Robinson 2017). The size of an insurance company may affect the oversight conducted by state insurance regulators. On one hand, large insurers tend to be more diversified, financially healthy and over-reserved. On the other hand, their large size also makes them more visible to monitors, and a large insurer's insolvency imposes a higher cost on society. Insurer size might affect the regulators' prioritization for additional regulatory scrutiny. If, for example, regulators are more likely to prioritize large insurers for detailed investigations, including on-site examinations even at the slightest sign of red flags, large insurers (including financially weak ones) potentially have less to gain from under-reserving. We re-estimate equation (1) after partitioning the full sample into four subsamples based on insurers' relative size based on their admitted assets. In panel A of Table 7, we

report the four sets of regression results, including one for each insurer-size quartile while using LOCAL_D50 as the measure of insurer location. In panel B of Table 7, we report similar results based on LOCAL_D100.

Table 6:
Estimated Coefficients and p-values From a Regression of Loss Reserve Error on Insurer Financial Condition, Distance to the Regulator and Control Variables[a]

Variable[b]	Expected Sign[c]	Coefficient (p-value)	Coefficient (p-value)
Intercept		0.0335	0.0306
		(0.432)	(0.475)
WEAK	+	0.0556***	0.0485***
		(0.001)	(0.001)
DISTANCE		-0.0008	0.0024
		(0.380)	(0.399)
WEAK×DISTANCE		-0.0014	-0.0034
		(0.125)	(0.284)
DISTANCE^2			-0.0004
			(0.261)
WEAK×DISTANCE^2			-0.0006
			(0.138)
LENGTH	-	-0.0472***	-0.0474***
		(0.001)	(0.001)
MAL	-	-0.0117	-0.111
		(0.241)	(0.251)
NI_SMOOTH	-	-0.5016***	-0.5014***
		(0.001)	(0.001)
HERF_EP	-	-0.0131***	-0.0131***
		(0.001)	(0.001)
HERF_GEO	-	-0.0102***	-0.0104***
		(0.005)	(0.004)
RATE_REG		-0.0030	-0.0028
		(0.625)	(0.648)
MUTUAL		-0.0064*	-0.0066*
		(0.077)	(0.071)
GROUP		0.0007	0.0007
		(0.771)	(0.790)
SIZE	-	0.0003	0.0003
		(0.815)	(0.814)
Fixed effects for year		Yes	Yes
Fixed effects for firm		Yes	Yes
Fixed effects for state of domicile		Yes	Yes
Sample size		18,007	18,007
Adjusted R^2		0.748	0.748

a. The full sample of 18,007 observations consists of insurers domiciled in the U.S., organized as stock companies or mutuals, and meeting certain data requirements for the years 1993–2013.
b. Variable definitions: refer to Table 3.
c. One-tailed p-values are reported for WEAK, LENGTH, MAL, NI_SMOOTH, HERF_EP, HERF_EP and SIZE. Two-tailed p-values are reported for DISTANCE, WEAKxDISTANCE, RATE_REG, MUTUAL, GROUP and the intercept.

In panel A using a 50-kilometer threshold for closeness, we report four sets of results that are relatively similar to the ones reported in Table 5 using a 50-kilometer threshold with the loss of some statistical significance among control variables and one noteworthy exception among variables of interest. The estimated coefficient on the interaction of WEAK and LOCAL is statistically significant when using the smallest two quartiles of insurers (0.0147; p-value=0.048; 0.0086; p-value=0.060, respectively). The corresponding estimated coefficient for WEAKxLOCAL is not significantly positive for the larger two quartiles (-0.0013; p-value=0.581; 0.0060; p-value=0.202, respectively). Based on these results, we determine that increased under-reserving among financially weak insurers located close to regulators is largely absent among the largest insurers but is present among the smallest insurers. We ascribe this result to the notion that the largest insurers are more visible even to regulators. They may be the most well-known and scrutinized by regulators regardless of their IRIS results, suggesting they are less likely to avoid or delay detailed scrutiny by managing their reserves. These circumstances may contribute to why the largest insurers are less inclined to use under-reserving to circumvent regulators' ratio monitoring.

The results for the 100-kilometer threshold for closeness reported in panel B of Table 7 provide similar evidence of a location effect among financially weak insurers and differences based on insurer size. Again, the estimated coefficients on WEAKxLOCAL are significantly positive for the smaller two quartiles (0.0165; p-value=0.044; 0.0143; p-value=0.042, respectively), but not for the larger two quartiles (0.0025; p-value=0.700; 0.0036; p-value=0.562, respectively). Thus, the results suggest that size may affect insurers' attempts to circumvent regulators' initial solvency screen.

Conclusion

Prior research indicates that proximity between a company and its monitor tends to improve the monitor's performance. The improvement is attributed to the availability and use of soft information about companies located close to monitors. Direct evidence about the effect of soft information is difficult to obtain. We examine a setting where soft information is more likely to be used after an initial step of investigation occurs, and likelihood of involvement in further scrutiny is determined largely by the initial step's outcome. In the case of state insurance regulators, the initial step involves calculating financial ratios computed using companies' financial reports. Such a regulatory environment potentially incentivizes companies to engage in more earnings management when they are located close to regulators. This higher than normal incentive occurs because companies engaging in earnings management can potentially alter their reported ratio results and affect whether they are prioritized for more detailed scrutiny where soft information may be more of a factor. Financially weak companies located close to the regulator have an especially high incentive to report favorable ratio results in

order to prevent regulators from considering additional information, including soft information, about the company's financial condition. Our results are in sharp contrast to the body of prior research investigating the effects of proximity on monitoring effectiveness. It also reflects the features of the particular industry we use to investigate these issues.

Table 7:
Estimated Coefficients and p-values From a Regression of Loss Reserve Error on Insurer Financial Condition, Distance to the Regulator and Control Variables for Subsamples Based on Firm Size[a]

Panel A: Insurers located within 50 kilometers of their state insurance regulator are considered local

Variable[b]	Expected Sign	First Quartile Coefficient (p-value)	Second Quartile Coefficient (p-value)	Third Quartile Coefficient (p-value)	Fourth Quartile Coefficient (p-value)
Intercept		-0.1263	0.1406*	0.1254	0.0392
		(0.108)	(0.085)	(0.113)	(0.624)
WEAK	+	0.0412***	0.0486***	0.0405***	0.0428***
		(0.001)	(0.001)	(0.001)	(0.001)
LOCAL		-0.0145	-0.0099	0.0011	0.0201
		(0.175)	(0.210)	(0.888)	(0.182)
WEAK×LOCAL		0.0147**	0.0086*	-0.0013	0.0066
		(0.048)	(0.060)	(0.581)	(0.202)
LENGTH	-	-0.0566***	-0.0671***	-0.0568***	-0.0369***
		(0.001)	(0.001)	(0.001)	(0.005)
MAL	-	-0.0151	0.0887	-0.0470***	-0.0308***
		(0.711)	(0.950)	(0.166)	(0.225)
NI_SMOOTH	-	-0.4097***	-0.5034***	-0.5040***	-0.5647***
		(0.001)	(0.001)	(0.001)	(0.001)
HERF_EP	-	-0.0125	-0.0120*	-0.0125*	-0.0296***
		(0.110)	(0.055)	(0.086)	(0.003)
HERF_GEO	-	0.0130	-0.0161**	-0.0351**	0.0042
		(0.834)	(0.020)	(0.001)	(0.636)
RATE_REG		-0.0052	0.0027	-0.0159	0.0078
		(0.677)	(0.852)	(0.325)	(0.478)
MUTUAL		-0.0070	0.0121	0.0166**	0.0058
		(0.379)	(0.137)	(0.024)	(0.641)
GROUP		0.0017	0.0012	-0.0072	-0.0045
		(0.826)	(0.772)	(0.156)	(0.442)
SIZE	-	0.0071	0.0039	-0.0062*	0.0027
		(0.897)	(0.375)	(0.092)	(0.535)
Clustering by year		Yes	Yes	Yes	Yes
Clustering by firm		Yes	Yes	Yes	Yes
Clustering by state of domicile		Yes	Yes	Yes	Yes
Sample size		4,501	4,503	4,500	4,503
Adjusted R^2		0.695	0.761	0.782	0.825

Table 7 (continued):

Panel B: Insurers located within 100 kilometers of their state insurance regulator are considered local

Variable[b]	Expected Sign	First Quartile Coefficient (p-value)	Second Quartile Coefficient (p-value)	Third Quartile Coefficient (p-value)	Fourth Quartile Coefficient (p-value)
Intercept		-0.1286	0.1567*	0.1258	0.0414
		(0.101)	(0.055)	(0.110)	(0.607)
WEAK	+	0.0376***	0.0453***	0.0389***	0.0439***
		(0.001)	(0.001)	(0.001)	(0.001)
LOCAL		0.0025	0.0047	0.0004	0.0213
		(0.847)	(0.530)	(0.961)	(0.074)
WEAK×LOCAL		0.0165**	0.0143**	0.0025	0.0036
		(0.044)	(0.041)	(0.700)	(0.562)
LENGTH	-	-0.0565***	-0.0672***	-0.0571***	-0.0365***
		(0.001)	(0.001)	(0.001)	(0.003)
MAL	-	-0.0162	0.0891	-0.0464*	-0.0299
		(0.345)	(0.949)	(0.086)	(0.119)
NI_SMOOTH	-	-0.4092***	-0.5033***	-0.5037***	-0.5650***
		(0.001)	(0.001)	(0.001)	(0.001)
HERF_EP	-	-0.0132*	-0.0126**	-0.0124*	-0.0300***
		(0.099)	(0.046)	(0.086)	(0.003)
HERF_GEO	-	0.0130	-0.0159**	-0.0351***	0.0051
		(0.832)	(0.021)	(0.001)	(0.573)
RATE_REG		-0.0057	0.0034	-0.0158	0.0086
		(0.650)	(0.812)	(0.326)	(0.432)
MUTUAL		-0.0064	0.0122	0.0166**	0.0053
		(0.427)	(0.122)	(0.024)	(0.671)
GROUP		0.0013	0.0005	-0.0072	-0.0042
		(0.866)	(0.908)	(0.159)	(0.469)
SIZE	-	0.0073	0.0037	-0.0062*	0.0023
		(0.897)	(0.394)	(0.093)	(0.594)
Clustering by year		Yes	Yes	Yes	Yes
Clustering by firm		Yes	Yes	Yes	Yes
Clustering by state of domicile		Yes	Yes	Yes	Yes
Sample size		4,501	4,503	4,500	4,503
Adjusted R^2		0.695	0.762	0.782	0.825

a.   Each subsample includes insurers domiciled in the U.S., organized as stock companies or mutuals, and meeting certain data requirements for the years 1993–2013 divided into quartiles by firm size using admitted assets.
b.   Variable definitions: refer to Table 3.

We examine P/C insurers. Since the 1970s, state insurance commissions have relied upon IRIS ratios as an early warning system. In this system, state regulators use financial ratios to help them prioritize insurers for further examination. The resulting examination may include site visits, including discussions with company personnel and others who may provide soft information not available in the insurer's statutory annual reports. Prior research into the effects of distances between parties suggests that soft information tends to be more readily available when parties are close, and soft information tends to make close stakeholders better monitors. The

use of soft information is likely to be both available and used by state insurance regulators when they are focusing on insurers that are located close.

Our study finds that financially weak insurers located close to state insurance regulators under-reserve losses more than those located far from their regulators. Close proximity alone does not increase the likelihood of under-reserving, such as among financially healthy insurers. Rather, the effect of proximity is strongest among those insurers expected to have the greatest incentives to under-reserve. We further determine that the size of the insurer influences the relation between proximity and under-reserving. The largest insurers are less likely to under-reserve when they are financially weak. This result is consistent with larger firms being the object of additional scrutiny regardless of their reported IRIS ratios.

We conclude that the multistep regulatory processes used in the insurance industry may have an unintended consequence. We believe it occurs as a result of the process starting with a set of measures used to prioritize companies for further additional scrutiny. An unintended consequence of the sequential nature of such a regulatory process is to give managers incentive to manage earnings to avoid failing the first step or phase of regulators' tests. We suggest that our findings provide insight into the debate about the advantages and disadvantages of rules-based versus principles-based regulatory systems. While insurer regulation is unique, regulators in other settings struggle with the choice of system to use. Our study provides a reason to be cautious at least in terms of using a rules-based system that involves using well-known, fixed measures to screen companies for further scrutiny. Other settings may be using similar screening processes with similar outcomes. Future research should focus on identifying other settings where similar unintended consequences occur. Future research should also consider whether changes that have occurred (e.g., federal Sarbanes-Oxley Act) and circumstances that exist (e.g., auditor choice) mitigate the negative effects of the unintended consequences we describe.

Appendix A: IRIS Description, Ratio Definitions, Bounds and Relation to Loss Reserve

Information about the Insurance Regulatory Information System (IRIS) ratios, including their formulas and bounds, are obtained from the 1994–2014 editions of *Insurance Regulatory Information System (IRIS) Ratios Manual*. The ratio's definitions and bounds remained the same during 1993–2004 period. In 2005, the National Association of Insurance Commissioners (NAIC) changed the upper and lower bounds for the investment yield ratio to 6.50 and 3.0. Also in 2005, the NAIC added the adjusted surplus ratio. In 2009, the NAIC changed the adjusted liabilities to liquid assets ratio bound to 100.

The following reflect the NAIC's ratio calculation worksheets (NAIC 2014):

Ratio 1: Gross premiums written to policyholders' surplus. Acceptable bound: not over 900.
Gross premiums: The sum of gross premiums written from direct business, reinsurance from affiliates and reinsurance from nonaffiliates. *Surplus*: Policyholders' surplus, which is analogous to the stockholders' equity accounts (retained earnings, common stock, preferred stock and additional paid-in capital) of a company following generally accepted accounting principles (GAAP).
Discussion: Lower levels of loss reserves decrease (improve) this ratio by increasing the surplus.

Ratio 2: Net premiums written to policyholders' surplus. Acceptable bound: not over 300.
Net premiums: Gross premiums reduced by reinsurance ceded to affiliates and reinsurance ceded to non-affiliates. *Discussion:* Lower levels of loss reserves decrease (improve) this ratio by increasing the surplus.

Ratio 3: Change in net premiums written. Acceptable bound: not over 33 and not less than
-33. *Change in net premiums written*: The increase or decrease in net premiums written, divided by net premiums written in the prior year. *Discussion:* Loss reserves do not affect this ratio.

Ratio 4: Surplus aid to policyholders' surplus. Acceptable bound: not over 15.
Surplus aid: The ratio of commissions on ceded reinsurance to premiums for ceded reinsurance multiplied by the unearned premiums on reinsurance ceded to nonaffiliates.
[(Commissions on ceded reinsurance/Premiums for ceded reinsurance) x Unearned premiums on reinsurance ceded to nonaffiliates] *Discussion:* Lower levels of loss reserves decrease (improve) this ratio by increasing the surplus.

Ratio 5: Two-year operating ratio. Acceptable bound: not over 100.
The two-year operating ratio is the loss ratio, plus the expense ratio, minus the net investment ratio, all measured during a two-year period. *Loss ratio:* The numerator is the sum of losses, loss expenses incurred and policyholder dividends from the current and prior period. The denominator is premiums earned in the current and prior period. *Expense ratio:* The numerator is other underwriting expenses and deductions from the current and prior period. The denominator is premiums written in the current and prior period. *Net investment ratio:* The numerator is net investment income from the current and prior period. The denominator is premiums earned in the current and prior period. *Discussion:* The expense ratio and the net investment ratio are not affected by the level of loss reserves. However, estimating lower loss reserves decreases current period losses, which decreases the loss ratio and, therefore, also decreases (improves) the two-year overall operating ratio.

Ratio 6: Investment yield. Acceptable bound: above 3%, but not over 6.5%.
Investment yield: Two times net investment income divided by the average amount of cash and invested assets during the year. Net investment income is the sum of interest, dividends and real estate income (excludes capital gains on sales of investments). *Discussion:* Loss reserves do not affect this ratio.

Ratio 7: Gross change in policyholders' surplus. Acceptable bound: not over 50% and not less than -10%.
Change in surplus: The increase or decrease in policyholders' surplus as a percentage of policyholders' surplus at the end of the prior year, where policyholders' surplus is defined as in ratio 1. *Discussion:* Lower levels of loss reserves increase this ratio by increasing the surplus.

Ratio 8: Change in adjusted policyholders' surplus. Acceptable bound: not over 25% and not less than -10%.
Change in surplus: The increase or decrease in policyholders' surplus net of change in surplus notes, capital paid-in or transferred, and surplus paid-in or transferred as a percentage of policyholders' surplus at the end of the prior year. *Discussion:* Lower levels of loss reserves increase this ratio by increasing the surplus.

Ratio 9: Adjusted liabilities to liquid assets. Acceptable bound: not over 100.
Liabilities: Obligations including estimated losses, such as incurred but not reported reserves.
Liquid assets: Cash and other investments (such as bonds), reported at their annual statement (book) value. *Discussion:* Under-reserving decreases (improves) the ratio by reducing the numerator.

Ratio 10: Gross agents' balances to policyholders' surplus. Acceptable bound: not over 40.
Agents' balances: Agents' balances in the course of collection. *Discussion:* Lower levels of loss reserves decrease (improve) this ratio by increasing the surplus.

Ratio 11: One-year reserve development to policyholders' surplus. Acceptable bound: not over 20.
One-year reserve development: The estimated incurred loss for all years except the current year minus the incurred loss for all years as reported at the end of the prior year. *Surplus$_{t-1}$:* Surplus, as defined in ratio 1, at the end of the prior year. *Discussion:* In general, lower loss reserve estimates reduce (improve) this ratio.

Ratio 12: Two-year reserve development to policyholders' surplus. Acceptable bound: not over 20.
Two-year reserve development: The estimated incurred loss for all years except the current and prior year, minus the incurred loss for all years as reported at the end of the year before the prior year.

Surplus$_{t-2}$: Surplus, as defined in ratio 1, at the end of the year before the prior year.
Discussion: In general, lower loss reserve estimates reduce (improve) this ratio.

<u>Ratio 13: Estimated current reserve deficiency to policyholders' surplus</u>. Acceptable bound: not over 25.
Estimated reserves: A forecast of the appropriate level of loss reserves, computed as the current net premium earned multiplied by the average ratio of developed reserves to earned premiums for the last two years. *Current estimated reserve deficiency:* The difference between the estimated reserves for the company and the actual reserves reported by the company. *Discussion:* Under-reserving increases the surplus (the denominator), which improves the ratio. However, under-reserving also increases the deficiency (the numerator), which worsens the ratio. In general, the numerator effect is stronger than the denominator effect, which means that under-reserving worsens the ratio.

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