Strategic Claim Payment Delays?
Evidence from Property and Casualty Insurance

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Abstract

It is well-known that insurers raise premiums after adverse events. We show that they also slow the pace of claim payments, potentially imposing high state-contingent costs on loss-making clients. In addition, payment adjustments also occur after adverse shocks in unrelated business lines. These shifts increase unpaid losses—a substantial liability on insurers' balance sheets—augmenting liquidity analogously to interest-free credit. Slowdowns are more prevalent among insurers with lower capital or liquidity, who serve clients less likely to file regulatory complaints. This evidence aligns with insurers' strategic financial considerations, though whether they constitute formal delays in the legal sense remains an open question.

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1. Introduction

We investigate whether and how insurers manage the timing of claim payments in response to financial pressures. We build on foundational work which examines the levers that insurers pull in response to adverse financial shocks—among others, Froot and O'Connell (2008) show that insurance premium adjustments help insurers maintain solvency and meet future claims to manage the financial strain caused by significant loss events.[1]

While price adjustments are an important lever, they are among many potential responses available to insurers under duress. For context, non-financial corporations employ various strategic responses—cost management, liquidity preservation, financial flexibility, operational adjustments, and enhanced risk management—to mitigate the impacts of adverse financial shocks. For example, firms typically scale back on capital expenditures, reduce labor costs, and reallocate resources to essential operations during downturns (Bernanke, Gertler, and Gilchrist, 1999). Firms also adjust their capital structures and financial policies to enhance flexibility in hard times: for example, Gorbenko and Strebulaev (2010) argue that firms facing temporary shocks maintain higher liquidity and exhibit lower leverage.[2] Financial constraints arising from limited access to external financing can also prompt firms to rely more on internal funding and asset liquidation (Campello, Graham, and Harvey, 2010), or to increase cash holdings and secure credit lines to ensure liquidity (Bates, Kahle, and Stulz, 2009).[3]

Conceptually, payment timing can serve as a critical buffer against financial constraints for insurers. "Float" in the insurance industry refers to the money held by the insurer between the time funds are received from policyholders and the time at which claims are paid out or policies expire. We argue that float can be leveraged to manage insurers' capital and liquidity positions in hard

[1]Froot and O'Connell (1999) examine the catastrophe reinsurance market and demonstrate that prices surge following significant losses. This response is driven by the immediate need to replenish capital reserves and mitigate risk and permitted by insurers' market power. Froot (2007) further explores the interplay between capital management and pricing strategies. He argues that insurers, facing capital depletion due to financial shocks, adjust their pricing to reflect the increased cost of capital. The study discusses how insurers may also employ other levers, such as raising additional capital, tightening underwriting standards, and diversifying risk portfolios to manage the impact of financial shocks. See also Ge (2022) and Ge and Weisbach (2021) who show that life insurers adjust pricing and portfolio holdings in response to losses in their P&C affiliates.

[2]A classic reference is Myers and Majluf (1984), who spell out firms' incentives to shift towards internal financing to avoid the higher costs and risks associated with external capital during periods of financial instability.

[3]From an accounting perspective, firms may also engage in earnings management by deferring expenses or accelerating revenue recognition to present a more favorable financial position, thus maintaining investor confidence (Healy and Wahlen, 1999)

times.

We focus on property and casualty insurance (P&C), an important sector of the insurance industry and one that is likely to become more important in the face of climate risks (Mills, 2005; Smith et al., 2023). In this sector, insurance float is both sizable (see Figure 1) and is largely driven by the temporal distance between insurance claims and payments. The aggregate float within the P&C industry is close to $1 trillion towards the end of the sample and fluctuates between 40 and 50% of insurers' net total assets between 1996 and 2022. By some distance, unpaid losses are the main driver of float (81-89% over the same period); these are liabilities linked to future claim payments but representing funds retained by the insurer.

In the time-series, we find that insurers facing large losses in one year make adjustments to both premiums and payment timing over the next year. We confirm previous results that insurers significantly raise their premiums following losses; our novel finding is that in such circumstances, insurers also pay less of their incurred losses in the current year and increase their payment duration. In terms of economic magnitudes, for the average firm with $297 million in losses incurred, associated delays increase the loss and loss adjustment expense (LAE) reserve by about $7-9 million, while elevated premium to loss ratios contribute roughly $191 million. There is also important cross-insurer variation in payment delays, which are notably longer for insurers with lower Risk-Based Capital (RBC) ratios and weaker short-term liquidity positions. Furthermore, long-tailed insurance lines such as workers' compensation and commercial auto liability exhibit significantly longer payment delays compared to short-tailed lines.[4]

In the cross-section of insurers, payment delays vary with financial strength; variation along this dimension is in the same basic range as for premium increases. An inter-decile increase in the RBC ratio is associated with an 3% higher fraction of incurred losses paid in the same year or a decrease in the overall payment duration of about 0.17 years.[5] For an average firm with $297 million in incurred losses, this reduction in delay translates to a decrease in reserves (through unpaid losses) of at least $52 million, or about 9% of the average reserve. For the purpose of comparison, the same increase in the RBC ratio correlates with a 10% higher premium-to-loss ratio, which is equivalent

[4]While the liability structure of a life or health insurer exhibits lower float, claim payment delays are nevertheless present, as evidenced by customer complaints.

[5]We measure payment duration as the average time to pay all claims filed in a given year considering all loss payments from years 0 to 4, which together account for about 95% of total loss payments.

to a $28 million premium difference for the average firm, assuming the same losses.

Although these facts are interesting, interpreting the link between "own" line losses and claim payment delays as a strategic choice of the insurer is complicated by the potential for operational bottlenecks: insurers overwhelmed with claims processing may inadvertently delay payments, blurring the distinction between strategic and logistical responses. To address this challenge, we exploit exogenous shocks arising from losses in "unrelated" business lines—which are operationally (and by construction, temporally) uncorrelated with the examined claim payment delays. This measure of unexpected unrelated losses allows us to isolate the effect of financial constraints on claim payment behavior while controlling for "own" line losses which may in part arise from logistical bottlenecks. This research design enables us to examine how payment delays serve as a distinct strategic response to financial shocks, helping to isolate the causal impact of insurers' financial pressures on their claim payment behavior.

Insurance claim adjusters are generally licensed by state and by insurance business line.[6] To implement the idea of "unrelated" losses, we follow two approaches. First, we focus on the impacts of losses in "catastrophe" business lines on payment timing in "non-catastrophe" insurance business lines. This relies on the observation that claim adjusters generally specialize in either assessing physical damage claims (catastrophe) or more routine claims (non-catastrophe). When we adopt this design, we find that those insurers who experience large unexpected losses in catastrophe lines tend to delay payments in non-catastrophe lines. For instance, we show that an insurer who moves from the bottom to the top decile in their loss to total premiums ratio pays on average 2.73% less of their incurred losses in non-catastrophe lines in the same year. This response magnitude per unit of loss in unrelated lines is about half as much as the response to "own" losses in non-catastrophe lines.

We augment this design by adding a geographic dimension to further distance the origin of the losses from the impact of the losses. More specifically, we evaluate the impact of catastrophe losses in a specific catastrophic risk area on payments on non-catastrophe losses outside that geographical area. Our results on delays are robust to this augmentation. Indeed, we show that while firms delay payments in non-catastrophe lines in response to unrelated catastrophe losses, we cannot detect a

[6] This follows the NAIC Producer Licensing Model Act (MDL-228). As we later discuss, this is not strict: many states do maintain reciprocity agreements allowing cross-state licensing, and many claim adjusters are licensed to assess losses in more than one business line.

corresponding rise in premiums using the same identification approach.

The term "payment delay" has a specific legal meaning in many jurisdictions. Most states require insurers to acknowledge, investigate, and pay claims within set timeframes, often 30 to 60 days after receiving a "clean" or undisputed claim. For instance, Colorado mandates payment of undisputed P&C claims within 60 days, while Indiana requires insurers to pay claims "promptly". Importantly, not all delays are legally problematic; complex claims, incomplete documentation, or ongoing investigations may justify longer timelines, particularly to reduce insurance fraud.[7] Legal liability for insurers generally arises only when these statutory windows are exceeded without valid cause, potentially exposing insurers to penalties or bad-faith litigation.

Since many states regulate claim payment timeframes, we investigate whether such regulations affect insurers' use of strategic claim delays to alleviate transitory financial constraints. For each insurer, we calculate the share of insurance premiums coming from states that impose explicit penalties for payment delays. We find that insurers' average claim payment speed and policy pricing do not differ significantly in states with delay penalties. As before, insurers with higher RBC ratios and ratios of liquid investments to liabilities appear to pay faster and price their policies higher; these relationships do not change significantly in states with delay penalties. The effects of regulatory penalties on the use of payment delays in response to losses are also insignificant.

Claim payment delays have significant implications for households. Such delays occur precisely in states of the world in which policyholders have experienced significant losses. In these strained circumstances, policyholders likely have a high marginal utility associated with receiving promised payments. Therefore, payment delays likely have more pronounced welfare implications than adjusting the insurance premium, which from the policyholders' perspective is an *ex ante* decision before losses are realized. Premium payments are subject to policyholders' choice of whether to enter or renew the contract, and alleviated by the forces of competition across insurers.[8] The implications of claim payment delays and denials for household welfare thus deserve particular

[7] Several papers in the insurance literature suggest that efforts to detect and deter insurance fraud can lead to delays in claim payments. For instance, investigations and fraud detection systems often lengthen processing times (Derrig, 2002; Schiller, 2006), while insurers may strategically delay payments to discourage opportunistic behavior in high-fraud environments (Boyer, 2007). At the same time, recent work explores how machine learning can mitigate such delays while maintaining detection accuracy (Gomes, Jin, and Yang, 2021).

[8] Ge, Johnson, and Tzur-Ilan (2025) show that higher insurance premiums due to climate risk raise mortgage and credit card delinquencies and lower borrowers' credit worthiness in affected areas.

scrutiny as the economic effects of this strategy are important in a state-contingent sense.[9]

A simple back-of-the-envelope calculation hints at the size of the implications for household finances. Assume that credit card interest rates of 14-25% (Telyukova, 2013) are the discount rates that appropriately reflect the constrained household cost of bridging liquidity. Under this assumption, the average payment duration of 0.96 years (i.e., close to one year following the year of incurrence) implies that the average insurer incurred losses of $297 million impose a cost on clients as high as $35-57 million (12-19% of incurred losses). Using the same calculation (and making the admittedly strong assumption of no assortative insurer-client matching), by shifting to insurers at the top from the bottom deciles of the RBC ratio, clients can reduce delays by about 0.35 years, which translates to about 4-8% cost savings if they incur insured losses.

Another important tool that insurers can use to manage liquidity and mitigate losses is to deny or reject claims. For example, Kalda et al. (2025) show that insurers pass on climate risk costs to policyholders even outside of disaster areas by raising premiums on price-insensitive clients and raising claim rejection rates on price-sensitive clients. We find that our results for payment delays largely carry over to payment denials and that financially weaker insurers deny more claims. In addition, when insurers experience losses in other unrelated businesses, they respond by increasing the denial rate as well as by increasing delays.

While the primary focus of our study is empirical, we develop a simple theoretical model to deepen our understanding of insurers' claim payment behavior. This framework formalizes the trade-offs insurers face when managing financial shocks, emphasizing the roles of liquidity constraints, regulatory capital pressures, and customer sophistication. The model provides insights into the mechanisms driving our empirical findings by illustrating how insurers strategically balance payment delays against reputational and legal costs. The model also predicts that insurers serving more sophisticated clientele, including those perhaps more likely to file complaints, are less likely to delay payments.

Building on the model's prediction that customer sophistication and responsiveness can act as a disciplining force against insurers' strategic use of payment delays, we examine customer complaints filed with state insurance regulators and aggregated nationally by the NAIC. We first

[9]Recent tragic events, including the brutal killing of an insurance company CEO have brought these concerns to the fore, see, for example, "Deny, Defend, Depose: What To Know About Words Reportedly On Shell Casings Tied To UnitedHealthcare CEO Shooting", Forbes, December 5, 2024

generate word clouds from publicly available granular data from Texas to show that in almost every business line, "delays" and "claims", along with "claims handling", are the words and bigrams that most frequently appear in complaints against P&C insurers. This confirms the significance of claim payment delays from the perspective of customers and households.

When we relate the levels of complaints to measures of financial strength and payment delays, we find that less capitalized and less liquid firms receive more complaints per dollar of direct premiums. Interestingly, firms that pay a larger fraction of claims in the year of incurrence also tend to experience more complaints, suggesting that the relationship between delays and complaints is complex—not only do complaints follow delays, but complaints may also be a disciplinary mechanism reflective of customer clientele. Put differently, insurers that serve customers with a greater tendency to complain (potentially "sophisticated" customers in our model) tend to pay faster, consistent with the model prediction. This is further confirmed by additional evidence that while firms often delay payments and deny claims in response to prior losses, firms experiencing increases in complaints do so to a lesser extent.[10]

To the best of our knowledge, we are the first to examine claim payment delays as a strategic response to financial shocks.[11] We argue that payment delays provide financing akin to interest-free credit to insurers (i.e., float) which helps alleviate insurers' capital and liquidity constraints. Importantly, we bring in new regulatory data, including payment timing and customer complaints, to provide novel empirical evidence on these issues.

Our study provides a novel contribution to the literature on capital and liquidity management that, following Froot and O'Connell (2008) and Ellul, Jotikasthira, and Lundblad (2011), has focused on insurance pricing and asset allocation adjustments in response to financial shocks and regulatory frictions. Analyzing the pricing implications of financial constraints, Koijen and Yogo (2015) estimate that life insurers sold policies at deep discounts, generating significant real

[10]Our results are robust to using confirmed or unconfirmed complaints, instead of complaints. Confirmed complaints are those for which the state regulator deems a violation of law, regulation, or policy terms has indeed occurred.

[11]While the literature analyzing insurance supply has not yet considered the role of payment timing, various intertemporal considerations have already been discussed in the literature on insurance demand, focusing on the incentives of policyholders to terminate contracts early (lapsation). For example, Gottlieb and Smetters (2021) provide evidence consistent with behavioral policyholders forgetting to pay premiums and understating future liquidity needs; and Hombert and Lyonnet (2022) analyze the ability of risk sharing between cohorts of policyholders to complete the financial market and argue that low investor sophistication improves aggregate risk sharing. Koijen, Lee, and Van Nieuwerburgh (2024) explore the implications of aggregate lapsation risk for hedging and valuation of life insurance contracts, estimating differential markups depending on age, income, and health status.

losses. Ge (2022) demonstrates that life insurance subsidiaries of insurance groups adjust their life insurance prices in response to their P&C divisions' losses, and increase the transfers to the P&C divisions. Knox and Sørensen (2024) show that insurers set lower prices on their policies when investment returns are unexpectedly higher. Oh, Sen, and Tenekedjieva (2023) show how insurers use cross-subsidization in prices across states to overcome regulatory frictions, resulting in a decoupling of insurance prices from underlying risk.[12] In addition to pricing, constrained insurers also adjust their asset portfolios. For example, Ge and Weisbach (2021) document that insurers shift their portfolios to safe bonds in response to severe weather shocks.[13]

The prior literature on insurance pricing also highlights how the value of insurance depends on the financial strength of the insurer, with a more narrow focus on the risk of default by the insurer. Cummins (1988) and Doherty and Schlesinger (1990) theoretically show that nonperformance reduces the value of insurance, while Cummins and Danzon (1997), Epermanis and Harrington (2006) and Sommer (1996) provide empirical evidence that financially stronger insurers can charge higher premiums and retain business after rating changes. Although this literature focuses on default and insolvency risk, we point out that actual default is not necessary to undermine the insurance contract: insurers can erode the value of the contract through substantial delays in claim payments, even when solvent.

Finally, we tie our findings back to household finance, as customers facing payment delays are largely households. For example, the nationally standardized complaint data show that more than 80% of complaints are associated with only two consumer lines of business: private passenger auto liability and homeowners. We provide back-of-the-envelope estimates for the monetary costs of claim payment delays to liquidity-constrained households, using discount rates from the credit card debt literature (Telyukova, 2013). In so doing, we contribute to the literature that estimates the

[12]A broader literature shows that insurance pricing is significantly influenced by regulatory costs and insurers' ability to mitigate them. For example, Koijen and Yogo (2016) analyze how life insurers shift their liabilities between more and less regulated subsidiaries and, as a result, reduce their prices and gain the retail market. Tang (2023) estimates a structural model that explains how states' competition to attract insurance business by setting lower capital requirements reduces insurance prices but increases insurers' default risk.

[13]While insurers are often referred to as asset insulators (Chodorow-Reich, Ghent, and Haddad, 2020), financial constraints have been shown to affect insurers' asset allocations. For example, Ellul et al. (2015) show that to improve their capital positions during the GFC, insurers resort to gains trading, selectively selling otherwise unrelated bonds with high unrealized gains, transmitting shocks across markets. Ellul et al. (2022) explain how the regulatory framework incentivizes insurers to hedge guarantees and to shift risks into high-risk and illiquid bonds, amplifying the fire-sale risk in the bond market. Becker, Opp, and Saidi (2021) analyze the effect of regulatory forbearance and document that more financially constrained insurers are more likely to respond to such forbearance by retaining risky assets.

welfare effects of insurance access and pricing. Froot (2001) shows that the catastrophe reinsurance premiums are too high and, therefore, most insurers purchase little reinsurance, arguing that market power is the main reason. Starc (2014), Gottlieb and Moreira (2023), and others also study the welfare effects of insurers' market power through pricing and coverage levels, but focus on health insurance. In addition to insurer rent, insurance pricing is often inefficient in the sense that it does not accurately reflect the risks being insured. Einav, Finkelstein, and Cullen (2010) propose a new approach for quantifying the welfare loss associated with inefficient pricing in insurance markets with selection.

2. Institutional background

A typical P&C insurance company balance sheet includes assets such as cash, investments, premium receivables and reinsurance recoverables, and liabilities such as loss reserves, unpaid claims, and unearned premiums. Table 1 presents a simplified schematic representation of a P&C insurance company balance sheet.

Assets	**Liabilities**
Cash	Loss Reserves
Investments	*Unpaid Claims* (+)
Premium Receivables (–)	*Unearned Premiums* (+)
Reinsurance Recoverables (–)	Other Liabilities
Agent's Balances (–)	
Other Assets	
Total Assets	**Total Liabilities**

Table 1: Balance Sheet of a P&C Insurance Company

Insurers collect premiums upfront and pay claims only later, when risks materialize. In insurance industry lingo, this feature of insurers'business models gives rise to a concept commonly known as "float" which is the difference between "funds held but not owned", and "funds owned but not held" by the insurer. In Table 1, the accounting items that are part of the float are highlighted in italics with (+) or (−) sign depending on their positive or negative contribution to the float. To unpack the phrases mentioned above, ”funds held but not owned” comprise unpaid claims (claims that have been either reported, or incurred but not reported, and that have not yet been paid) as well as unearned premiums (premiums received for coverage that has not yet been provided). And ”funds owned but not held” comprise premium receivables (premiums that are owed to the insurer but have not yet been collected), agent’s balances (premiums collected by insurance intermediaries on behalf of the insurer but not yet remitted to the insurer) and reinsurance recoverables (amounts due from reinsurers for claims paid by the insurer that have not yet been disbursed).

Typically, the float of a P&C insurance company is positive. Effectively, float funds can be invested by insurers to generate returns before disbursing them to claimants, which serves a useful function for an insurer whose current liabilities exceed their current assets (Marais, 2022).

When faced with a consequential negative shock, such as a natural disaster, an insurer typically faces a surge in claims. Given the strategic choices insurers can make, how do these claims flow through the balance sheet and liquidity position? Understanding how the different categories of the float as well as the aggregate magnitude and cross-sectional variation of the float help us understand the levers that insurers have at their disposal to manage their capital and liquidity positions in the face of such shocks.

Paying Claims: If the insurer decides to promptly pay the claims, the balance sheet will be affected as follows. First, assets decrease (cash and investments) as the insurer pays out claims. Second, liabilities decrease (unpaid claims) as the insurer settles these obligations. Last, on liquidity, paying claims reduces the insurer’s cash and investments. This immediate outflow of funds can strain the insurer’s ability to meet other short-term obligations.

Raising Premiums: If the insurer raises premiums after the shock, it can help offset the financial impact of disaster claims. First, assets (premium receivables and cash, once premiums are collected) will increase. Second, liabilities (unearned premiums) will also increase as the insurer collects more premiums in advance. Finally, raising premiums enhances liquidity by (eventually) increasing cash inflows, allowing the insurer to better manage future claims and maintain financial stability. However, the insurer may lose customers, depending on their sensitivity to higher premiums, and the benefit of liquidity will accrue only slowly as the insurer must wait for the additional premium payments to be collected over time.

Delaying Claim Payments: If the insurer delays claim payments, the balance sheet is affected as follows. First, Assets (cash and investments) remain elevated as payments are delayed. Second, liabilities (unpaid claims) also remain elevated as obligations are not settled promptly. Finally, delaying payments immediately improves liquidity by keeping cash within the company for a longer period.[14]

The raising of premiums and the delay of claim payments are two different possible responses available to insurers; the combination of these two strategies that insurers adopt likely depends on many different factors. The academic literature has largely focused on the response of raising premiums—in an influential early article, Froot (2001) analyzes the impact of premium adjustments on insurer financial strength. In contrast, there is little emphasis in the literature on the strategy of delaying claim payments. Before we turn to the data to examine the extent to which insurers engage in such strategic payment delays, we offer a few additional thoughts.

First, while both raising premiums and delaying claim payments have significant implications for insurance customers, payment delays may be more consequential for customers because they impact customers when they have already incurred a loss which was insured. Put differently, claim payment delays potentially exacerbate insurance customers' financial strain when the marginal utility of an extra dollar to them is extremely high (i.e, when they have just suffered catastrophic losses). In contrast, raising premiums imposes a forward-looking cost, giving customers time to adjust their financial planning when their circumstances are not necessarily dire.

Second, there are important constraints that insurers face if they attempt to delay claim payments. For one, insurers face formal payment regulations that specify time frames within which claim payments must be made. They may also have contractual obligations that delineate specific payment timelines. At a less formal but equally important level, delays in claim payments may impact policyholders' trust (Gennaioli et al., 2021). Insurance companies rely on their credibility to attract and retain policyholders. Negative publicity could have long-term consequences on insurers' ability to thrive.

Furthermore, individual insurers do not operate in a vacuum. While segmented in complicated ways by its unusual regulatory treatment, the insurance industry is nonetheless highly competitive.

[14] Even without a shock, insurers may differentiate across products in how fast they pay claims. In general, the delays fall in three categories: a delay in discovery and reporting of claims (e.g., exposure to asbestos), a delay in claim settlement (e.g., medical malpractice litigation or payouts following natural disasters), and extended payment periods (e.g., worker's compensation insurance).

Policyholders have the freedom to choose among different insurers, so an insurer contemplating payment delays or raising premiums must consider the potential loss in market share. Of course, this reputational channel is predicated on insurance buyer sophistication in studying the claims performance of different insurers.

This last point about insurance buyer sophistication raises important auxiliary questions regarding the correlation between payment delays and the relative sophistication of any given insurer's customer base. Are customers with lower levels of educational attainment or from lower socioeconomic strata likely to face a higher probability of payment delays? Understanding this detail is crucial to ensure fair treatment in all customer segments, as suggested by the literature on household finance, as well as the literature that analyzes the impact of financial literacy on economic decision making and welfare (Lusardi and Mitchell, 2014; Gomes, Haliassos, and Ramadorai, 2021).

3. Data and variable construction

We use the National Association of Insurance Commissioners (NAIC) annual regulatory filing data, obtained through S&P Global Market Intelligence, on balance sheet items that together constitute float. The metrics of financial strength, such as the RBC ratio, are calculated and reported by S&P Global. We also use premium and loss data at the business line level to measure loss and pricing levels. Finally, we use NAIC Schedule P data, which report losses incurred and paid by year over the rolling period of 10 years, also at the business line level, to calculate metrics of payment speed. The data frequency is annual and the unit of observation is firm-year, where each firm refers to a stand-alone P&C insurer or a consolidated insurance group. Our sample period is from 1996 to 2021, but the Schedule P data from 1996 show payments of losses that are incurred as far back as 1987. Our analysis uses the maximum possible period over which a particular measure that we analyze can be calculated.

3.1 Insurer float magnitudes

Figure 1 shows the evolution of aggregate float for the P&C industry from 1996 to 2022. Approaching $1 trillion towards the end of the sample, aggregate float within the P&C industry is sizable. While the dollar amount of float appears to increase over time, it actually decreases slightly as a percentage of assets (from the peak of almost 50% in 1996 to about 40% in 2022) or as a percentage of premiums (from about 155% in 1996 to the peak of 165% in 2011 to about 140% in 2022). Within the total float, the relative importance of the different components of the float (enumerated earlier) vary over time. However, Figure 1 also shows that the main driver of float is the component linked to unpaid losses (81-89% of float); these are liabilities linked to future claim payments, but retained by the insurer. By postponing these cash outflows, the magnitude of float can be strategically managed through claim payment delays to enhance liquidity or alleviate financial constraints—payment timing deserves careful scrutiny.[15] Unearned premiums are also a large contributor to float (about 25-30%), while unpaid premiums, or premiums receivables, reduce float (by as much as 25% in the most recent year). At the end of 2022, the unearned and unpaid premiums amount to about 37% and 31% of the net premiums, respectively.

3.2 Summary statistics

We exclude firms whose net total assets or net premiums are non-positive and those whose RBC ratios are below the regulatory control level of 2 (200%) or above 40 (4,000%). These firms are usually tiny, often created for short-term special purposes or in the process of dissolution, and are not representative of the sample.

Table 2, Panel A reports the summary statistics of basic firm characteristics. Overall, we have a total of 1,711 unique firms and 21,532 firm-year observations. The average insurer has net total assets of $1.67 billion, net premiums of $498 million, RBC ratio of 10.14 (1,014%), liquid investments to liabilities ratio of 179%, and a loss ratio of 0.49.

As of 2021, our sample insurers have over $2.5 trillion in aggregate net assets and over $700 billion in aggregate net premiums. Capital and surplus account for 40% of total net assets, with various forms of liabilities accounting for the remaining 60%. The largest components of insurer liabilities are the loss and loss adjustment expense (LAE) reserves, which amount to $776 billion in aggregate, or about half of all insurer liabilities. After claims have been reported, losses are

[15]Marais (2022) is one of the few academic studies analyzing insurance float, reporting considerable cross-sectional variation in float across insurers. In the cross-section of insurers, float is concentrated in long-tail lines, i.e., commercial multi-peril, workers' compensation, medical malpractice, and product liability, where claims are typically reported and settled over a prolonged period, sometimes spanning several years. Companies that are members of an insurance group rely less on the float.

considered incurred, but insurers can take additional time to investigate and pay (or not) these incurred losses. The estimated amount of losses that remain unpaid plus LAE at year end flow into reserves. In 2021, for example, the loss and LAE reserves are about 80% higher than the losses incurred in that year. This suggests that a significant fraction of prior incurred losses remain unpaid. We verify this, calculating the dollar-weighted average payment duration to be almost one year after the year of incurrence (i.e., taking payments within the year of incurrence as payments within year 0).

This flexibility in payment timing differs across lines of business. For short-tailed businesses (e.g., auto physical damage insurance), claims are often settled and paid within a year after they are filed. For long-tailed businesses, conditional on losses being incurred, claim payments can spread over several years. Schedule P allows for the reporting of incurred and paid losses for each incurrence year up to 9 years after incurrence (or 10 years inclusive of the incurrence year). Our analysis therefore focuses on the five largest long-tailed business lines, which together account for 47% of net premiums for the average insurer.[16] About 70% of firm-year observations in our sample have at least one long-tailed business line. The five business lines we investigate include homeowner and farmowner insurance, private passenger auto liability, worker compensation, commercial auto liability, and commercial multi-perils (henceforth, HF, PA, WC, CA, and CM), which on average account for 12%, 9%, 11%, 6%, and 7% of total net premiums, respectively.

3.3 Payment delays

We measure the speed (and its inverse, the delay) of claim payments in two ways. We construct the first measure as the fraction of incurred losses that are paid in the year of incurrence. Table 2, Panel B shows that across business lines, the average fraction of incurred losses paid in the incurrence year ranges from 0.22 for WC to 0.67 for HF, with a weighted average across the five business lines of 0.42. The fraction of incurred losses paid in the incurrence year also exhibits significant variation over time within business lines. For example, for homeowner and farmowner insurance, the 90th percentile is 0.84, almost twice as much as the 10th percentile.

[16] One exception is the case where we look at payment delays across states, using data from Schedule T, which only includes the incurred, paid, and unpaid losses in each reporting year. In this case, we include all non-catastrophe risk lines to reduce noise and maximize power.

The second measure calculates the payment duration as the dollar-weighted average time to payment in years, counting the incurrence year as year 0, and going up year 4 (for a total of 5 years). The reasons we do not track the payments for the full 10 year cycle are that (i) the second half of the cycle only accounts for about 5% of total loss payments, on average; (ii) doing so would truncate our sample in 2012 since we would need 10 years to calculate the measure; and (iii) firms' financial constraints that can be addressed by delaying claim payments are likely transitory, and firms are likely to have to respond within a few years. Consistent with our first measure, i.e., the fraction of incurred losses paid in the incurrence year, HF has the shortest average payment duration of 0.45 years (i.e., on average, the payment is made a little after half way between the ends of years 0 and 1) and CA has the longest average payment duration of 1.45 years (i.e., on average, the payment is made about half way between the ends of years 1 and 2). The weighted average payment duration across all five long-tailed lines is 0.96 years, with the 10th and 90th percentiles significantly far apart at 0.16 and 0.73 years, respectively. While the payment duration is informative of the overall time to payment, it is inevitably noisy, as it incorporates losses paid far into the future and thus less responsive by construction to short-term shocks such as catastrophe losses. In examining how insurers respond to catastrophic shocks, we therefore focus on the very short end—losses paid in the incurrence year as a fraction of losses eventually paid by the end of five years. The average of this "current year payment ratio" is about 0.36 for the combined non-catastrophe long-tailed lines, which include PA, WC, and CA.

Much of the variation in payment delays is cross-sectional, i.e., across insurers. But do individual insurers manage their payment delays to absorb losses or alleviate financial constraints? To examine this, we inspect changes in the payment speed of the same insurer over time. Table 2, Panel D reports the summary statistics of these changes. The average and median changes of both the fraction of incurred losses paid in the incurrence year and payment duration are close to zero, suggesting that insurers' payment delays have a well-defined mean and any increases or decreases from the mean are often temporary. However, changes in payment delays show significant variation. For example, the standard deviation of the changes in the fraction of incurred losses paid in the incurrence year for all lines is 0.10, about half the standard deviation of its level counterpart. For business lines that take more time to pay, such as WC or CA, the standard deviation of changes in the fraction of incurred losses paid in the incurrence year is lower, but the standard deviation of the changes in payment duration is higher, suggesting that there is more variation following the incurrence year. In our analysis, we examine whether these changes are related to variation in individual insurers' financial circumstances.

3.4 Pricing and premiums

Following the literature, we measure insurers' pricing level using the premium to loss ratio, or the inverse loss ratio. The idea is that losses from insurance claims are the costs of writing an insurance policy. If insurers price their policies exactly at cost, the average premium to loss ratio should be close to one. Values of the ratio in excess of one reflect the insurer's profit margin, and the higher the premium to loss ratios, the higher are insurance prices and insurer margins. Table 2, Panel C reports the summary statistics of the premium to loss ratio. The average premium to loss ratios, and even the 10th percentiles, are well above one, suggesting that insurers maintain healthy profit margins on average. Across business lines, the average premium to loss ratios range from 1.50 for PA to 2.00 for CM. Moreover, the variation in pricing is significant—for example, even for PA, which exhibits the lowest margin and the least variation in pricing, the standard deviation of the premium to loss ratio is still 0.51 (i.e., over 50% of losses) and the inter-decile range is almost one.

3.5 Insurer financial health and unexpected losses

Figure 2 shows the cross-sectional and time-series variation in the financial strength of the insurers. First, Panels (a) and (c) illustrate the cross-sectional distributions of the Risk-Based Capital (RBC) ratio and the liquid investments to liabilities ratios, respectively, across insurers. Panel (a) displays RBC ratios, an important regulatory measure of insurer financial strength and ability to withstand significant insurance losses. The mass of the distribution depicted in this panel is indicative of the general financial health of the insurance industry, with most insurers displaying adequate capital levels, but there is a subset of insurers with significantly lower ratios. Panel (c) shows the distribution of the liquid investments to liabilities ratio. Complementing the RBC ratio, this ratio sheds light on the short-term liquidity position of insurers. As with the RBC ratio, this distribution highlights generally prudent investment and liquidity management strategies among most insurers, but once again, there are some insurers on the left-hand side of the distribution who may face important constraints. Panels (b) and (d) explore the temporal evolution of these distributions from 1996 to 2021 for the RBC ratio and from 2001 to 2021 for the liquid investments ratio. Both panels show that while the mean or median value of insurer capital or liquidity positions may have improved modestly over the sample, there is a subset of insurers that appears to be in a more precarious financial position in each sample year.

Panels (e) and (f) of Figure 2 focus on the unexpected ratio of losses in catastrophe risk lines to total premiums. As described earlier, we study how insurers adjust their policy prices, payment schedules, and claim denials in the non-catastrophe long-tailed lines of interest (which include PA, WC, and CA) in response to unanticipated losses in catastrophe risk lines. We treat these losses as exogenous to the non-catastrophe risk long-tailed lines. To measure shocks, we residualize the ratio of losses in catastrophe risk lines to total premiums by regressing it on the ratio of losses in non-catastrophe risk long-tailed lines to total premiums. The regression includes firm-specific fixed effects and seeks to capture how actual losses deviate from expected losses based on each firm's unique characteristics. Panel (e) illustrates the cross-sectional distribution of these residualized ratios of catastrophe losses to total premiums across insurers. The distribution highlights a broad spread of unexpected catastrophe across insurers, with substantial variation in the right tail. We later leverage this variation to assess how unexpected losses from unrelated catastrophe lines affect the management of the non-catastrophe long-tailed businesses that comprise our primary focus. Panel (f) extends this analysis over time by showing the distribution of unexpected catastrophe losses from 1996 to 2021. While there are years for which the distribution of insurers' losses in catastrophe lines is higher vs. lower or more vs. less dispersed, there is always a right tail of sizable unexpected, unrelated losses which we employ as exogenous shocks to study how insurers respond in the non-catastrophe long-tailed business lines.

4. Empirical analyses of payment delays

4.1 The role of financial health

We use the RBC ratio and the ratio of liquid investments to liabilities to capture, respectively, insurers' capital and liquidity positions—two important aspects of insurer financial health. To take a first look at how differences in payment behavior are played out between insurers with different levels of financial health, we plot the cumulative fraction of losses paid since they were incurred for firms sorted into quintiles by their RBC ratios in Figure A1 and by their ratio of liquid investments to liabilities in Figure A2. The plots reveal that insurers with weaker financial positions (lower RBC ratios or lower ratios of liquid investments to liabilities) tend to pay out incurred losses more slowly. While there is some variation across panels, this pattern is broadly consistent across lines of business. This pattern is consistent with weaker firms facing pressures to delay claims, possibly to manage cash flows and liquidity, while stronger firms with more robust capital buffers and elevated liquidity positions settle claims more quickly, possibly to maintain client satisfaction. This sharp degree of variation in claim payment timelines is a novel fact that adds to our understanding of insurer' financial management. However, this is a simple correlation, meaning that reverse causality is a possible driver of this pattern, as is an omitted third variable that drives insurers' financial positions and payment behaviors.

Figure 3 presents bin-scatter plots that examine the relationships between insurer' financial health measures and both their claim payment speed and pricing strategies for combined long-tailed business lines. The top panels (a) through (c) categorize insurers by their RBC ratio, reflecting different levels of financial strength similar to Figure A1. Panel (a) illustrates the ratio of losses paid to losses incurred in the year of incurrence, revealing disproportionately longer payment delays among lower (weaker) RBC-ratio insurers. Panel (b) uncovers a similar story by presenting the consolidated measure of payment duration. Finally, panel (c) examines insurance pricing using the premium-to-loss ratio. The lower panels (d) through (f) organize the insurers according to their ratio of liquid investments to liabilities, paralleling the analysis in Figure A2. Taken together, these panels show that insurers with stronger financial positions (higher RBC ratios and/or higher liquid investments to liabilities ratios) tend to have shorter payment delays and payment durations and more aggressive insurance pricing.

Table 3 reports the coefficient estimates from the panel regressions of payment speed and pricing measures on financial health with year-fixed effects. The regressions largely capture the cross-sectional relationship and confirm the findings in Figure 3. Focusing on the RBC ratio, the coefficients show that insurers with higher RBC ratios tend to pay more of the incurred losses in year 0, have lower payment duration, and charge higher prices. In economic terms, an inter-decile increase in the RBC ratio is associated with an 3% higher fraction of incurred losses paid in the incurrence year and a payment duration that is 0.17 years shorter. By the same calculation, an inter-decile increase in the liquid investments to liabilities ratio is associated with a 13% higher fraction of incurred losses paid in the incurrence year, and a payment duration that is 0.31 years shorter. For the average firm with incurred losses of $297 million per year, the delay difference of 0.35 years associated with the variation in the RBC ratio translates to an additional loss and LAE reserve of at least $52 million, which is about 9% of the average reserve. In comparison, an inter-decile increase in the RBC ratio is associated with a 10% higher premium-to-loss ratio. Holding the incurred losses constant, the premium difference translates to about $28 million for the average firm.

Another way to look at these numbers is from the perspective of households on the other side of payment delays. The household finance literature shows that a significant fraction of households are extremely liquidity-constrained. For example, Lusardi, Schneider, and Tufano (2011) find that about a quarter of households cannot come up with $2,000 to cope with an unexpected liquidity shock. Even for households that have some savings, the literature finds that they still borrow from credit cards at very high interest rates. Telyukova (2013) estimates that interest rates on credit cards range from 14% for revolving credit to 20-25%. Since savings often earn very low yields (see Gross and Souleles (2002), for example), the literature has labeled such findings collectively as the "credit card debt puzzle." Suppose we use credit card interest rates of 14-25% as the discount rates that reflect the constrained household cost of interim liquidity. In that case, the average payment duration of 0.96 years implies a cost to households in terms of the time value of money (using the average insurer with incurred losses of $297 million) as high as $35-57 million (or, 12-19% of the incurred losses).[17] By the same calculation, ceteris paribus and assuming away assortative matching between clients and insurers, by switching insurers from the top to the bottom deciles of the RBC ratio (holding the liquid investments to liabilities ratio constant), clients could hypothetically reduce the delay by about 0.17 years (which translates to a cost savings of about 2-4%) in the event that they incur insured losses.

[17] $297 - 297/(1 + 0.14)^{0.96} = 35$.

4.2 Change in payment delays in response to unexpected losses

4.2.1 Own losses

The literature has shown that insurers facing large losses tend to raise premiums to protect their financial conditions. The negative relationship between payment delays and financial strength measures suggests that payment delays may be used for the same purpose. To investigate this hypothesis, we replicate existing studies in our setting by regressing changes in payment speed and pricing (in our five long-tailed business lines) on the ratio of losses in these business lines to total premiums in the prior year. In examining changes, we focus on the immediate short-term response and replace the payment duration by the ratio of losses paid in the incurrence year to losses eventually paid by the end of five years. Table 4 reports the results. Consistent with Froot and O'Connell (2008) and Ge (2022), among others, we find that insurers facing large losses in the past significantly raise their premiums (column 3). In addition, these insurers also pay less of the incurred losses in the current year (column 1) and shift more of the loss payment towards future years (column 2), confirming our hypothesis that insurer also manage payment timing to help overcome financial constraints.

In terms of economic magnitudes, an increase in the loss ratio from the bottom to the top decile is associated with insurers paying about 2.45% (0.043×0.57) of the losses incurred less in year 0 (column 1) and shifting about 4.21% (0.074×0.57) of losses that are eventually paid towards future years (column 2). For the average firm with \$297 million in incurred losses and \$207 million in losses that are eventually paid within 5 years, such a delay would increase the loss and LAE reserve by about \$7-9 million.[18] In comparison, the same increase in losses is associated with insurers raising their premium to loss ratio by 64% (1.128×0.57), which amounts to \$191 million for the average firm.

[18]We can also make back-of-the-envelope aggregate computations. In 2021, across all sample firms, an inter-decile increase in losses is associated with insurers collectively raising the loss and LAE reserves by about \$10-12 billion (compared to the total reserves of \$780 billion).

4.2.2 Losses in unrelated business lines

Our results so far, while suggestive, do not necessarily establish payment delays as a financial management tool for insurers. One alternative explanation is that insurers facing many claims and large losses face resource constraints and hence need more time to process claims. Moreover, insurers that delay payments carry higher liabilities and may therefore appear financially weaker (reversed causality). For insurance premiums, past losses may also raise expected future losses, which form the basis for premium setting. To rule out these alternatives and to identify that insurers employ claim payment delays as a financial strategy, we exploit losses in "other" unrelated lines of business as an exogenous shock.

As discussed earlier, our first approach is to look at the effects of catastrophe risk lines, including both long-tailed lines (HF and CM) and short-tailed lines (e.g., auto physical damages), on payment speed and pricing in non-catastrophe risk long-tailed lines (PA, WC, and CA).[19] Again, we lag the measure one year to look at insurer responses to these losses. We begin by looking at binned-scatter plots that relate (lagged) unexpected losses in catastrophe-risk lines to (current) changes in claims handling and pricing strategies in the three non-catastrophe risk long-tailed lines of interest. Figure 4 panel (a) shows that insurers that experience higher unexpected losses in unrelated lines slow down payment speeds over the next year. This slowdown provides evidence consistent with a strategic response by insurers to manage liquidity and ensure stability in the face of unanticipated financial stress; the use of claim payment delays in this manner has significant implications for the customers of these firms. Panel (b) shows how these unexpected catastrophe line losses impact the ratio of paid losses to 5-year cumulative paid losses in the non-catastrophe lines. Consistent with panel (a), insurers pay less in the incurrence year and shift more of the loss payment to future years after experiencing unexpected losses in other unrelated lines.

In panel (c) of Figure 4, for comparison purposes, we examine how insurers adjust insurance premia in response to unexpected losses in unrelated lines. Unlike the relationship we observe between past losses and future premiums within the same business lines, the results show that insurers, when faced with unexpected losses in unrelated catastrophe-risk lines, do not necessarily

[19] As described earlier, we measure unexpected losses in catastrophe risk lines by regressing the ratio of losses in those lines to total premiums on the loss to total premium ratio of non-catastrophe risk long-tailed lines (i.e., "own" lines), and include firm-specific fixed effects in these regressions. The residuals are our measure of unexpected losses.

increase premia (normalized by losses) in their non-catastrophe risk lines.[20] Insurers may face regulatory constraints or fierce competition in some non-catastrophe risk long-tailed lines such that, unless these lines also suffer larger than expected losses, they cannot easily raise premiums. Management of payment speed may provide insurers with a more flexible tool to address financial and liquidity issues across business lines.

To confirm the relationships we observe in the bin-scatter plots, we run panel regressions of the change in payment speed or pricing in non-catastrophe risk long-tailed businesses on the lagged ratio of losses in unrelated catastrophe-risk lines to total premiums. We include firm- and year-fixed effects plus various controls. Table 5 reports coefficient estimates. We note that the introduction of time fixed-effects in these regressions controls for the possibility of common shocks across insurers at each point in time. In addition, as in Table 4, we include the past "own" loss to total premium ratio of the non-catastrophe risk long-tailed lines because these losses have first-order implications for payment speed and pricing, as we have shown above. Ultimately, the regressions aim to capture how insurers respond to these unrelated and unexpected losses by adjusting their payment timing and pricing behavior.

The results in columns 1 and 2 confirm the patterns in Figure 4. Insurers experiencing higher losses in catastrophe risk business lines in the past year increase payment delays in non-catastrophe-risk lines in the current year by paying less of the incurred losses in that year. They shift more of the loss payment into the future (effectively increasing payment duration). These sensitivities to "unrelated" losses are about a third to half of the sensitivities to "own" losses. Also consistent with Panel (c) of Figure 4, insurers do not seem to raise their premiums in response to unexpected losses in other unrelated lines. Given that we observe cross-line adjustments only in claim payment timelines, not in the insurance premia, the evidence suggests that while insurers employ a multifaceted approach to financial management, claim payment management may be more flexible for cross subsidizing among different business lines. When a business line suffers large unexpected losses, insurers adjust not only financial levers in pricing within that line but also operational levers in claims processing across potentially many business lines.

If insurers adjust to shocks to their financial circumstances by delaying payments, such ad-

[20] When we measure unexpected losses in unrelated lines using only firm fixed effects, without extracting the effects of losses in own lines, the relationship is actually positive.

justments can have significant implications for an insurer's customers. Claim payment delays are particularly worrisome from a customers' perspective, as these claims are generally made when their personal circumstances are dire and their marginal utility is extremely high. Moreover, this delay behavior will be more painful for customers with less wealth, enhancing the importance of studying the welfare consequences of delays and denials. For example, an interdecile increase in the ratio of catastrophic losses to total premiums would result in a decrease of 0.025 in the fraction of 5-year cumulative paid losses paid in the incurrence year (-0.052 $\times$ 0.479) for the non-catastrophe risk long-tailed lines. Given an average of about 0.358, a decrease of 0.025 represents a 7% decline. Assuming the same percentage shift in the payment duration for these non-catastrophe lines, this incremental delay would translate to an increase in payment duration of 0.08 years (7% $\times$ 1.217). This delay implies an incremental cost to consumers, in terms of the time value of money, of $3-6 million (from the average incurred losses of $297 million at 14-25% interest rate per year, taken, as earlier, from credit card rates paid). To better outline the forces involved and potential implications, we set up a simple model of insurers' interactions with their customers in the next section.

4.2.3 Losses in unrelated business lines and in other regions

Up to this point, we have shown that losses in catastrophe-risk lines affect payment delays in unrelated non-catastrophe risk lines. Skeptics might argue that even if the catastrophe and non-catastrophe risk lines are unrelated and their claim adjustments require very different skills, our results may still not establish that insurers strategically delay payments if, for example, customers of these different lines are the same customers who may be inundated with damages along multiple fronts and file claims late. To further rule out alternative explanations along these lines, we use geographical variation to further enhance our identification.

More specifically, we investigate how losses in catastrophe risk lines in a particular region, such as a hurricane zone, affects payment delays and pricing in unrelated non-catastrophe risk lines *outside* of that particular region. We use three catastrophe zones based on S&P Global classifications: hurricane, earthquake, and tornado.[21] We combine several hurricane zones, including the Caribbean, Florida, Gulf, North-East, and South-East together, since many hurricanes hit several zones over several days. We construct our variables using state-level data from NAIC Schedule T, in which

[21]We ignore the Typhoon Pacific zone, which is too small.

insurers report direct premiums written, direct losses incurred, direct losses paid (less salvage), and direct losses unpaid (cumulative).

We adjust our previous empirical specifications to mitigate noise coming from smaller units within a firm and to circumvent data limitations. First, unlike NAIC Schedule P, Schedule T does not report the matrix of the fraction of losses incurred in year t are paid in years t, $t+1$, etc. We only observe incurred and paid losses in a given year, and some of the paid losses may be incurred in that year, while the remainder may be carried over from prior years as unpaid losses. Therefore, we measure the payment speed to the degree to which losses that could have been paid in year t are actually paid in year t, and smooth the measure over two years. That is, we calculate the ratio of paid to incurred and unpaid losses as the sum of paid losses in years t and $t-1$ divided by the sum of unpaid losses at the end of year $t-2$, incurred losses in year $t-1$, and incurred losses in year t.

Second, we focus on large, unexpected losses because small losses from a few lines and a few states are unlikely to trigger significant changes in payment behaviors. We create a high loss dummy indicator variable both for catastrophe-risk lines from a particular catastrophe zone but also for non-catastrophe-risk lines outside of that zone (i.e., own losses). The high loss dummy equals one if the incurred losses from a particular block of business lines and states, scaled by total premiums, are greater than 1.65 standard deviations above the mean (corresponding to a 90% two-sided confidence interval), where both the standard deviation and the mean are specific to that particular block. Third, to ensure that the business lines and states we examine matter for the firm, our sample only includes observations in which both the catastrophe risk lines in a particular catastrophe zone and the non-catastrophe risk lines outside that particular zone represent at least 5% of the firm's total premium.

Finally, in our regressions for ease of interpretation, we normalize the change in the ratio of paid to incurred and unpaid losses and the change in the premium to loss ratio and include both the contemporaneous high-loss dummy and up to 3 lagged high-loss dummies. Table 6 reports the results from regressions in which we stack the three catastrophe zones together so that each observation is a firm-zone-year. The results confirm that both own and unrelated losses matter for payment speed, but only own losses matter for pricing. Focusing on the cross-state cross-business line effects, when catastrophe losses from a particular zone are high in year $t-1$, insurers delay claim payments in non-catastrophe risk lines outside that particular zone in year t by about 10% of the standard deviation. The effect is statistically significant at the 5% level, as is the cumulative effect over the contemporaneous period plus three lags. In Internet Appendix Table A2, we run regressions separately for the hurricane, earthquake, and tornado sub-samples, and the cross-state cross-business line effects are significant in two out of three cases. Overall, our results are consistent with insurers strategically delaying claim payments to manage financial conditions emanating from underwriting losses.

4.3 State regulations

The term "payment delay" has a specific legal meaning in many jurisdictions. Most states require insurers to acknowledge, investigate, and pay claims within set timeframes, often 30 to 60 days after receiving a "clean" or undisputed claim. For instance, Colorado mandates payment of undisputed P&C claims within 60 days, while Indiana requires insurers to pay claims "promptly". Importantly, not all delays are legally problematic; complex claims, incomplete documentation, or ongoing investigations can justify longer timelines. In such cases, state regulations often permit exceptions from the mandated time-frames but require that the insurer updates the affected customer periodically until the claim is settled. Legal liability generally arises only when these statutory windows are exceeded without valid cause, potentially exposing insurers to penalties or bad-faith litigation. Explicit penalties, imposed by about half of the states, often come in the form of interest charges on unpaid claims over the delay window. For example, Colorado's regulation states that "If the claim is $100 or less, the penalty shall not be greater than $20. If the claim is more than $100, penalty shall be 8% on benefits due from the date that the valid claim is received."

We investigate whether these state regulations on payment time-frames affect insurers' choice of financial strength and payment promptness. First, we classify states by regulatory strictness on claim payment timing. We focus on whether the state imposes explicit penalties for delaying claim payments beyond its mandated window. Then, we calculate for each insurer the share of insurance premiums coming from states that impose explicit penalties. The share of premiums coming from states with explicit delay penalties has a distribution ranging from almost 0 to 1, with the 25th, 50th, and 75th percentiles equal to 0.08, 0.55, and 1.00, respectively.[22] Finally, we rerun the main

[22]We focus on explicit penalties, rather than the payment windows, because most large states mandate the payment windows, and the share of premiums coming from these states has the 25th, 50th, and 75th percentiles equal to 0.84,

regressions in Tables 3 and A4 and add as additional explanatory variables the share of premiums coming from states with delay penalty and its interactions with measures for financial strength and unexpected losses.

Internet Appendix Table A3 reports the results. Columns 1 to 3 show that on average, insurers' claim payment speed and policy pricing do not significantly differ in states with a delay penalty. In addition, insurers with higher liquid investments to liabilities generally pay more claims in the incurrence year, have lower payment duration, and price their policies higher, and these relationships do not significantly change in states with stricter payment-timing rules (insignificant interaction terms). Columns 4 to 6 investigate insurers' responses, in terms of payment timing and pricing in non-catastrophe risk long-tailed business lines, to unexpected losses in the same lines and in the unrelated catastrophe-risk lines. Consistent with the baseline results, insurers tend to delay payments when suffering larger unexpected losses in other unrelated lines, but tend to raise prices when suffering larger unexpected losses within the same business lines. The payment delay effects do not change in states with delay penalties, but interestingly the premium effects do weaken. In states with a delay penalty, insurers, on average, still raise premiums (perhaps because they cannot flexibly use the delay lever), but the rate of premium increase depends less on underwriting losses.

4.4 Claim denials

Another important tool that insurers can potentially employ to manage liquidity and mitigate losses is to deny or reject claims. This can be thought of as an extreme form of payment delay (infinite delay). An examination of claim denials affords one clear advantage that supplements our analyses of delays; while operational backlog and late claim filing may affect payment timing and even the number of claims that are closed within a certain timeframe, they should not affect the fraction of closed claims with vs. without payments. Kalda et al. (2025) show that, by raising premiums on price-insensitive clients and raising claim rejection rates on price-sensitive clients, insurers pass on climate risk costs to policyholders, even outside of disaster areas. In this section, we investigate whether, in addition to claim payment delays and price adjustments, insurers also strategically alter denial rates.

In Table 7, we rerun the main regressions in Tables 3 and A4 but, as dependent variables, our

0.98, and 1.00, respectively.

measure of the inverse denial rate (i.e, the fraction of claims closed with payment in the incurrence year)[23] and its annual change. Column 1 shows that insurers with a higher RBC ratio are less likely to deny claims, i.e., a higher fraction of claims closed with payment. Unlike the case of payment delays, the liquid investments to liabilities ratio is not a significant determinant of claim denials, suggesting that denials are more related to solvency than liquidity. Columns 2 and 3 focus on changes in the fraction of claims closed with payment in response to past own and unrelated losses. Column 2 shows that past losses in long-tailed business lines raise the denial rate in these lines, i.e., decrease the fraction of claims closed with payment, while column 3 shows that this effect disappears when we consider only non-catastrophe risk lines and include past losses in unrelated catastrophe risk businesses. That is, insurers appear to use claim denials more to smooth losses across business lines than to mitigate losses within the same business lines. Overall, the results are consistent with insurers also using claim denials to manage solvency and smooth losses.

5. Model

To shed light on the mechanisms behind our empirical results, we develop a theoretical model that formalizes the trade-offs insurers face when delaying claim payments. The model highlights how financial constraints, customer sophistication, and reputational costs interact to shape payment strategies. By providing structure to these dynamics, the model sharpens our interpretation of the observed patterns and clarifies the economic forces at play.

Consider a 3-period model of insurance, time indexed by $t = 0, 1, 2$. We assume there is a unit mass of customers, equally divided into two types, h and l. (We think of these types as capturing financially sophisticated and unsophisticated customers.) The customer's type is observable to the insurer, but the customer has less knowledge about their own type. This reflects the documented household-level correlation (see, e.g., Campbell (2016)) between low financial sophistication and high self-confidence. We model this as an information asymmetry; more specifically, the customer may know about themselves but may have more limited knowledge of their sophistication relative to other customers. In contrast, the insurer sees the full distribution of customers, permitting a more accurate relative ranking.

[23]On average, the fraction of claims closed with payment is about 70-75%. That is, about 25-30% of claims are denied.

In the model, all customers and insurers face a time discount factor ρ between periods. In period 0, each customer pays a premium p to the insurer, to insure themselves against the possibility of a negative shock in period 1. In the beginning of period 1, with probability π the customer faces a negative shock of c and files an insurance claim with the insurer. The insurer can choose to delay the payment for the claim until period 2. We denote by $\theta_i \in [0, 1]$ the share of the claim the insurer chooses to pay in period 1 for a claim from a customer of type i.

Delay is costly for the insurer. If the insurer chooses to delay the payment, they suffer a reputational/legal cost $\xi_i(1-\theta)^2$, where we assume that the cost to the insurer from delaying the payment is higher for more highly sophisticated customers $\xi_h > \xi_l$. This parameter restriction can be microfounded with better knowledge by the sophisticated that some delays are not reasonable, combined with easier access to legal services for the sophisticated; or differential ability to "kick up a fuss," e.g., file complaints with regulators or alert media outlets that generate bad press for the insurer.

The insurer's problem is to minimize the present value of the payment in period 1, subject to the legal and reputational cost:

$$\min_{\theta} \, [\theta + (1-\theta)\rho]c + \xi_i(1-\theta)^2$$

Note that, since the insurer observes types, they can fully discriminate payments between the two types of customers and minimize the cost separately for each type.

The first order condition of the problem is

$$2\xi_i(1-\theta) + (1-\rho)c = 0,$$

which gives

$$\theta_i^* = \theta^*(\rho, \xi_i, c) = 1 - \frac{(1-\rho)c}{2\xi_i}.$$

Figures 5 and 6 plot the optimal payment as a function of ρ and ξ_i. Note that delays are higher when the discount factor is higher and vice versa. This helps the model to rationalize patterns in the data which connect measures of financial health to delays—here the discount factor is a simple stand-in for the financial health of the insurer, with worse financial health or higher demands for immediate liquidity represented by higher discount factors.

Conditional on receiving a negative shock, the payment for a type i customer is:

$$\theta_i^* c = c - \frac{(1-\rho)}{2\xi_i} c^2. \tag{1}$$

The customer anticipates the possibility of a delayed payment. Still, since they do not know their type, they are unable to fully anticipate the length of the delay they would experience in the event of making a claim. The fair value of the insurance perceived by a customer of any type is then:[24]

$$p = \pi \left[\frac{\theta_h^* + \theta_l^*}{2} \rho + \left(1 - \frac{\theta_h^* + \theta_l^*}{2}\right) \rho^2 \right] c. \tag{2}$$

An implicit assumption is that customers cannot infer their type from observing the price. This assumption means that they are not fully aware of the legal/reputational cost they can impose on the insurer in case of a delayed payment. Consequently, low-sophistication customers overpay for the insurance *ex-post*. Indeed, assuming free entry and a zero-profit condition for the insurer (i.e., insurers sell the insurance at the perceived fair value given by equation (2)), the unsophisticated end up cross-subsidizing insurance for sophisticated customers.

To see this, note that conditional on a negative shock, the *ex-ante* expected payment in period 1 is:

$$\frac{\theta_h^* + \theta_l^*}{2} c,$$

whereas the true payment for both types is given by equation (1).

In Figures 7 and 8, we plot the cross-subsidy from unsophisticated to sophisticated customers, depicting the amounts of payment in period 1 in excess of the expected payment for both types as a function of $1 - \rho$ and ξ_h, respectively.

This is an interesting implication of the model that connects to the growing literature on perverse cross-subsidization in household finance (see, e.g., (Fisher et al., 2024; Berger et al., 2024; Agarwal et al., 2023; Zhang, 2022). We cannot test this issue directly in our setting, as identifying cross-

[24]Assuming the customer expects to get full payment in period 1, the actuarially fair price of the insurance is $p = \rho\pi c$. The true value of the insurance for a type i customer is, however, given by

$$p = \pi[\theta_i^* \rho + (1 - \theta_i^*) \rho^2] c.$$

subsidies requires very granular data at the customer level. However, we can attempt to illuminate the customer perspective on claim payment delays using data on the complaints that customers make to the NAIC. We turn to that in the next section.

6. Customer complaints

Building on the model's predictions, we now turn to empirical evidence from customer complaints to examine how client characteristics, particularly sophistication and responsiveness, influence insurers' strategic use of payment delays. This analysis provides a unique perspective on the interplay between customer behavior and the operational decisions highlighted in the model.

In particular, how important are payment delays to insurance customers? How do customers respond to these delays? Are these responses indicative of customer type and are they effective in curbing delays and other similar tactics? To address these important questions, we examine data on customer complaints. We begin by analyzing detailed complaint data from Texas. These data are publicly available from the Texas Department of Insurance; they detail the reasons behind complaints and span the period from April 2011 to April 2024.

Figure 9 provides the word clouds from complaints for the major business lines. Panels (a) to (d) are within the P&C domain, i.e., homeowners, automobile, fire, allied lines, commercial multi-perils, and liability. These word clouds reveal that the word "delays" together with the word "claims" as well as the words "claims" and " handling," which provide a broad umbrella for delays and related practices such as denials, are the most common words. Panels (e) and (f) provide evidence of the importance of claim delays outside the P&C domain, showing that customers of both life and annuity insurers (and, to a somewhat lesser extent, customers of accident and health insurers) are also aggrieved by claim delays.

Next, we look at the national standardized complaint data. These data are provided to us by the NAIC and span all U.S. states from January 2014 to August 2024. Similarly to Texas data, the national sample shows that claim handling is the main complaint type description, accounting for more than 60% of all complaints. The top reasons include descriptors such as "delays", "delays/no response", "delayed authorization decision", etc., which account for about 25% of all complaints. The second most important reason is the denial of claims, which is also part of the claim handling and represents about 20% of all complaints.

To understand which firms receive more complaints and how receiving complaints may affect their strategies, we count the number of complaints for each firm in each year and then scale the number of complaints by the direct premiums (in millions of dollars) to account for the fact that larger firms naturally receive more complaints. Table 2, Panel F shows that the (pooled) average number of complaints per $1 million of direct premiums is 0.21, with the 10th and 90th percentiles 0 and 0.61, respectively. Much of the variation comes from the cross section (71%) rather than the time series (3%), because complaints vary mainly between insurers rather than within them, consistent with insurers segmenting the market for customer types as in our model in the previous section. We explore this idea in more detail below. In our analyses, we focus on "confirmed" complaints, defined formally as complaints that have been investigated by a state insurance department, and where the department has determined that the insurer violated a law, regulation, or policy term. On average, confirmed complaints account for about 25% of all complaints. The percentage is higher in years 2014-2019 (about 26-36%), drops sharply in 2020, and remains low since (about 18-19%). Arguably, "unconfirmed" complaints may be unjustified and not necessarily indicative of insurers'claim handling or customers' understanding of their policies and the applicable regulation.

Complaints can be the result of firms' strategic claim handling tactics, in which case we would expect firms that delay claim payments more to also receive more complaints. Complaints can also be indicative of firms' customer clientele and may also constrain firms' ability to use delay or denial tactics to preserve liquidity in the event of a large negative shock, as our model predicts. To assess these potentially different aspects /roles of complaints, we first create bin-scatter plots in Figure 10 for complaints against (lagged) measures of financial health, claim payment delays, and pricing. Panel (a) shows that insurer-time observations with higher RBC ratios are associated with fewer complaints, although the relationship flattens out once we move past the 80th percentile. Panel (b) shows that higher liquidity ratios are also associated with fewer complaints. Together with Figures A1 and A2, these results suggest that financially weaker firms that tend to delay loss payments also face more complaints.[25] However, the relationship is more nuanced, as Panel (c) shows that insurers that pay faster (pay more claims in the incurrence year) also face more complaints. This indicates

[25]We show, in the Internet Appendix (Figures A3 and A4), that the patterns are similar when we measure complaints using either unconfirmed complaints or all (confirmed plus unconfirmed) complaints.

that complaints may not simply respond to payment delays, but may also reflect different customer clientele across insurers. In fact, the latter seems to dominate; insurers facing customers who complain a lot must naturally pay faster. Finally, we find no clear relationship between complaints and insurance pricing.

To more formally establish the idea that complaints reflect customer clientele, and hence the use of payment delays and pricing adjustments as levers to manage liquidity and finances, Table 8 extends the regressions in Table 5 by adding as regressors the change in complaints and its interaction with past unexpected losses in unrelated catastrophe risk businesses. Column 1 shows that insurers that experience an increase in confirmed complaints tend to pay more claims in the incurrence year. However, column 2 shows that once we include the interaction of the change in complaints with losses in unrelated catastrophe risk lines, the direct effects of complaints become insignificant, i.e., largely absorbed by the interaction term. While firms respond to past losses by delaying claim payments (paying less in the incurrence year), those that see an increase in complaints use delay tactics less. This interaction effect is both statistically and economically significant. An inter-decile increase in confirmed complaints decreases the loading on losses in unrelated catastrophe lines by about half ($0.284 \times 0.139 = 0.039$). The results are generally robust in columns 3-4, although significance varies, when we measure payment speed using the fraction of 5-year cumulative paid losses paid in the incurrence year.[26] This finding suggests that the nature of the customer clientele can limit the extent to which firms use payment delays.[27] In columns 5-6, we do not observe either the direct or the interaction effects of complaints on premium pricing. Regarding claim denials, while the effects of the change in confirmed complaints in columns 7-8 are not significant, we show in the Internet Appendix Table A4 that the effects of the change in "all" complaints are.

7. Conclusion

This study emphasizes the strategic importance of claim payment delays as an operational lever for insurers, particularly those facing liquidity or regulatory constraints. Beyond traditional responses

[26]By construction, the ratio of paid losses in year t to 5-year cumulative paid losses (years t to $t+4$) requires 4 years of additional data from the year of incurrence, which effectively cuts our complaint sample by over half.

[27]In the Internet Appendix (Tables A4 and A5), we show that while significance varies, the finding is generally robust to using either all or unconfirmed complaints.

such as raising premiums, payment delays emerge as an additional mechanism to manage financial shocks. Insurers with lower RBC ratios and compromised liquidity are more likely to use this tool, especially in long-tailed business lines such as workers' compensation and commercial auto liability. These delays, which extend the "float" on insurers' balance sheets, allow firms to preserve cash and stabilize their financial positions during challenging periods.

The analysis of complaints data further underscores the significance of these findings. Complaints about payment delays dominate grievance records. Insurers with weaker financial profiles are associated with a higher incidence of complaints and, interestingly, the complaint data suggest that customer sophistication plays a role in moderating insurer behavior. Firms serving a more vocal or sophisticated clientele are less likely to delay payments, illustrating a complex dynamic where customer feedback serves as both a disciplining force and a reflection of strategic adjustments.

Lastly, while claim payment delays are a financial buffer for insurers, the connection to customer welfare is particularly profound. Payment delays coincide with challenging moments when policyholders experience high marginal utility from insurance payouts. Future work should further explore these dynamics, incorporating nuanced measures of financial shocks and customer characteristics to deepen our understanding of this critical insurance mechanism.

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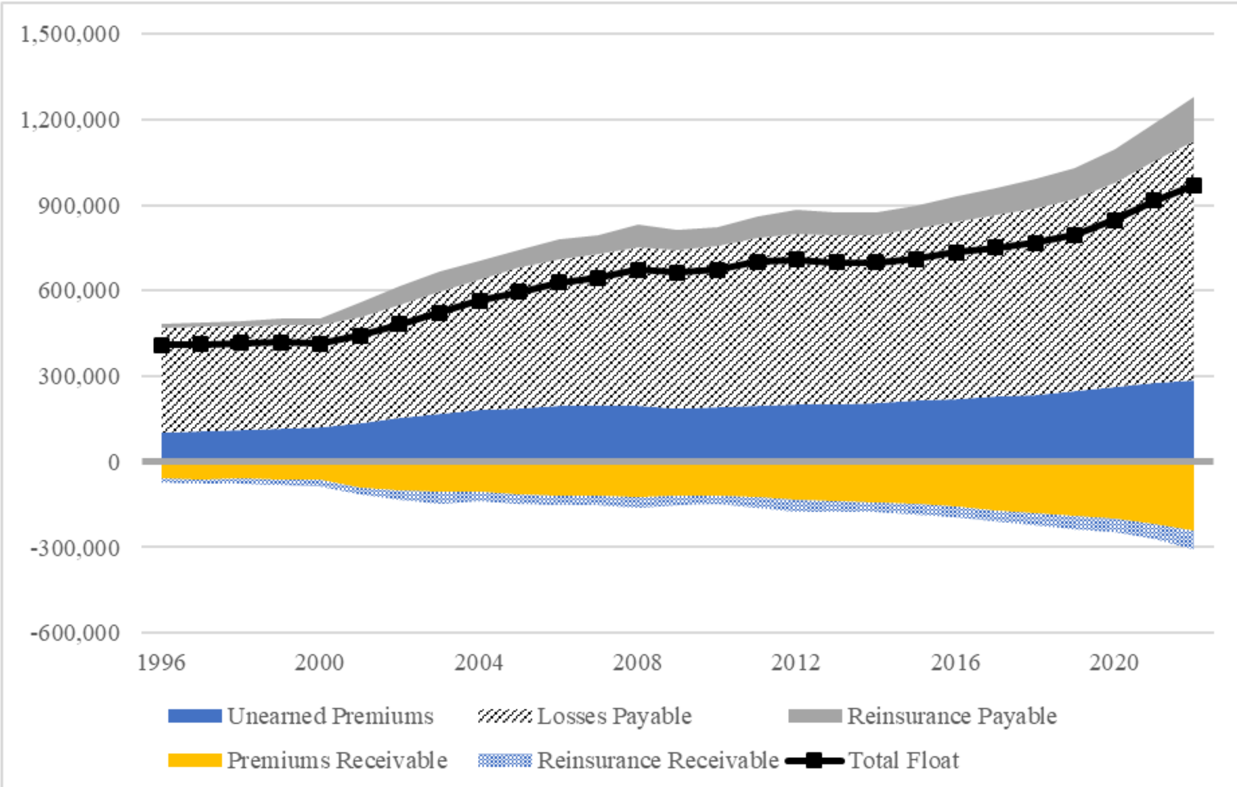
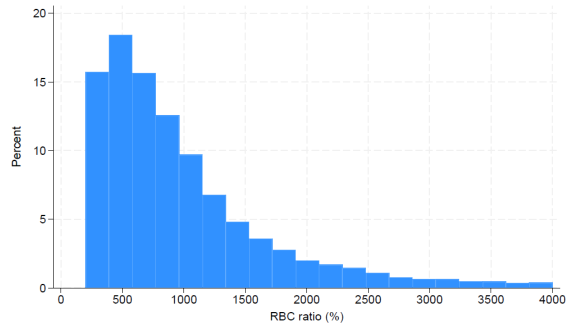
Figure 1: Float and Its Components over Time

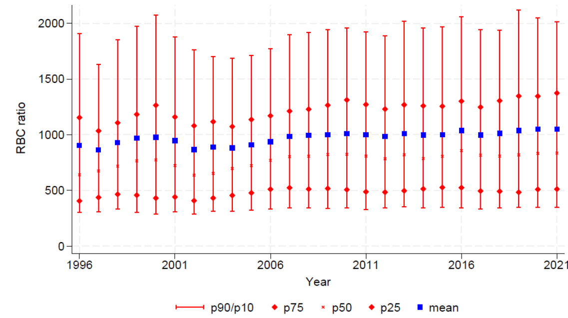


Notes: The figure plots dollar float and its components, summed across all P&C insurers at the end of each year, over the period from 1996 to 2021.

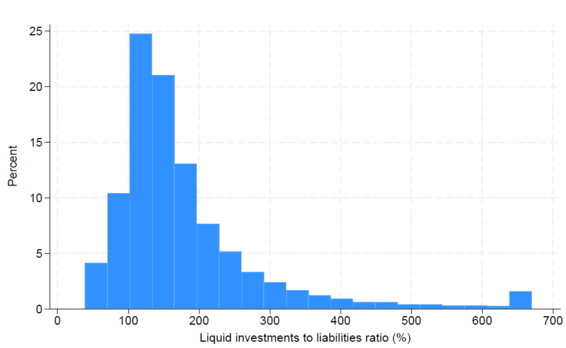
Figure 2: Distributions of Financial Strength and Unexpected Losses in Other Businesses



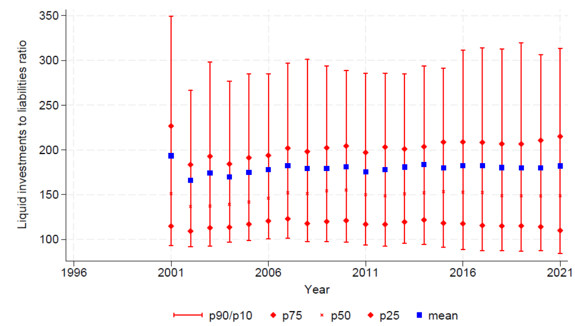
(a) RBC ratio



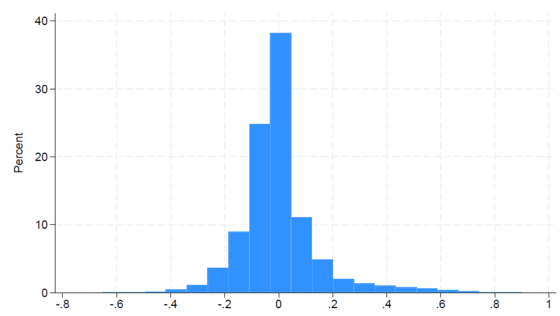
(b) RBC ratio over time



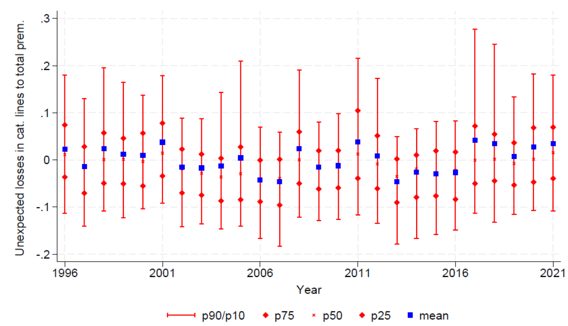
(c) Liquid investments to liabilities ratio



(d) Liquid investments to liabilities ratio over time



(e) Unexpected losses in cat. lines to total premiums

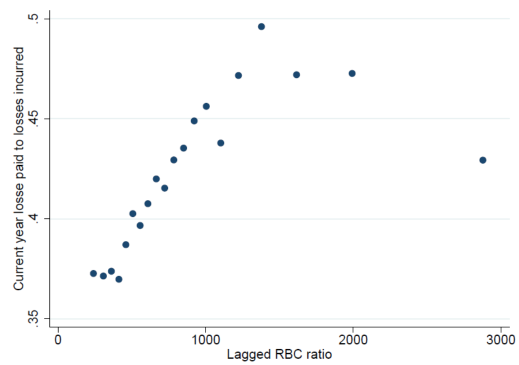


(f) Unexpected losses in cat. lines to total premiums over time

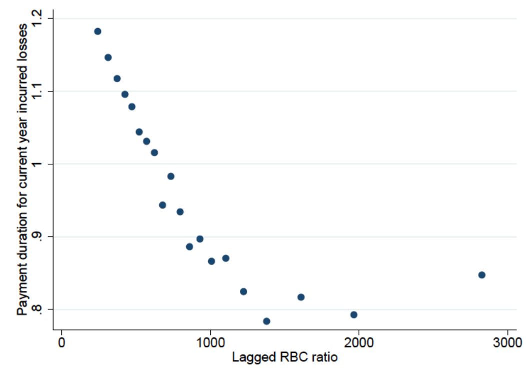
Notes: The figure plots the histograms and distributional statistics of the RBC ratio (panels (a) and (b)), liquid investments to liabilities ratio (panels (c) and (d)), and unexpected losses in catastrophe risk lines to total premiums ratio (panels (e) and (f)). Following the definition by S&P Global, Catastrophe risk lines include homeowner and farm owner (HF) and commercial multi-perils (CM), among the five long-tailed lines, and passenger and commercial auto physical damages, among others. The sample period is 1996-2021, with the exception of the liquid investments to liabilities ratio for which the data are available only from 2001 onwards. The unexpected losses in catastrophe risk lines to total premiums is calculated as the residual from regressing the losses in catastrophe risk lines to total premiums ratio on firm fixed effects and the losses in non-catastrophe risk lines to total premiums ratio.

Figure 3: Financial Strength, Loss Payment Speed, and Pricing

Sorted by RBC Ratio



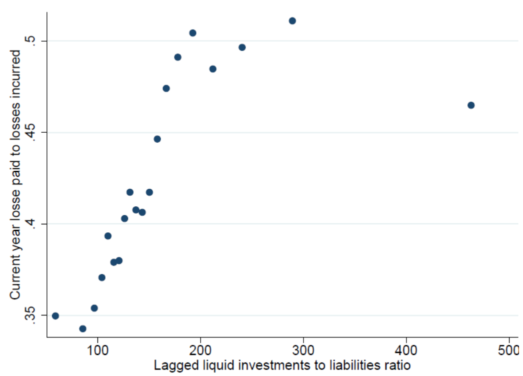
(a)



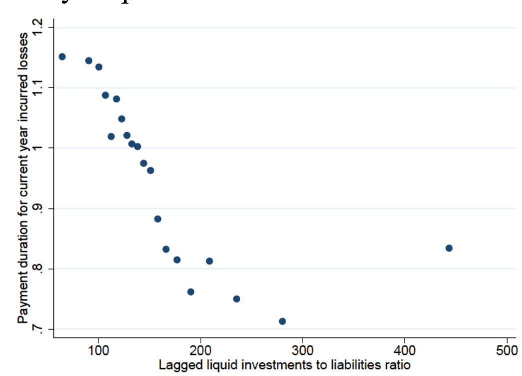
(b)

(c)

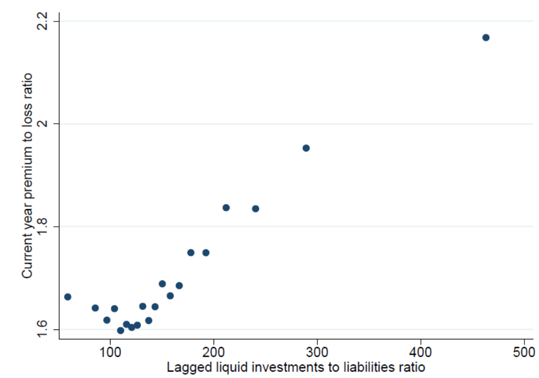
Sorted by Liquid Investments to Liabilities Ratio



(d)



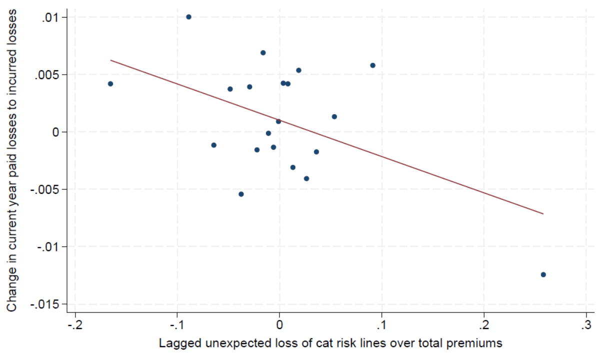
(e)



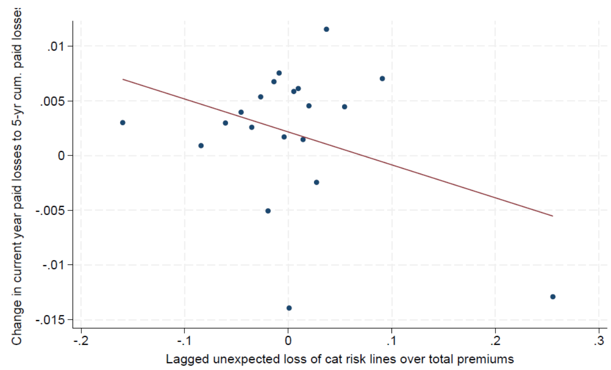
(f)

Notes: The figure presents bin-scatter plots relating financial health measures in year $t-1$ to loss payment speed and insurance pricing for the combined five long-tailed business lines in year t. Measures of financial health include RBC ratio (panels (a) - (c)) and liquid investments to liabilities ratio (panels (d) - (f)). Loss payment speed is captured by the ratio of losses paid to losses incurred in the year of incurrence (panels (a) and (d)) and payment duration (panels (b) and (e)). Insurance pricing is captured by the premium to loss ratio (panels (c) and (f)). In each graph, observations are divided into 20 bins by one of the financial strength measures. The coordinate for each bin is given by the average financial strength and the average payment speed or pricing of all observations in the bin.

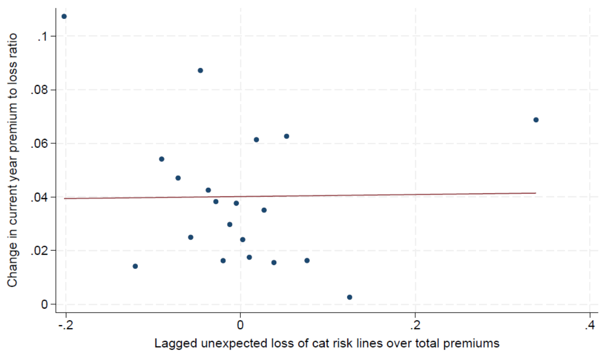
Figure 4: Unexpected Losses and Changes in Loss Payment Speed and Pricing



(a)



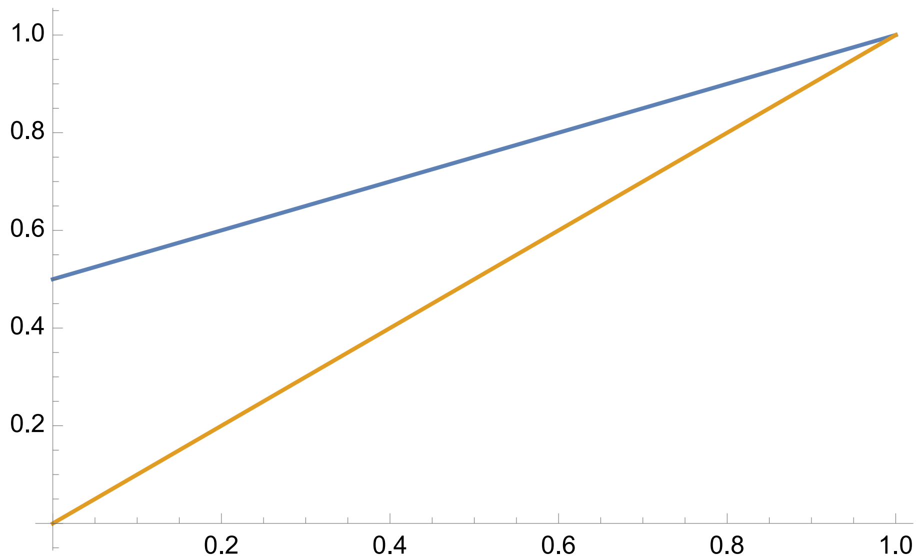
(b)



(c)

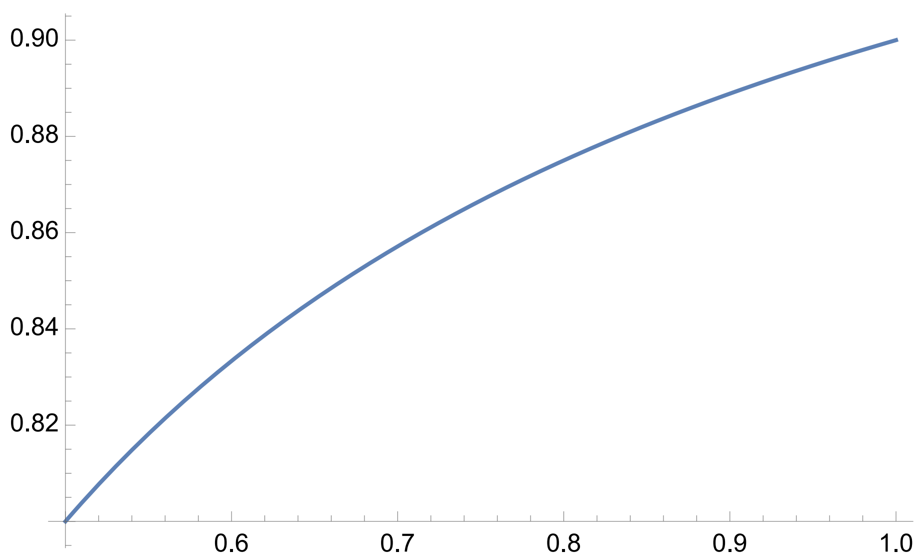
Notes: The figure presents bin-scatter plots relating the unexpected ratio of losses in catastrophe-risk lines to total premiums in year $t-1$ to the changes in loss payment speed and insurance pricing for the combined three non-catastrophe risk long-tailed lines (PA, WC, and CA) from years $t-1$ to t. The unexpected loss to total premium ratio of catastrophe-risk lines is calculated as the residual from regressing the raw ratio on firm fixed effects and the loss to total premium ratio of the three non-catastrophe risk long-tailed lines ("own" business lines). Loss payment speed is captured by the ratio of losses paid to losses incurred in the year of incurrence (panel (a)) and the ratio of losses paid in the year of incurrence to cumulative losses paid over 5 years (panel (b)). Insurance pricing is captured by the premium to loss ratio. In each graph, observations are divided into 20 bins by one of the unexpected loss ratio of other business lines. The coordinate for each bin is given by the average unexpected ratio of losses in catastrophe-risk lines to total premiums and the average payment speed or pricing of all observations in the bin.

Figure 5: Optimal Delay as a Function of ρ



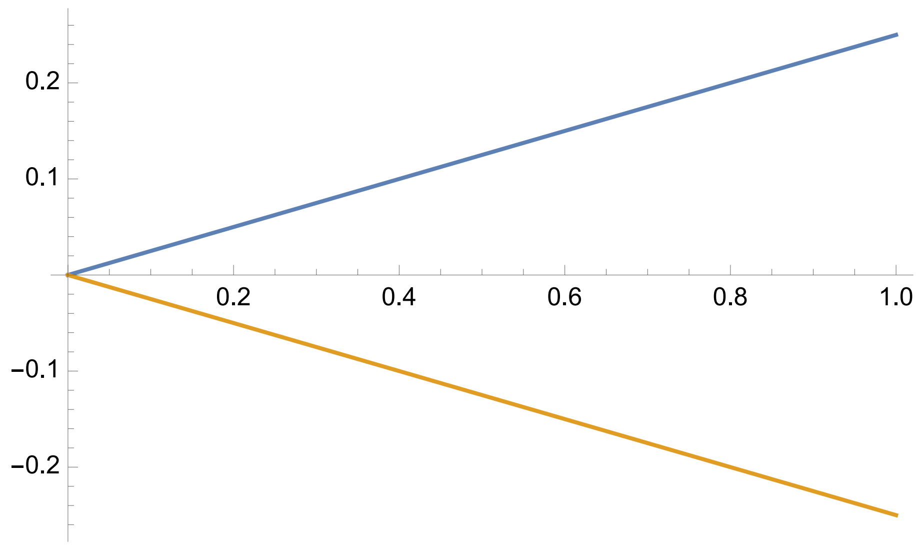
Notes: The figure shows the optimal payment θ^* as a function of $\rho \in [0, 1]$ for two parameter specifications: $\theta^* = \theta^*(\rho, 0.5, 1)$ (orange) and $\theta^* = \theta^*(\rho, 1, 1)$ (blue).

Figure 6: Optimal Delay as a Function of Reputational Cost ξ



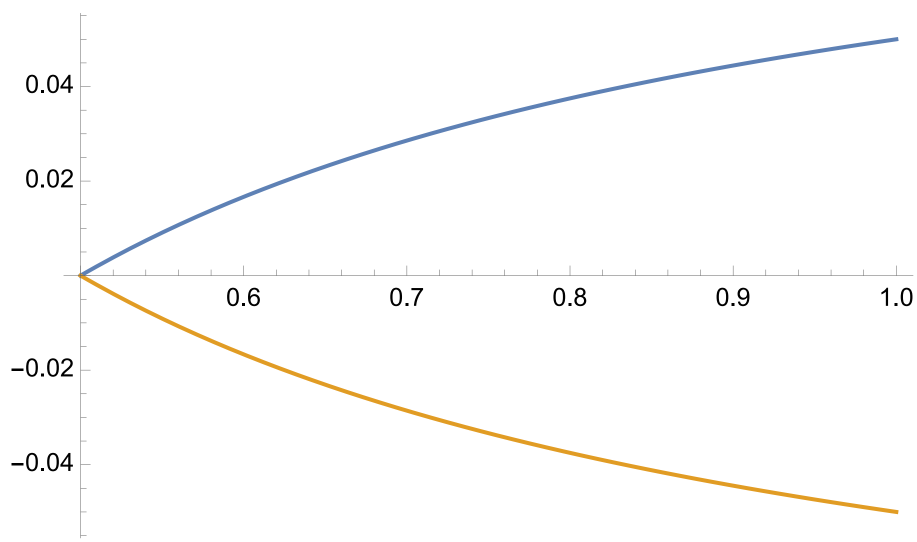
Notes: The figure shows the optimal payment $\theta^*(0.8, \xi_h, 1)$ as a function of the legal cost $\xi_h \in [0.5, 1]$.

Figure 7: **Cross-Subsidy as a Function of Impatience**



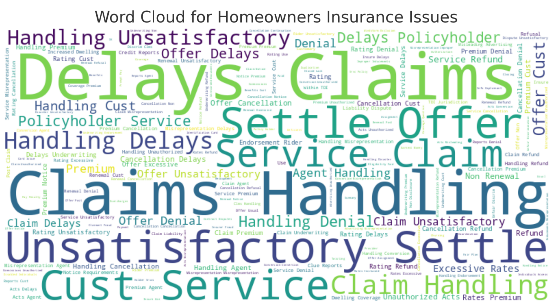
Notes: The figure shows the extent of the cross-subsidy from unsophisticated to sophisticated as a function of $1 - \rho$ for $\xi_l = 0.5, \xi_h = 1, c = 1$. The blue line shows the payment to the sophisticated in period 1 *in excess* of the ex-ante expected payment, and the orange line shows the negative of that, i.e., the loss experienced by the unsophisticated relative to their expectation.

Figure 8: **Cross-Subsidy as a Function of Legal Cost**



Notes: The figure shows the extent of the cross-subsidy from unsophisticated to sophisticated as a function of ξ_h for $\rho = 0.8, c = 1$ and $\xi_l = 0.5$. The blue line shows the payment to the sophisticated in period 1 *in excess* of the ex-ante expected payment, and the orange line shows the negative of that, i.e., the loss experienced by the unsophisticated relative to their expectation.

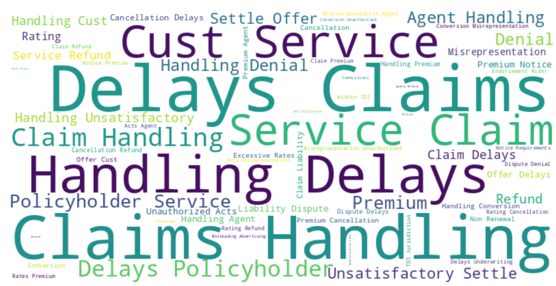
Figure 9: Word Cloud from Complaint Reasons



(**a**) Homeowners

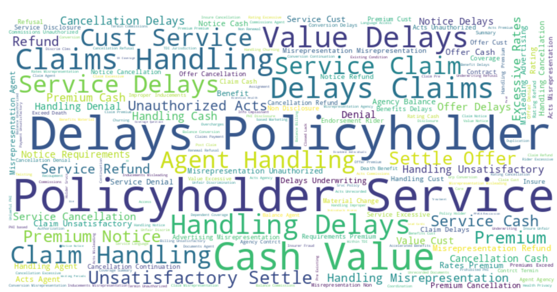
(**b**) Automobile

(**c**) Fire, allied lines, and commercial multi-perils



(**d**) Liability

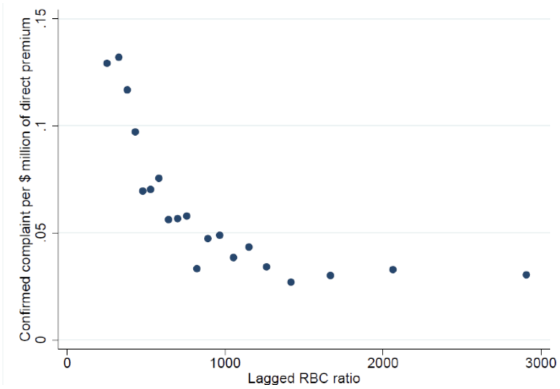
(**e**) Accident and health



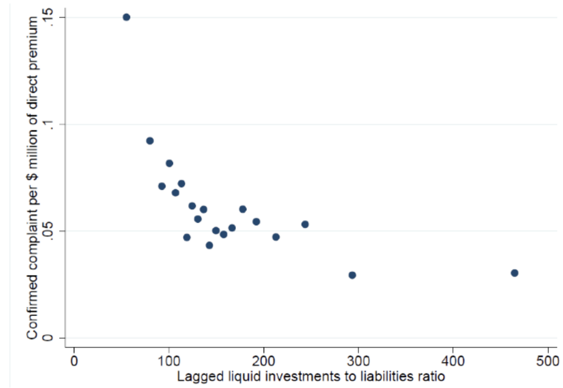
(**f**) Life and annuity

Notes: The figure presents word clouds generated from listed reasons for insurance complaints. The data are from Texas and include complaints received during the period from April 2011 to April 2024. Panels (a) to (f) are for coverage types equal "Homeowners", "Automobile", "Fire, allied lines, and commercial multi-perils", "Liability", "Accident and health", and "Life and annuity." Across all coverage types, the word "delay" is used to describe reasons in 38.5% of the complaints.

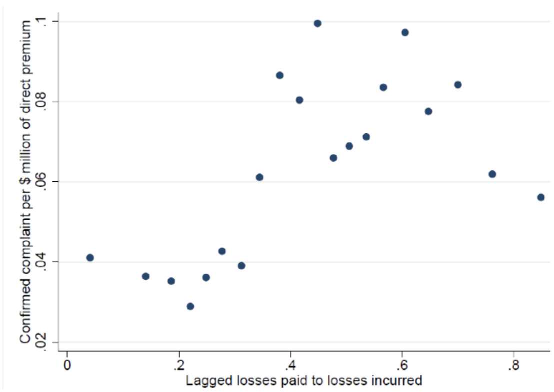
Figure 10: "Confirmed" Customer Complaints, Financial Strength, Loss Payment Speed, and Pricing



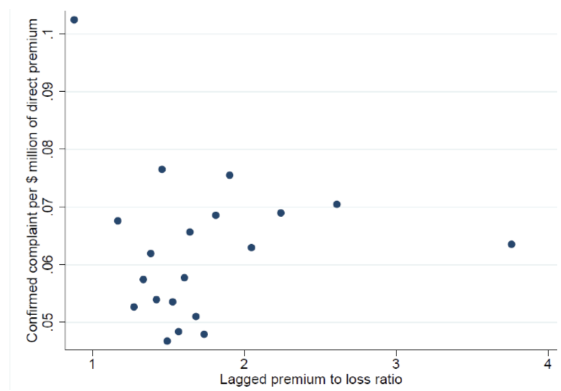
(a)



(b)



(c)



(d)

Notes: The figure presents bin-scatter plots relating measures of financial health, loss payment speed, and pricing in year $t-1$ to "confirmed" complaints per \$1 million of direct premiums in year t. Panels (a) and (b) focus on financial health, which is measured by RBC ratio and liquid investments to liabilities ratio, respectively. Panel (c) focuses on loss payment speed as captured by the ratio of losses paid to losses incurred in the year of incurrence. Panel (d) focuses on insurance pricing as captured by the premium to loss ratio. In each graph, observations are divided into 20 bins by a measure of financial health, loss payment speed, or pricing. The coordinate for each bin is given by the average of the sorting variable and the average number of "confirmed" complaints per \$1 million of direct premiums.

Table 2: Summary Statistics

This table presents summary statistics of basic firm characteristics (Panel A), measures of claim payment speed (Panel B), measures of pricing level (Panel C), changes in claim payment speed and pricing level (Panels D and E, respectively), and measures of customer complaint (Panel F). The data are based on the NAIC annual regulatory filing, obtained through S&P Global. The sample period is from 1996 to 2021 (with the exception of the liquid investments to liabilities ratio, which begins in 2001), and the observation frequencies are firm-year. The sample includes only (group-level) P&C insurers whose net total assets, net premiums, and incurred losses are positive and whose RBC ratios are greater than 200% and less than 4,000%. A total of 1,711 unique firms and 21,532 unique firm-year observations are included, of which 70% conduct business in at least one long-tailed line. For each firm, net total assets equal total assets minus loss reserves. Net premiums equal gross premiums minus net reinsurance ceded. Fraction of premium in each business line equals net premium in that line divided by net premiums in all lines. For firms not conducting a business in a given line, fraction of premium in that line is zero. Risk-based capital ratio (RBC ratio) is the (adjusted) statutory capital divided by the required risk-based capital. Liquid investments to liabilities ratios is the ratio of short-term assets and marketable securities to total liabilities. Loss ratio is the ratio of losses incurred to premiums earned in a given year. Complaints are measured as the number of complaints or delay-related complaints filed againts each firm, scaled by direct premiums in $ million. The complaint data starts in 2014. Reported statistics are pooled across all firm-year observations in the sample.

Panel A: Basic firm characteristics

	Mean	Std. Dev.	P10	P50	P90
Net total assets ($ mil)	1,670.72	12,085.67	5.47	52.32	1,559.83
Total liabilities ($ mil)	1,055.73	6,736.10	2.03	28.24	976.49
Loss and LAE reserve ($ mil)	575.14	3,507.11	0.45	13.21	529.11
Capital and surplus ($ mil)	615.03	5,701.87	2.58	21.58	576.28
Net premium ($ mil)	498.33	3,106.18	1.14	16.14	485.35
Incurred losses ($ mil)	296.88	1,957.54	0.22	7.36	282.14
Fraction of premium					
All long-tailed lines	0.47	0.38	0.00	0.57	0.97
Homeowner and farmowner (HF)	0.12	0.22	0.00	0.00	0.50
Passenger auto-liability (PA)	0.09	0.18	0.00	0.00	0.37
Worker compensation (WC)	0.11	0.27	0.00	0.00	0.45
Commercial auto-liability (CA)	0.06	0.16	0.00	0.00	0.14
Commercial multi-perils (CM)	0.07	0.14	0.00	0.00	0.25
RBC ratio (%)	1,014.37	1,453.34	313.66	763.51	1,900.82
Liquid investments to liabilities (%)	178.65	116.72	91.14	146.96	295.42
Loss ratio	0.49	0.52	0.15	0.51	0.76

Panel B: Payment speed

	Mean	Std. Dev.	P10	P50	P90
Fraction of losses paid to losses incurred in year of incurrence					
All long-tailed lines	0.42	0.21	0.16	0.41	0.73
Homeowner and farmowner (HF)	0.67	0.17	0.45	0.70	0.84
Passenger auto-liability (PA)	0.41	0.14	0.25	0.40	0.57
Worker compensation (WC)	0.22	0.11	0.09	0.22	0.35
Commercial auto-liability (CA)	0.25	0.16	0.08	0.23	0.45
Commercial multi-perils (CM)	0.43	0.21	0.15	0.42	0.71
Payment duration (years, with year of incurrence being year 0)					
All long-tailed lines	0.96	0.58	0.27	0.89	1.65
Homeowner and farmowner (HF)	0.45	0.45	0.13	0.34	0.85
Passenger auto-liability (PA)	1.00	0.49	0.55	0.95	1.43
Worker compensation (WC)	1.31	0.53	0.78	1.26	1.83
Commercial auto-liability (CA)	1.45	0.63	0.66	1.51	2.14
Commercial multi-perils (CM)	0.99	0.62	0.26	0.93	1.72

Table 2, cont'd: Summary Statistics

Panel C: Pricing

	Mean	Std. Dev.	P10	P50	P90
Premium to loss ratio					
All long-tailed lines	1.68	0.62	1.15	1.56	2.32
Homeowner and farmowner (HF)	1.80	0.87	1.06	1.63	2.65
Passenger auto-liability (PA)	1.50	0.51	1.07	1.43	1.99
Worker compensation (WC)	1.56	0.67	1.04	1.49	2.07
Commercial auto-liability (CA)	1.87	1.02	1.07	1.61	2.94
Commercial multi-perils (CM)	2.00	1.15	1.12	1.73	3.10

Panel D: Changes in payment speed

	Mean	Std. Dev.	P10	P50	P90
Change in fraction of losses paid to losses incurred in year of incurrence					
All long-tailed lines	0.00	0.10	-0.09	0.00	0.09
Homeowner and farmowner (HF)	0.00	0.13	-0.12	0.00	0.13
Passenger auto-liability (PA)	0.00	0.11	-0.08	0.00	0.09
Worker compensation (WC)	0.00	0.09	-0.08	0.00	0.08
Commercial auto-liability (CA)	0.00	0.12	-0.11	0.00	0.11
Commercial multi-perils (CM)	0.00	0.16	-0.15	0.00	0.16
Change in payment duration (years, with year of incurrence being year 0)					
All long-tailed lines	-0.01	0.35	-0.26	-0.00	0.24
Homeowner and farmowner (HF)	-0.01	0.34	-0.24	-0.01	0.22
Passenger auto-liability (PA)	-0.01	0.38	-0.27	-0.00	0.22
Worker compensation (WC)	-0.01	0.45	-0.38	-0.01	0.35
Commercial auto-liability (CA)	0.01	0.58	-0.57	0.00	0.57
Commercial multi-perils (CM)	-0.01	0.47	-0.46	-0.00	0.45

Panel E: Changes in pricing

	Mean	Std. Dev.	P10	P50	P90
Change in premium to loss ratio					
All long-tailed lines	0.01	0.49	-0.38	0.00	0.41
Homeowner and farmowner (HF)	-0.01	0.75	-0.66	-0.01	0.64
Passenger auto-liability (PA)	0.05	0.43	-0.27	0.01	0.39
Worker compensation (WC)	0.01	0.53	-0.38	0.00	0.37
Commercial auto-liability (CA)	0.05	0.89	-0.60	0.01	0.74
Commercial multi-perils (CM)	-0.01	1.06	-0.79	-0.01	0.75

Panel F: Complaints

	Mean	Std. Dev.	P10	P50	P90
Complaints to direct premiums	0.21	0.40	0.00	0.04	0.61
Delay-rel. comp. to direct prem.	0.05	0.13	0.00	0.00	0.14
Change in complaints to direct premiums	0.01	0.26	-0.11	0.00	0.15
Change in delay-rel. comp. to direct prem.	0.00	0.09	-0.03	0.00	0.04

Table 3: Financial Strength, Payment Speed, and Pricing

This table presents OLS estimates from regressions of fraction of incurred losses paid in the incurrence year (column (1)), payment duration (column (2)), and premium to loss ratio (column (3)) in the current year on RBC ratio and liquid investments to liabilities ratio at the end of the past year. The RBC and liquid investment ratios enter the regressions in decimal. All control variables are as of the end of the past year. All models include year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Fraction of incurred losses paid in incurrence year (1)	Payment duration (years) (2)	Premium to loss ratio (3)
RBC ratio (decimal)	0.002**	-0.011***	0.006*
	(0.001)	(0.003)	(0.003)
Liquid investments to liabilities	0.064***	-0.152***	0.091***
(decimal)	(0.009)	(0.024)	(0.026)
Controls			
log(Net total assets)	-0.162***	0.375***	-0.069**
	(0.010)	(0.028)	(0.030)
log(Net premiums)	0.159***	-0.372***	0.022
	(0.010)	(0.028)	(0.031)
Share of long-tailed lines	-0.010	0.052	-0.127**
	(0.021)	(0.057)	(0.063)
Year fixed effects	YES	YES	YES
Observations	12,474	9,325	12,474
R-squared	0.226	0.181	0.091

Table 4: Unexpected Losses in "Own" Business Lines and Changes in Payment Speed and Pricing

This table presents OLS estimates from regressions of change in fraction of incurred losses paid in the incurrence year (column (1)), change in fraction of 5-year cumulative paid losses paid in the incurrence year (column (2)), and change in premium to loss ratio (column (3)) in long-tailed businesses in the current year on loss ratio of the same long-tailed businesses in the past year. All control variables are as of the end of the past year. All models include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Δ Fraction of incurred losses paid in incurrence year (1)	Δ Fraction of 5-year cum. paid losses paid in incurrence year (2)	Δ Premium to loss ratio (3)
Losses in "own" lines to total premiums	-0.043***	-0.074***	1.128***
	(0.013)	(0.019)	(0.135)
Controls			
RBC ratio (decimal)	0.000	0.000	-0.003
	(0.000)	(0.001)	(0.002)
Liquid investments to liabilities (decimal)	0.005	0.001	-0.092***
	(0.005)	(0.008)	(0.019)
log(Net total assets)	0.009	0.014	0.036
	(0.006)	(0.009)	(0.037)
log(Net premiums)	-0.001	-0.004	-0.115***
	(0.005)	(0.007)	(0.031)
Share of long-tailed lines	0.036***	0.114***	-0.101
	(0.013)	(0.023)	(0.074)
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
Observations	9,751	8,836	9,751
R-squared	0.056	0.059	0.115

Table 5: Unexpected Losses in "Other" Businesses and Changes in Payment Speed and Pricing

This table presents OLS estimates from regressions of change in fraction of incurred losses paid in the incurrence year (column (1)), change in fraction of 5-year cumulative paid losses paid in the incurrence year (column (2)), and change in premium to loss ratio (column (3)) in non-catastrophe risk long-tailed lines in the current year on the ratio of losses in catastrophe-risk lines to total premiums in the past year. All control variables are as of the end of the past year. All models include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Δ Fraction of incurred losses paid in incurrence year (1)	Δ Fraction of 5-year cum. paid losses paid in incurrence year (2)	Δ Premium to loss ratio (3)
Losses in catastrophe lines to total premiums	-0.048***	-0.052**	0.038
	(0.017)	(0.023)	(0.058)
Losses in "own" non-catastrophe long-tailed lines to total premiums	-0.087**	-0.150**	0.402***
	(0.043)	(0.074)	(0.130)
Controls			
RBC ratio (decimal)	0.001	-0.000	0.000
	(0.000)	(0.001)	(0.002)
Liquid investments to liabilities (decimal)	-0.014**	-0.017*	-0.030
	(0.006)	(0.010)	(0.030)
log(Net total assets)	0.004	0.013	0.046
	(0.008)	(0.010)	(0.038)
log(Net premiums)	-0.002	-0.005	-0.055
	(0.007)	(0.009)	(0.038)
Share of non-catastrophe long-tailed lines	0.029***	0.022	0.112***
	(0.010)	(0.020)	(0.037)
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
Observations	6,901	5,281	6,764
R-squared	0.073	0.060	0.242

Table 6: Unexpected Losses in "Other" Businesses and in "Other" Regions and Changes in Payment Speed and Pricing

This table presents OLS estimates from regressions of change in ratio of paid to incurred and unpaid losses (column (1)) and change in premium to loss ratio (column (2)) in non-catastrophe risk long-tailed lines outside a given catastrophe zone on current and lagged indicators of high losses in catastrophe-risk lines in that given catastrophe zone. The dependent variables are standardized for ease of interpretation. Following the definitions of S&P Global, three catastrophe zones, including hurricane, earthquake, and tornado, are considered. The catastrophe zones are stacked together, such that observations are at the firm-zone-year level. High loss indicator equals one if the ratio of losses to total premiums is greater than 1.65 standard deviations above the mean for each firm-zone block, and zero otherwise. All control variables are as of the end of the past year. All models include firm × zone and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Standardized Δ ratio of paid losses to incurred and unpaid losses (1)	Standardized Δ Premium to loss ratio (2)
Dummy: high cat. zone losses (t)	-0.028	-0.046
	(0.040)	(0.056)
Dummy: high cat. zone losses ($t-1$)	-0.101**	0.050
	(0.046)	(0.047)
Dummy: high cat. zone losses ($t-2$)	-0.056	-0.043
	(0.049)	(0.043)
Dummy: high cat. zone losses ($t-3$)	0.028	0.085
	(0.040)	(0.062)
Dummy: high "own" non cat. zone losses (t)	-0.329***	0.158**
	(0.074)	(0.069)
Dummy: high "own" non cat. zone losses ($t-1$)	0.372***	0.097
	(0.078)	(0.076)
Dummy: high "own" non cat. zone losses ($t-2$)	-0.063	-0.128
	(0.048)	(0.090)
Dummy: high "own" non cat. zone losses ($t-3$)	-0.182***	-0.008
	(0.053)	(0.085)
Controls: RBC ratio, Liq. Inv. to liab. Ratio, ln(Net total assets), ln(Net premiums), Share of non-catastrophe risk lines		
Firm × cat. Zone fixed effects	YES	YES
Year fixed effects	YES	YES
F-test: Cumulative effects of cat. zone losses = 0	4.62**	0.32
F-test: Cumulative effects of "own" losses = 0	3.03*	1.57
Observations	6,066	6,047
R-squared	0.124	0.037

Table 7: Financial Strength, Unexpected Losses, and Claim Denials

Column (1) presents OLS estimates from regressions of fraction of claims closed with payment in the current year on RBC ratio and liquid investments to liabilities ratio at the end of the past year. Columns (2)-(3) present OLS estimates from regressions of changes in fraction of claims closed with payment in non-catastrophe risk long-tailed lines (including PA, WC, and CA) in the current year on the ratios of losses in the same lines and losses in unrelated catastrophe-risk lines to total premiums in the past year. All control variables are as of the end of the past year. Column (1) include year fixed effects, and columns (2)-(3) include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Frac. of claims closed with payment	Δ Frac. of claims closed with payment	
Included business lines	All long-tailed	All long-tailed	Non-cat. long-tailed
	(1)	(2)	(3)
Losses in catastrophe lines to total premiums			-0.021**
			(0.010)
Losses in "own" lines to total premiums		-0.033**	0.017
		(0.013)	(0.015)
RBC ratio (decimal)	0.004***	-0.000	0.000
	(0.001)	(0.000)	(0.000)
Liquid investments to liabilities (decimal)	0.001	-0.001	-0.003
	(0.007)	(0.004)	(0.005)
Other controls	log(Net total assets), log(Net premiums), Share of "own" lines		
Firm fixed effects	NO	YES	YES
Year fixed effects	YES	YES	YES
Observations	11,595	9,045	6,173
R-squared	0.031	0.044	0.087

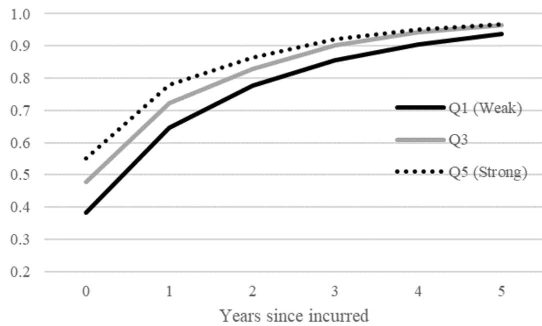
Table 8: Unexpected Losses, "Confirmed" Complaints, and Changes in Payment Speed and Pricing

This table presents OLS estimates from regressions of change in fraction of incurred losses paid in the incurrence year (columns (1) and (2)), change in fraction of 5-year cumulative paid losses paid in the incurrence year (columns (3) and (4)), change in premium to loss ratio (columns (5) and (6)), and change in fraction of claims closed with payment (columns (7) and (8)) in non-catastrophe risk long-tailed lines in the current year on change in "confirmed" complaints per $ million of direct premiums and its interaction with the ratio of losses in unrelated catastrophe risk lines to total premiums in the past year. All control variables are as of the end of the past year. All models include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

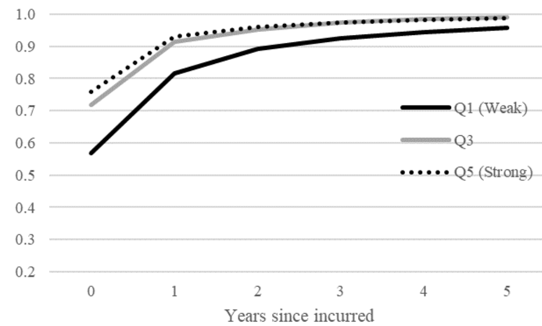
Dependent variable	Δ Fraction of incurred losses paid in incurrence year		Δ Fraction of 5-year cum. paid losses paid in incurrence year		Δ Premium to loss ratio		Δ Claims closed with payment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ "Confirmed" complaints to direct premiums	0.045*	-0.019	0.041	-0.070	-0.012	-0.023	0.010	-0.021
	(0.023)	(0.023)	(0.030)	(0.047)	(0.065)	(0.078)	(0.013)	(0.018)
Losses in catastrophe lines to total premiums		-0.081**		-0.048		0.038		-0.030
		(0.038)		(0.041)		(0.106)		(0.021)
Δ "Confirmed" complaints to direct premiums		0.284**		0.500*		-0.054		0.160
× Losses in catastrophe lines to total premiums		(0.125)		(0.258)		(0.305)		(0.098)
Losses in "own" non-catastrophe long-tailed lines	-0.069	-0.117	-0.584***	-0.639***	1.270***	1.216***	0.033	0.044
to total premiums	(0.091)	(0.089)	(0.180)	(0.180)	(0.429)	(0.450)	(0.037)	(0.038)
<u>Controls</u>								
RBC ratio (decimal)	-0.000	-0.000	0.002	0.002	-0.002	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.005)	(0.001)	(0.001)
Liquid investments to liabilities (decimal)	0.004	0.001	-0.005	-0.001	-0.036	-0.050	-0.005	-0.009
	(0.010)	(0.010)	(0.017)	(0.017)	(0.067)	(0.069)	(0.008)	(0.008)
log(Net total assets)	0.005	0.000	-0.067*	-0.080**	0.120*	0.117*	0.029**	0.028**
	(0.019)	(0.019)	(0.035)	(0.038)	(0.068)	(0.071)	(0.013)	(0.014)
log(Net premiums)	-0.015	-0.010	0.054	0.062*	-0.141***	-0.152***	-0.011	-0.012
	(0.015)	(0.016)	(0.036)	(0.037)	(0.052)	(0.056)	(0.011)	(0.013)
Share of non-catastrophe long-tailed lines	0.013	0.014	0.006	0.008	0.148	0.136	-0.032**	-0.034***
	(0.013)	(0.013)	(0.011)	(0.011)	(0.095)	(0.087)	(0.013)	(0.012)
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,639	2,468	1,384	1,303	2,639	2,468	2,472	2,301
R-squared	0.118	0.137	0.142	0.151	0.474	0.499	0.160	0.168

Internet Appendix

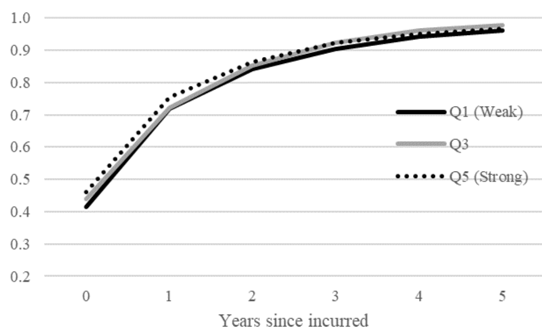
Figure A1: Cumulative Fraction of Losses Paid since Incurred for Firms Sorted by RBC Ratio



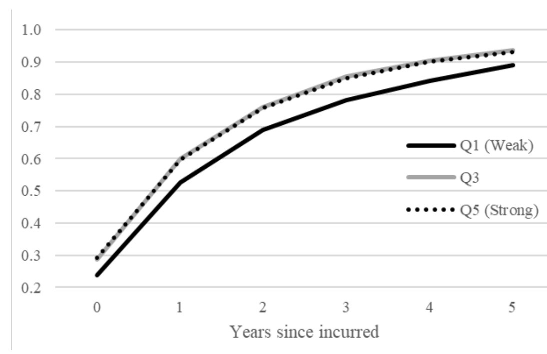
(a) All



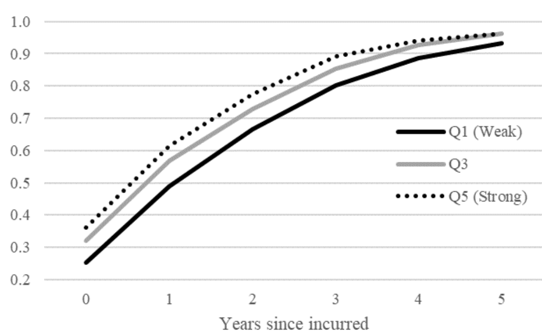
(b) HF



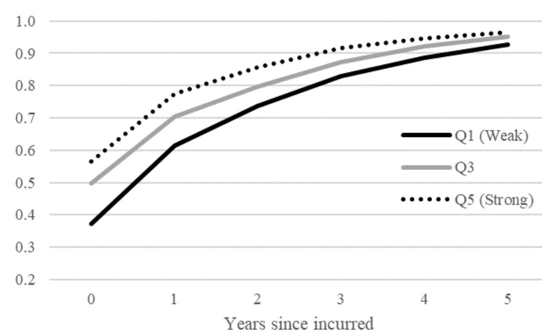
(c) PA



(d) WC



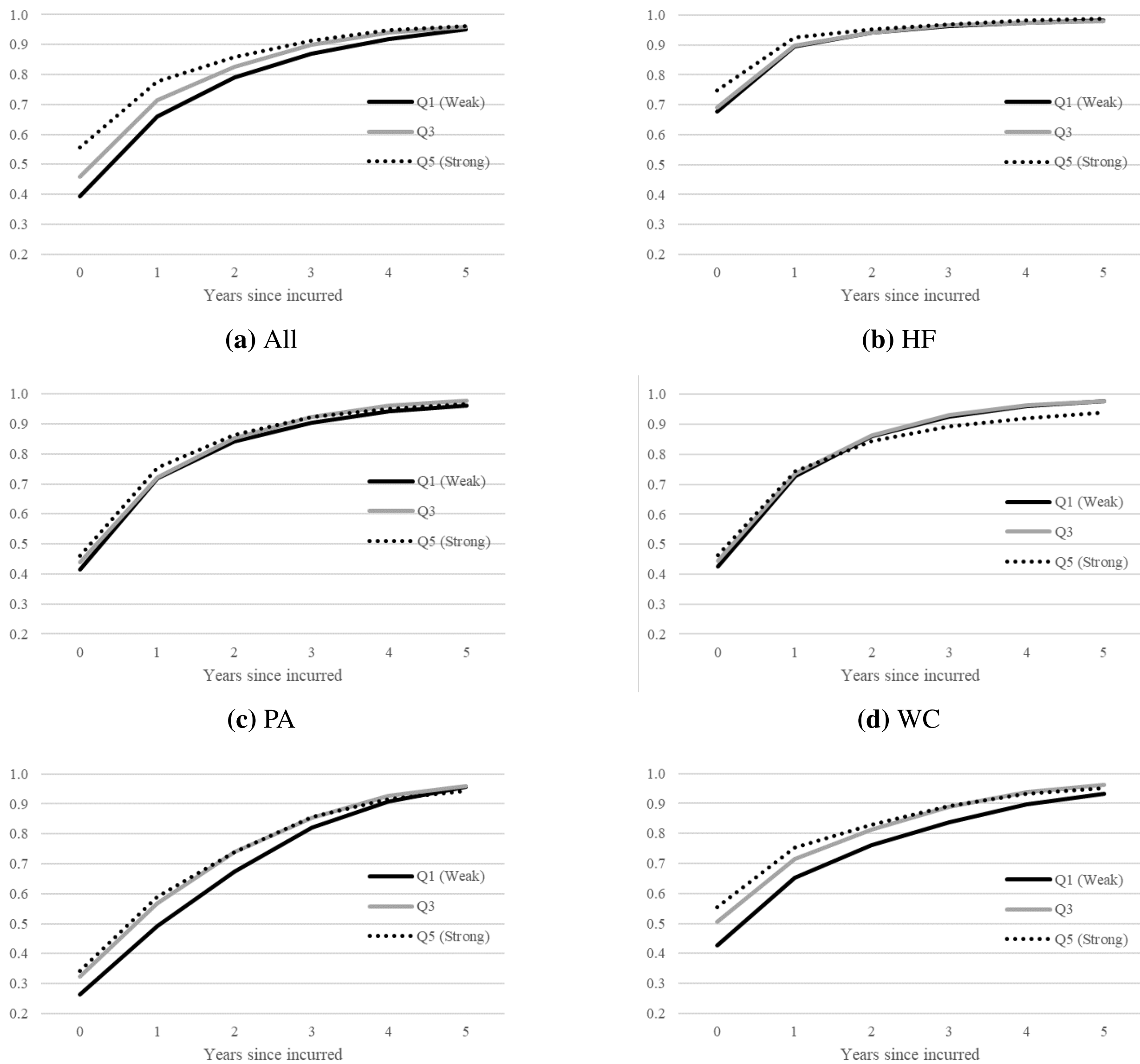
(e) CA



(f) CM

Notes: The figure plots, by quintile of RBC ratio, the average cumulative losses paid up to year t as a fraction of the total paid losses, where $t = 0$ is the year in which the losses are reportedly incurred. The total paid losses are assumed to equal the cumulative losses paid up to year 9, the last year in which Schedule P separately reports the paid losses for a given year of incurrence. Each year, firms are sorted into quintiles 1 (lowest) to 5 (highest) by RBC ratio. Panel (a) combines all five long-tailed lines. Individual lines are reported in panels (b) - (f). The solid black lines represent quintile 1. The solid gray lines represent quintile 3 (middle). The dotted black lines represent quintile 5.

Figure A2: **Cumulative Fraction of Losses Paid since Incurred for Firms Sorted by Liquid Investments to Liabilities Ratio**



(a) All

(b) HF

(c) PA

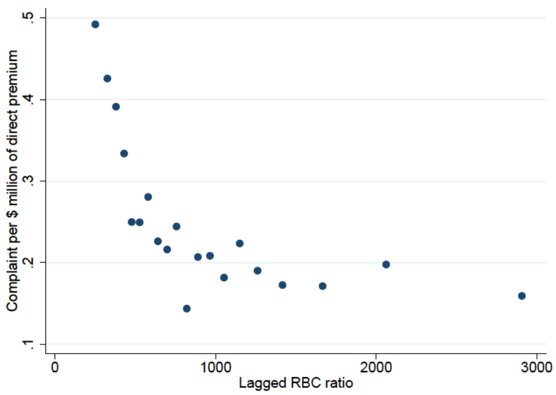
(d) WC

(e) CA

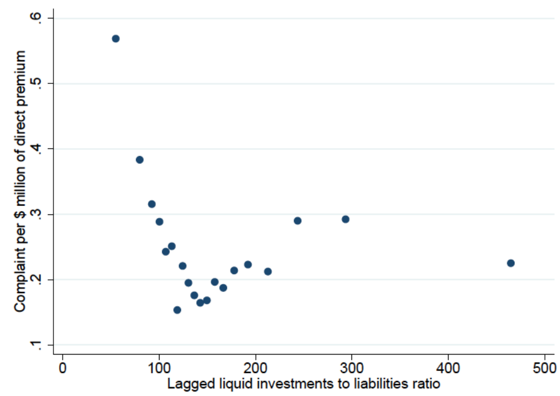
(f) CM

Notes: The figure plots, by quintile of liquid investments to liabilities ratio, the average cumulative losses paid up to year t as a fraction of the total paid losses, where $t = 0$ is the year in which the losses are reportedly incurred. The total paid losses are assumed to equal the cumulative losses paid up to year 9, the last year in which Schedule P separately reports the paid losses for a given year of incurrence. Each year, firms are sorted into quintiles 1 (lowest) to 5 (highest) by liquid investments to liabilities ratio. Panel (a) combines all five long-tailed lines. Individual lines are reported in panels (b) - (f). The solid black lines represent quintile 1. The solid gray lines represent quintile 3. The dotted black lines represent quintile 5.

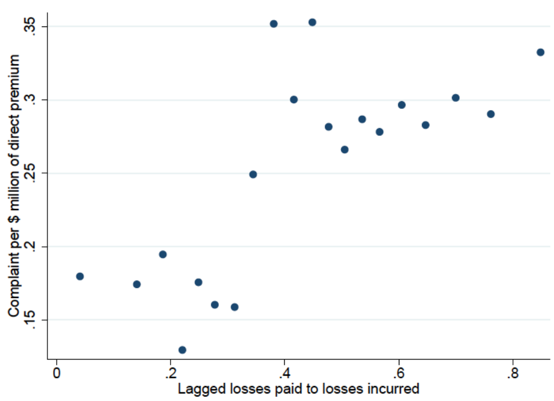
Figure A3: "All" Customer Complaints, Financial Strength, Loss Payment Speed, and Pricing



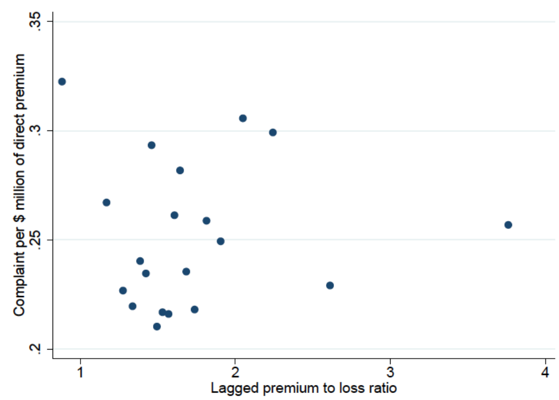
(a)



(b)



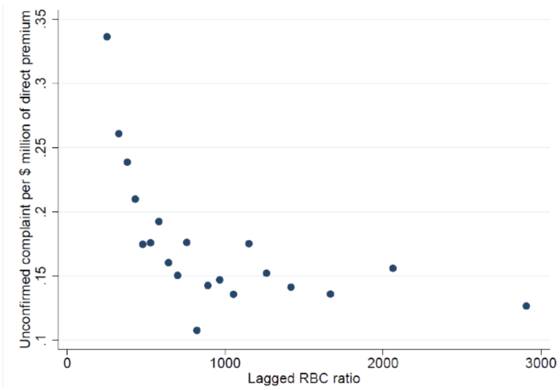
(c)



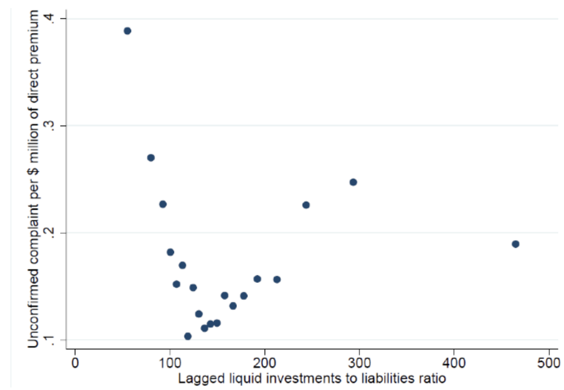
(d)

Notes: The figure presents bin-scatter plots relating measures of financial health, loss payment speed, and pricing in year $t-1$ to all (confirmed and unconfirmed) complaints per $1 million of direct premiums in year t. Panels (a) and (b) focus on financial health, which is measured by RBC ratio and liquid investments to liabilities ratio, respectively. Panel (c) focuses on loss payment speed as captured by the ratio of losses paid to losses incurred in the year of incurrence. Panel (d) focuses on insurance pricing as captured by the premium to loss ratio. In each graph, observations are divided into 20 bins by a measure of financial health, loss payment speed, or pricing. The coordinate for each bin is given by the average of the sorting variable and the average number of complaints per $1 million of direct premiums.

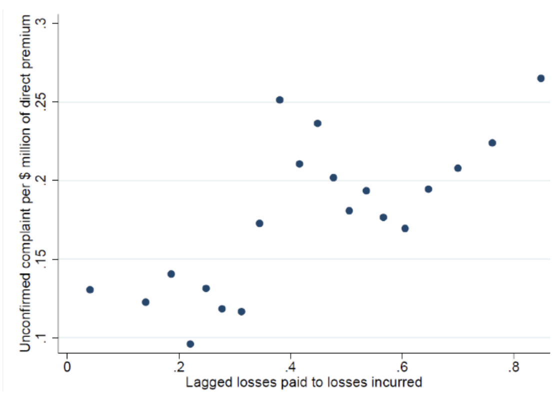
Figure A4: "Unconfirmed" Customer Complaints, Financial Strength, Loss Payment Speed, and Pricing



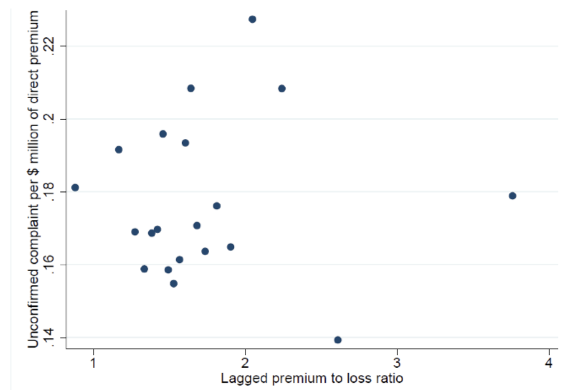
(a)



(b)



(c)



(d)

Notes: The figure presents bin-scatter plots relating measures of financial health, loss payment speed, and pricing in year $t-1$ to "unconfirmed" complaints per $1 million of direct premiums in year t. Panels (a) and (b) focus on financial health, which is measured by RBC ratio and liquid investments to liabilities ratio, respectively. Panel (c) focuses on loss payment speed as captured by the ratio of losses paid to losses incurred in the year of incurrence. Panel (d) focuses on insurance pricing as captured by the premium to loss ratio. In each graph, observations are divided into 20 bins by a measure of financial health, loss payment speed, or pricing. The coordinate for each bin is given by the average of the sorting variable and the average number of "unconfirmed" complaints per $1 million of direct premiums.

Table A1: Financial Strength, Payment Speed, and Pricing - Supplement to Table 3

This table presents OLS estimates from regressions of fraction of incurred losses paid in the incurrence year (columns (1)-(3)), payment duration (columns (4)-(6)), and premium to loss ratio (columns (7)-(9)) in the current year on RBC ratio and liquid investments to liabilities ratio at the end of the past year. The RBC and liquid investment ratios enter the regressions in decimal. All control variables are as of the end of the past year. All models include year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Fraction of incurred losses paid in incurrence year			Payment duration (years)			Premium to loss ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
RBC ratio (decimal)	0.007***		0.002**	-0.022***		-0.011***	0.012***		0.006*
	(0.001)		(0.001)	(0.002)		(0.003)	(0.003)		(0.003)
Liquid investments to liabilities		0.073***	0.064***		-0.198***	-0.152***		0.116***	0.091***
(decimal)		(0.008)	(0.009)		(0.021)	(0.024)		(0.024)	(0.026)
Controls									
log(Net total assets)	-0.137***	-0.160***	-0.162***	0.313***	0.366***	0.375***	-0.050**	-0.063**	-0.069**
	(0.009)	(0.010)	(0.010)	(0.025)	(0.027)	(0.028)	(0.025)	(0.031)	(0.030)
log(Net premiums)	0.126***	0.157***	0.159***	-0.290***	-0.364***	-0.372***	-0.005	0.017	0.022
	(0.009)	(0.009)	(0.010)	(0.025)	(0.028)	(0.028)	(0.025)	(0.032)	(0.031)
Share of long-tailed businesses	-0.021	-0.005	-0.010	0.093*	0.030	0.052	-0.112*	-0.114*	-0.127**
	(0.019)	(0.021)	(0.021)	(0.053)	(0.056)	(0.057)	(0.057)	(0.063)	(0.063)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	14,920	12,474	12,474	11,260	9,325	9,325	14,920	12,474	12,474
R-squared	0.177	0.223	0.226	0.143	0.172	0.181	0.082	0.089	0.091

Table A2:
Unexpected Losses in “Other” Businesses and in “Other” Regions and Changes in Payment Speed and Pricing - Supplement to Table 6

This table presents OLS estimates from regressions of change in ratio of paid to incurred and unpaid losses (columns (1)-(3)) and change in premium to loss ratio (columns (4)-(6)) in non-catastrophe risk long-tailed lines outside a given catastrophe zone on current and lagged indicators of high losses in catastrophe-risk lines in that given catastrophe zone. The dependent variables are standardized for ease of interpretation. Following the definitions of S&P Global, three catastrophe zones, including hurricane (columns (1) and (4)), earthquake (columns (2) and (5)), and tornado (columns (3) and (6)), are considered. The catastrophe zones are considered separately, and observations for each catastrophe zone sample are at the firm-year level. High loss indicator equals one if the ratio of losses to total premiums is greater than 1.65 standard deviations above the mean for each firm-zone block, and zero otherwise. All control variables are as of the end of the past year. All models include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Standardized Δ ratio of paid losses to incurred and unpaid losses			Standardized Δ premium to loss ratio		
Catastrophe zone	Hurricane	Earthquake	Tornado	Hurricane	Earthquake	Tornado
	(1)	(2)	(3)	(4)	(5)	(6)
Dummy: high cat. zone losses (t)	-0.006	-0.105*	-0.006	-0.056	-0.073	0.084
	(0.039)	(0.053)	(0.059)	(0.046)	(0.068)	(0.062)
Dummy: high cat. zone losses ($t-1$)	-0.070*	-0.133*	-0.055	0.051	0.125	-0.044
	(0.037)	(0.072)	(0.070)	(0.039)	(0.090)	(0.031)
Dummy: high cat. zone losses ($t-2$)	-0.015	-0.034	-0.082	-0.007	-0.025	-0.034
	(0.037)	(0.053)	(0.080)	(0.039)	(0.055)	(0.048)
Dummy: high cat. zone losses ($t-3$)	0.021	-0.023	0.013	0.018	0.026	0.109*
	(0.033)	(0.050)	(0.062)	(0.052)	(0.089)	(0.066)
Dummy: high “own” non cat. zone losses (t)	-0.303***	0.084	-0.204**	0.061	0.244*	0.032
	(0.064)	(0.121)	(0.101)	(0.053)	(0.135)	(0.068)
Dummy: high “own” non cat. zone losses ($t-1$)	0.256***	0.169***	0.285***	0.072	-0.001	0.069
	(0.076)	(0.059)	(0.102)	(0.057)	(0.125)	(0.076)
Dummy: high “own” non cat. zone losses ($t-2$)	-0.085	0.095	-0.038	-0.117*	0.116	-0.103
	(0.054)	(0.068)	(0.045)	(0.063)	(0.151)	(0.085)
Dummy: high “own” non cat. zone losses ($t-3$)	-0.170***	-0.060	-0.085*	-0.012	-0.089	0.059
	(0.050)	(0.123)	(0.045)	(0.071)	(0.106)	(0.086)
Controls: RBC ratio, Liq. Inv. to liab. Ratio, ln(Net total assets), ln(Net premiums), Share of non-catastrophe risk lines						
Firm fixed effects	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Observations	2,746	1,157	2,163	2,739	1,150	2,158
R-squared	0.142	0.148	0.124	0.044	0.059	0.043

Table A3: State Claim-Handling Regulations, Payment Speed, and Pricing

Columns (1)-(3) present OLS estimates from regressions of fraction of incurred losses paid in the incurrence year, payment duration, and premium to loss ratio in the current year, respectively, on RBC ratio, liquid investments to liabilities ratio, and their interactions with share of premiums from states with penalty for payment delays. Columns (4)-(6) present OLS estimates from regressions of changes in fraction of incurred losses paid in the incurrence year, change in fraction of 5-year cumulative paid losses paid in the incurrence year, and change in premium to loss ratio in non-catastrophe risk long-tailed lines in the current year, respectively, on the ratio of losses in catastrophe risk lines to total premiums and its interaction with share of premiums from states with penalty for payment delays. All explanatory variables are as of the end of the past year. Columns (1)-(3) include year fixed effects, and columns (4)-(6) include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

	Levels			Changes		
Dependent variable	Frac. of incurred losses paid in incurrence year (1)	Payment duration (years) (2)	Premium to loss ratio (3)	Frac. of incurred losses paid in incurrence year (4)	Frac. of 5-year cum. paid losses paid in incurrence year (5)	Premium to loss ratio (6)
[A] Share of businesses in states with delay penalty	0.027	0.061	0.086	0.028	0.020	0.193*
	(0.034)	(0.081)	(0.075)	(0.022)	(0.032)	(0.110)
Losses in catastrophe lines to total premiums				-0.042*	-0.009	-0.005
				(0.024)	(0.039)	(0.093)
[A] x Losses in catastrophe lines to total premiums				0.031	-0.059	0.095
				(0.038)	(0.057)	(0.153)
Loss ratio of "own" non-catastrophe long-tailed lines				0.037	0.010	0.801***
to total premiums				(0.024)	(0.041)	(0.223)
[A] x Loss ratio of "own" non-catastrophe long-tailed lines				-0.039	-0.004	-0.564*
to total premiums				(0.040)	(0.058)	(0.298)
RBC ratio (decimal)	0.002	-0.007	0.004	0.001**	0.000	-0.001
	(0.002)	(0.005)	(0.005)	(0.000)	(0.001)	(0.002)
[A] x RBC ratio (decimal)	0.001	-0.006	0.005			
	(0.002)	(0.006)	(0.007)			
Liquid investments to liabilities (decimal)	0.069***	-0.171***	0.107***	-0.010	-0.013	-0.049
	(0.014)	(0.034)	(0.032)	(0.007)	(0.011)	(0.031)
[A] x Liquid investments to liabilities (decimal)	-0.006	0.022	-0.012			
	(0.021)	(0.050)	(0.053)			
Other controls	log(Net total assets), log(Net premiums), Share of long-tailed businesses					
Firm fixed effects	NO	NO	NO	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES
Observations	11,407	9,003	11,407	6,220	5,021	6,220
R-squared	0.230	0.183	0.099	0.075	0.057	0.095

Table A4: Unexpected Losses, "All" Complaints, and Changes in Payment Speed and Pricing - Supplement to Table 8

This table presents OLS estimates from regressions of change in fraction of incurred losses paid in the incurrence year (columns (1) and (2)), change in fraction of 5-year cumulative paid losses paid in the incurrence year (columns (3) and (4)), change in premium to loss ratio (columns (5) and (6)), and change in fraction of claims closed with payment (columns (7) and (8)) in non-catastrophe risk long-tailed lines in the current year on change in "all" (confirmed plus unconfirmed) complaints per $ million of direct premiums and its interaction with the ratio of losses in unrelated catastrophe risk lines to total premiums in the past year. All control variables are as of the end of the past year. All models include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Δ Fraction of incurred losses paid in incurrence year		Δ Fraction of 5-year cum. paid losses paid in incurrence year		Δ Premium to loss ratio		Δ Claims closed with payment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ "All" complaints to direct premiums	0.005	-0.015	0.006	-0.026	-0.042	-0.022	0.006	-0.006
	(0.010)	(0.014)	(0.016)	(0.021)	(0.037)	(0.046)	(0.006)	(0.010)
Losses in catastrophe lines to total premiums		-0.076**		-0.027		0.044		-0.036*
		(0.035)		(0.042)		(0.103)		(0.019)
Δ "All" complaints to direct premiums		0.101		0.153		-0.083		0.067**
× Losses in catastrophe lines to total premiums		(0.073)		(0.098)		(0.132)		(0.033)
Losses in "own" non-catastrophe long-tailed lines	-0.075	-0.110	-0.593***	-0.610***	1.257***	1.195***	0.034	0.045
to total premiums	(0.090)	(0.090)	(0.173)	(0.180)	(0.431)	(0.456)	(0.037)	(0.038)
Controls								
RBC ratio (decimal)	-0.000	-0.000	0.001	0.002	-0.002	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.005)	(0.001)	(0.001)
Liquid investments to liabilities (decimal)	0.005	0.002	-0.003	0.001	-0.034	-0.050	-0.005	-0.009
	(0.010)	(0.010)	(0.017)	(0.017)	(0.067)	(0.069)	(0.008)	(0.008)
log(Net total assets)	0.004	0.001	-0.068*	-0.076**	0.117*	0.112	0.029**	0.027*
	(0.019)	(0.019)	(0.035)	(0.037)	(0.068)	(0.071)	(0.013)	(0.014)
log(Net premiums)	-0.014	-0.010	0.055	0.062*	-0.138***	-0.146**	-0.011	-0.012
	(0.015)	(0.016)	(0.035)	(0.037)	(0.052)	(0.057)	(0.011)	(0.013)
Share of non-catastrophe long-tailed lines	0.013	0.014	0.007	0.007	0.148	0.132	-0.033***	-0.034***
	(0.013)	(0.013)	(0.011)	(0.011)	(0.095)	(0.087)	(0.013)	(0.012)
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,639	2,468	1,384	1,303	2,639	2,468	2,472	2,301
R-squared	0.115	0.130	0.140	0.146	0.475	0.499	0.160	0.169

Table A5: Unexpected Losses, "Unconfirmed" Complaints, and Changes in Payment Speed and Pricing

This table presents OLS estimates from regressions of change in fraction of incurred losses paid in the incurrence year (columns (1) and (2)), change in fraction of 5-year cumulative paid losses paid in the incurrence year (columns (3) and (4)), change in premium to loss ratio (columns (5) and (6)), and change in fraction of claims closed with payment (columns (7) and (8)) in non-catastrophe risk long-tailed lines in the current year on change in "unconfirmed" complaints per $ million of direct premiums and its interaction with the ratio of losses in unrelated catastrophe risk lines to total premiums in the past year. All control variables are as of the end of the past year. All models include firm and year fixed effects. *, **, and *** indicate statistical significance at the 10%, 5% and 1% levels.

Dependent variable	Δ Fraction of incurred losses paid in incurrence year		Δ Fraction of 5-year cum. paid losses paid in incurrence year		Δ Premium to loss ratio		Δ Claims closed with payment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ "Unconfirmed" complaints to direct premiums	-0.008	-0.031	-0.007	-0.047**	-0.063	-0.002	0.004	-0.010
	(0.013)	(0.025)	(0.019)	(0.024)	(0.057)	(0.074)	(0.009)	(0.020)
Losses in catastrophe lines to total premiums		-0.066*		0.002		0.034		-0.026
		(0.037)		(0.047)		(0.101)		(0.017)
Δ "Unconfirmed" complaints to direct premiums		0.136		0.221**		-0.243		0.088
× Losses in catastrophe lines to total premiums		(0.154)		(0.112)		(0.312)		(0.083)
Losses in "own" non-catastrophe long-tailed lines	-0.083	-0.110	-0.606***	-0.617***	1.250***	1.184**	0.034	0.044
to total premiums	(0.089)	(0.089)	(0.174)	(0.181)	(0.433)	(0.461)	(0.038)	(0.039)
Controls								
RBC ratio (decimal)	-0.000	-0.001	0.001	0.001	-0.002	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)	(0.005)	(0.001)	(0.001)
Liquid investments to liabilities (decimal)	0.005	0.003	-0.003	0.004	-0.034	-0.051	-0.005	-0.008
	(0.010)	(0.010)	(0.017)	(0.017)	(0.067)	(0.069)	(0.008)	(0.008)
log(Net total assets)	0.004	0.003	-0.067*	-0.068*	0.120*	0.110	0.029**	0.029**
	(0.019)	(0.019)	(0.035)	(0.036)	(0.068)	(0.072)	(0.013)	(0.014)
log(Net premiums)	-0.013	-0.011	0.056	0.058	-0.139***	-0.143**	-0.011	-0.013
	(0.015)	(0.016)	(0.035)	(0.036)	(0.052)	(0.058)	(0.011)	(0.013)
Share of non-catastrophe long-tailed lines	0.013	0.013	0.007	0.007	0.147	0.128	-0.032**	-0.034***
	(0.013)	(0.013)	(0.011)	(0.012)	(0.095)	(0.087)	(0.013)	(0.012)
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2,639	2,468	1,384	1,303	2,639	2,468	2,472	2,301
R-squared	0.115	0.128	0.140	0.144	0.475	0.499	0.160	0.167