Strategic Claim Payment Delays: Evidence from Property and Casualty Insurance

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February 3, 2025

Abstract

Following adverse events, insurers not only raise premiums but also delay claim payments, potentially imposing high state-contingent costs on clients who experience losses. These delays increase losses payable, one of the largest liability items on insurers' balance sheets, augmenting insurer liquidity analogously to interest-free credit. Claim payment delays are larger and more prevalent for insurers that are less capitalized, less liquid, and those who serve clients who are less likely to complain to the regulator. In addition to losses in the same line of business, delays, unlike premiums, also increase in response to losses in unrelated lines of business.

JEL classification: G21, G32

Key words: Insurance, Claim payments, Delays, Financial constraints

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1. Introduction

We explore whether and how insurers manage claim payments in response to incentives to delay these payments to alleviate financial constraints. 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]

In this spirit, we examine the extent to which insurers engage in strategic claim payment delays as an alternative to insurance premium adjustments as a potential response to adverse shocks. More specifically, we discuss how delayed payments can serve as a critical buffer against financial constraints for insurers. "Float" in the insurance industry refers to the money held by the insurer

[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)

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 an insurer's capital and liquidity positions.

To understand the importance of this mechanism, we focus on property and casualty (P&C) insurance, an important sector of the insurance industry (and one which is only likely to become more important in the face of climate risks (Mills, 2005; Smith et al., 2023)). In this sector, we find that insurance float is both sizable (see Figure 1) and largely driven by the temporal distance between insurance claims and payments. Aggregate float within the P&C industry is close to $1 trillion towards the end of the sample, and by some distance, the main driver of float stems from unpaid losses; these are liabilities linked to future claim payments but representing funds retained by the insurer. The empirical question is then whether insurers strategically manage float via payment delays during periods of distress.

We first show how payment delays affect the insurers' balance sheet accounting items and note that unpaid claims are the major component of float. We then establish that insurers do respond to adverse financial shocks within individual business lines not only by raising premiums, but also by delaying claim payments. These findings corroborate prior research that identifies premium increases as a standard tool for addressing financial constraints, and provide new evidence that payment delays are an additional important lever.

We uncover important cross-insurer variation in payment delays. More specifically, payment delays are notably longer among insurers with lower Risk-Based Capital (RBC) ratios and compromised short-term liquidity positions. Further, 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 with varying financial strength, the economic magnitude of payment delays seems to be in the same basic range as the more familiar premium increases. An inter-decile increase in the RBC ratio is associated with an 11% higher fraction of incurred losses paid in the same year or a decrease in the overall payment duration of about 0.35 years.[5] For an

[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.

average firm with $297 million in incurred losses, this reduction in delay translates to a decrease in reserves (through unpaid losses) of at least $104 million, or about 18% of the average reserve. For the purpose of comparison, this RBC ratio increase also correlates with a 19% higher premium-to-loss ratio, amounting to a $95 million premium difference for the average firm, assuming the same losses.

In time-series, insurers that face large losses in the past year make adjustments to both premiums and delays. We confirm prior results that insurers significantly raise their premiums following losses, additionally finding that in such circumstances, insurers also pay less of the incurred losses in the current year and increase their payment duration, suggesting that insurers also manage payment timing to help overcome financial constraints. In terms of economic magnitudes, for the average firm with $297 million in incurred losses, associated delays increase the loss and LAE reserve by about $30 million, while elevated premium to loss ratios contribute roughly $335 million to the average firm.

While 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 financial pressures on claim payment behavior.

Using this identification strategy, we find that insurers experiencing larger unexpected losses in unrelated business lines tend to delay payments more. For instance, we show that an increase in the loss ratio from the bottom to the top decile results in insurers paying about 1.44% less of the incurred losses in the same year. This response magnitude per unit of loss in unrelated lines is about half of what we observe for losses in own lines.

This analysis also reveals how financial robustness impacts insurers' responses to unexpected

unrelated losses. Insurers in the lowest RBC ratio tercile show more pronounced adjustments, significantly slowing down payments in response to these unrelated losses. In contrast, insurers in the highest RBC ratio tercile are less impacted by such shocks, suggesting that financial strength provides greater operational stability. Interestingly, unrelated losses do not significantly affect premium adjustments in long-tail business lines, suggesting that this lever is less frequently utilized, potentially due to regulatory constraints. This potential regulatory arbitrage highlights the nuanced and underappreciated role of payment delays in insurers' financial strategies.

Claim payment delays also have significant implications for households. Such delays occur precisely in states of the world in which policyholders have experienced significant losses. In these straitened circumstances, policyholders likely have a high marginal utility of receiving promised payments. Therefore, such tactics likely have more pronounced welfare implications than adjusting the insurance premium, which from 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. The implications of claim payment delays and denials for household welfare thus deserve particular scrutiny as the economic effects of this strategy are important in a state-contingent sense.[6]

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. Even within the same insurer, the incremental delay of 0.06 years, in response to an inter-decile increase in unrelated losses faced by insurers at the 10th percentile of RBC ratio, can cost the customers about $2-4 million in terms of the time value of money.

[6]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

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 generate word clouds from the publicly available detailed 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 levels of complaints to measures of financial strength and payment delays, we find that less capitalized and less liquid firms observe 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 in response to prior losses, firms experiencing increases in complaints do so to a lesser extent. Overall, the complaint data highlight the importance of delays and show that the strategic use of claim payment delays depends on customer clientele as measured by the response of customer complaints to such tactics.

To the best of our knowledge, we are the first to examine claim payment delays as a strategic response to financial shocks.[7] We build a theoretical model that explains the economic underpinnings

[7]While the literature analyzing insurance supply has not yet considered the role of payment timing, various

of payment delays and provide institutional details that help connect delays to insurers' balance sheets. Our model quantifies the conditions under which insurers opt to delay payments, emphasizing the roles of both insurers' financial health metrics such as the Risk-Based Capital (RBC) ratios and liquidity levels and customers' sophistication. Institutionally, 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 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 Sorensen (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.[8] 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.[9]

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.

[8]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.

[9]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

Finally, we tie our findings back to household finance as the customers facing payment delays are largely households. For example, the nationally standardized complaint data show that over 80% of the complaints are associated with just two consumer lines of business: private passenger auto liability and homeowners. We provide novel 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 welfare effects of insurance access and pricing. Froot (2001) shows that catastrophe reinsurance premiums are too high, and hence, 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.

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

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.

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

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 the insurer to generate returns before disbursing them to claimants—serving a useful function for an insurer whose current liabilities exceed their current assets (Marais, 2022).

When facing 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 float helps 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 following the shock, it can help offset the financial impact of the 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.[10]

Raising premiums and delaying claim payments are two different possible responses available to insurers; which combination of these two strategies insurers adopts likely depends upon 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

[10]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).

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 nevertheless highly competitive. 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 for ensuring fair treatment across all customer segments, as suggested by the household finance literature as well as the literature analyzing 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. Metrics of financial strength, such as the RBC ratio, are as 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 we analyze can be calculated.

3.1 Insurer float magnitudes

Figure 1 shows the evolution of aggregate float for the entire P&C industry from 1996 to 2021. Approaching $1 trillion towards the end of the sample, aggregate float within the P&C industry is sizable. Within the total float, the relative importance of the different components of float (enumerated earlier) vary over time. That said, Figure 1 also shows that the main driver of float is the component linked to unpaid losses; 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.[11]

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 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

[11] 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.

in aggregate, or about half of all insurer liabilities. After claims have been reported, losses are 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, loss and LAE reserves are about 80% higher than incurred losses 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 out 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. 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.

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.

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. That said, the changes in payment delays show significant variation. For example, the standard deviation of the changes in payment duration for all lines is 0.35 years, over half of the standard deviation of the level of payment duration. For business lines that take more time to pay, such as WC or CA, the standard deviation of the changes in payment duration is higher, and the inter-decile range is close to one 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 the 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 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 the 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 loss ratios for insurers' business lines that are separate from the long-tailed lines that are our main focus in this study. To help identify how insurers adjust their policy prices and payment schedules in these long-tailed lines of interest, we measure unanticipated losses—which we treat as an exogenous shock to the long-tailed lines—

from these unrelated lines of business. Panel (e) illustrates the cross-sectional distribution of this unexpected loss ratio across insurers, calculated as the residual from a regression of the loss ratio on firm-specific fixed effects, capturing how actual losses deviate from expected losses based on each firm's unique characteristics. The distribution displayed in panel (e) highlights a broad spread of unexpected loss ratios among insurers, with substantial variation in the left tail. We later use this variation to assess how unexpected losses from unrelated business lines affect the management of the long-tailed business lines that are our primary focus. Panel (f) extends this analysis over time by showing the distribution of unexpected loss ratios from 1996 to 2021. While there are years for which the distribution of insurers' unrelated losses are higher vs. lower or more vs. less dispersed, there is always a left tail of sizable unexpected, unrelated losses which we use as exogenous shocks to study how insurers respond in the long-tailed business lines.

4. Empirical analyses of payment delays

4.1 The role of financial health

Figure 3 presents the cumulative fraction of losses paid since they were incurred across several different long-tailed lines of business. The figure comprises six panels—(a) through (f). Panel (a) aggregates data from all long-tailed lines of business, while panels (b) through (f) show these statistics for specific lines of business, namely, homeowner and farmowner (HF), private passenger auto liability (PA), workers' compensation (WC), commercial auto liability (CA), and commercial multiple peril (CM). In each panel, insurers are categorized into quintiles based on their RBC ratios, where quintile 1 represents insurers with the lowest (weakest) RBC ratios, and quintile 5 represents those with the highest (strongest) ratios. This is a first look at how differences in payment behavior play out across insurers with different levels of financial strength.

The plots reveal that insurers with weaker financial positions (lower RBC ratios) tend to pay out their incurred losses more slowly than those with higher ratios. 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 more aggressively. However, since this is a simple correlation, reverse causality or an omitted third variable that drives financial position and payment behavior are also possibilities. The plot also

shows that stronger firms with more robust capital buffers settle claims more quickly, possibly enjoying the financial freedom to maintain client satisfaction. This sharp degree of variation in claim payment timelines is a novel fact, adding to our understanding of the dynamics of insurers' financial management.

Similarly, Figure 4 presents the cumulative fraction of losses paid since incurred, this time sorting insurance firms by their ratio of liquid investments to liabilities across the same long-tailed lines of business. This figure includes the same panels as in Figure 3. Panel (a) again shows aggregated data from all long-tailed lines of business, whereas panels (b) through (f) focus on specific business lines. To gauge how liquidity levels might influence the timing of claim payments, insurers are separated into quintiles based on their liquidity ratios, with quintile 1 (5) featuring insurers with the lowest (highest) ratios, indicative of weaker (stronger) liquidity positions. Similar to the RBC separation above, we see that insurers with lower liquid investments to liabilities ratios tend to settle their incurred losses more slowly in comparison to those in higher quintiles. This cross-sectional pattern is somewhat less pronounced relative to the RBC-based sorts. The pattern nevertheless suggests, with the same caveat about correlational analysis, that insurers with less liquidity are not as well positioned to quickly make claim payouts and could face challenges in managing cash flows, potentially delaying payments to preserve liquidity.

Figure 5 presents bin-scatter plots that examine the relationships between measures of insurers' financial health 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 3. 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 insurers by their liquid investments to liabilities ratio, paralleling the analysis from Figure 4. 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 coefficient estimates from 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 5. Focusing on the RBC ratio, the coefficients in columns (1), (4), and (7) 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 11% higher fraction of incurred losses paid in the incurrence year and a payment duration that is 0.35 years shorter. For the average firm with incurred losses of $297 million per year, the delay difference of 0.35 years translates to an additional loss and LAE reserve of at least $104 million, which is about 18% of the average reserve. In comparison, an inter-decile increase in the RBC ratio is associated with a 19% higher premium-to-loss ratio. Holding the incurred losses constant, the premium difference translates to about $95 million for the average firm. Put differently, these statistics suggest that the economic magnitude of the variation in strategic payment delays is at least as large, if not larger, than more thoroughly studied strategic premium adjustments.

Another way to look at these numbers is from the perspective of the 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 the interest rates on credit cards can range from about 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 the 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).[12] By the same calculation, ceterus paribus and assuming away assortative matching between clients and insurers, by switching to insurers in the top versus bottom deciles of the RBC ratio, clients could hypothetically reduce the delay by about 0.35 years (which translates to about 4-8% cost savings) in the event that they incur insured losses.

[12] $297 - 297/(1+0.14)^{0.96} = 35$.

4.2 Change in payment delays in response to unexpected 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 settings by regressing changes in payment speed and pricing in our five long-tailed business lines on loss ratios in these business lines in the prior year. 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 increase their payment duration (column 2), confirming our hypothesis that insurer also manage payment timing to help overcome financial constraints.

In terms of economic magnitudes, an increase in loss ratio from the bottom to the top deciles is associated with insurers paying about 2.93% (0.048×0.61) of the incurred losses less in year 0 (column 1) and extending their payment duration by 0.10 years ($0.161 \times .0.61$). For the average firm with $297 million in incurred losses, such a delay would increase the loss and LAE reserve by about $30 million, which is equivalent to 5% of the average.[13] In comparison, the same increase in losses is associated with insurers raising their premium to loss ratio by 113% (1.849×0.61), which amounts to $335 million for the average firm.

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 the insurance premia, past losses may also raise the expected future losses, which form the basis for premium setting. To rule out these alternatives and 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, we measure unexpected losses in other unrelated lines of business as the

[13]We can also make some 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 $39,553 million (compared to the total reserves of $779,712 million).

residuals of a regression of loss ratios in those lines on firm-specific fixed effects and loss ratios of our five long-tailed lines (i.e., "own" lines). Again, we lag the measure one year to look at insurer responses to these losses. We begin by looking at bin-scatter plots that relate (lagged) unexpected losses in other unrelated lines to (current) changes in claims handling and pricing strategies in the five long-tailed lines of business of interest. Figure 6 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 holds significant implications for the customers of these firms. Panel (b) shows how these unexpected losses impact the duration of payment. Consistent with panel (a), insurers extend the payment duration in their long-tailed lines of business subsequent to experiencing unexpected losses in other unrelated lines.

In panel (c) of Figure 6, for comparison purposes, we examine how insurers adjust insurance premia in response to unexpected losses. Unlike the relationship we observe between past losses and future premiums within the same business lines, the results show that insurers do not necessarily increase premia (normalized by losses) in their long-tailed lines of business when faced with unexpected losses in other unrelated lines. If anything, the relationship is even negative, albeit noisy.[14] Possibly, insurers face regulatory limits or fierce competition in some long-tailed business lines such that unless these lines also suffer larger than expected losses, they cannot easily raise the premia. This would suggest that the management of payment speed may provide a more flexible tool for insurers 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 of long-tailed businesses on the lagged unexpected loss ratio of other unrelated businesses, including 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 loss ratio of our long-tailed business lines because these losses have first-order effects on payment speed and pricing as we have shown above. Ultimately,

[14]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.

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 4 confirm the patterns in Figure 6. Insurers experiencing higher losses in other lines of business in the past year increase payment delays in the current year by paying less of the incurred losses in the year of incurrence, as well as by increasing the overall payment duration. These sensitivities to "unrelated" losses are about a third to half of the the sensitivities to "own" losses. Also consistent with Panel (c) of Figure 6, 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. This holds significant implications for insurers' customers. We discuss this aspect further in the next subsection.

4.3 Insurer responses to shocks and financial health

Figure 7 stratifies the results by insurers' financial strength as measured by their RBC ratios, to investigate the mechanisms underlying the effects of unexpected losses in unrelated business lines on insurers' operational responses. We hypothesize that since insurers vary in their financial robustness and the tightness of their regulatory capital constraints, this can create variation in the strength of their incentives to strategically respond to unexpected losses using claim payment delays and premiums. The figures are split between insurers in the lowest and highest terciles of RBC ratios (top and bottom panels, respectively).

For insurers in the lowest RBC ratio tercile, panels (a), (b), and (c) show pronounced adjustments in the face of unexpected losses. Panel (a) shows a strong response for such insurers in delays to loss claim payments (measured by the ratio of losses paid to losses incurred in the year of incurrence), indicating a noticeable slowdown in payments as unexpected losses increase. This could reflect a liquidity-preserving strategy among less financially robust insurers facing sudden financial strains.

Among the lowest RBC ratio insurers, panel (b) for overall payment duration also shows a response to unexpected losses. In panel (c), the impact on insurance premium pricing is more markedly evident, unlike what we observe in the full sample, with significant premium increases in long-tailed lines of business following higher unexpected, unrelated losses. These adjustments likely bolster low RBC ratio insurers' financial positions and mitigate the impacts of potential future losses.

In contrast, panels (d), (e), and (f) depict the responses of insurers from the highest RBC ratio tercile. The effects are less pronounced, suggesting that these financially stronger insurers are less impacted by unexpected losses in unrelated business lines. In particular, panel (f) shows that these insurers do not raise premia in the long-tailed lines at all (and may even reduce the premia possibly due to regulatory and competitive pressures).

These findings illustrate how financial strength (captured by the RBC ratio) influences insurers' operational responses to unexpected losses. Insurers with lower RBC ratios react more defensively across various operational measures than those with higher capital adequacy ratios. This stratified analysis not only underscores the importance of capital adequacy in insurance operations but also highlights how capital constraints can drive strategic decisions in risk management and financial planning.

Figure 8 parallels the approach in Figure 7 but replaces the RBC ratios with insurers' liquidity positions. Hypothesizing that the financial flexibility afforded by elevated liquidity might moderate the operational adjustments to unexpected shocks, the figure is stratified into the lowest and highest terciles of the liquidity ratio. The findings reveal a pattern consistent with those observed for the RBC ratio stratification; insurers in the lowest liquidity tercile, on balance, exhibit more pronounced responses to unexpected losses. Potentially facing greater liquidity constraints, these insurers adjust their loss payment speeds and insurance pricing more significantly. Conversely, as can be seen in the lower panels, insurers from the highest liquidity tercile, on balance, exhibit less pronounced adjustments.

Overall, Figure 8 reinforces the notion that an insurer's financial situation, whether in terms of capital adequacy or liquidity, plays an important role in how insurers respond to unexpected financial stresses. It echoes the findings related to RBC ratios, highlighting the broader theme that financial health significantly influences operational adjustments.

To quantify the effects of financial health on the use of payment delays to address stresses,

we introduce the interactions between unrelated losses and RBC ratio (columns 2, 5, and 8) and between unrelated losses and liquid investments to liabilities ratio (columns 3, 6, and 9) to the panel regressions in Table 5. While the interaction coefficients have expected signs, they are largely insignificant. The exception is the interaction effects of unrelated losses and RBC ratio and those of unrelated losses and liquidity on claim payment duration (columns 5-6). Insurers with low RBC ratios and poor liquidity adjust their claim payment timing significantly more. For an insurer at the 10th percentile of RBC ratio (RBC ratio of about 3), for example, an interdecile increase in unrelated loss ratio increases the payment duration for claims in the five long-tailed lines by about 0.06 years (0.61 $\times$ [0.114 - 3.14 $\times$ 0.007]) or more than double the unconditional effect.

While these insurer responses are potentially rational to address shocks to their financial circumstances, these adjustments may have significant implications for an insurer's customers. Claim payment delays are particularly worrisome from 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 may be more or less prevalent for customers at lower levels of wealth, enhancing the importance of studying the welfare consequences of this behavior. For example, the above incremental delay of 0.06 years that results from an inter-decile increase in losses from unrelated businesses translate to incremental costs, in terms of the time value of money, of \$2-4 million (from the average incurred losses of \$297 million at 14-25% interest rate per year, taken 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.

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.

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 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 9 and 10 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:[15]

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

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:

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

[15] 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

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

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

In Figures 11 and 12, 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 which 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-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 the delay and other similar tactics?

To address these important questions, we examine the 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 for complaints and span the period from April 2011 to April 2024.

Figure 13 shows word clouds from complaints for 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. Similar to the data from Texas, the national sample shows that claim handling is the main complaint type description, accounting for over 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 denial of claims, which is also part of claim handling and accounts for 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 million 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 being 0 and 0.61, respectively. Much of the variation comes from the cross section (71%) rather than the time series (3%)—complaints mainly vary across rather than within insurers, 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.

Complaints can be outcomes of firms' strategic claim handling tactics, in which case we would expect that firms that delay claim payments more also receive more complaints. Complaints can also be indicative of firms' customer clientele and may also constrain firms' ability to use delay tactics to preserve liquidity in events of large negative shocks, as our model predicts. To assess these potentially different facets/roles of complaints, we first create bin-scatter plots in Figure 14 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 70th percentile. Panel (b) shows that in the range of liquidity ratios at and below the median, higher liquidity ratios are also associated with fewer complaints, but above the median, the relationship turns slightly positive. Together with Figures 3 and 4, these results suggest that financially weaker firms that tend to delay loss payments also face more complaints. 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.[16] This indicates that complaints may not just 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 6 extends the regressions in Table 5 by adding as regressors the lagged change in complaints and its interaction with past unexpected losses in unrelated businesses. Columns (1) and (3) show that the change in complaints alone has no significant effects on payment delays, as measured by the fraction of incurred losses paid in the incurrence year, or on premium pricing. However, column (2) shows that while firms respond to past losses by delaying claim payments (paying less in the incurrence year), those that see an increase in complaints in the prior year (lags 2 to 1) use delay tactics less. The effect, as indicated by the interaction coefficient, is both statistically and economically significant. A one standard deviation increase in complaints decreases the loading on the loss ratio of other businesses by 0.017 (0.26×0.069), which is about 69% of the average loading. This finding suggests that the nature of the customer clientele can limit the extent to which firms use payment delays. Column (4) applies the same specification as in column (2) to premium pricing, and as before, we do not observe any significant effects.

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 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.

[16] We do not look at the payment duration measure as it requires 5 years of additional data from the year of incurrence, which effectively cut our complaint sample by over half.

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 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.

Last, 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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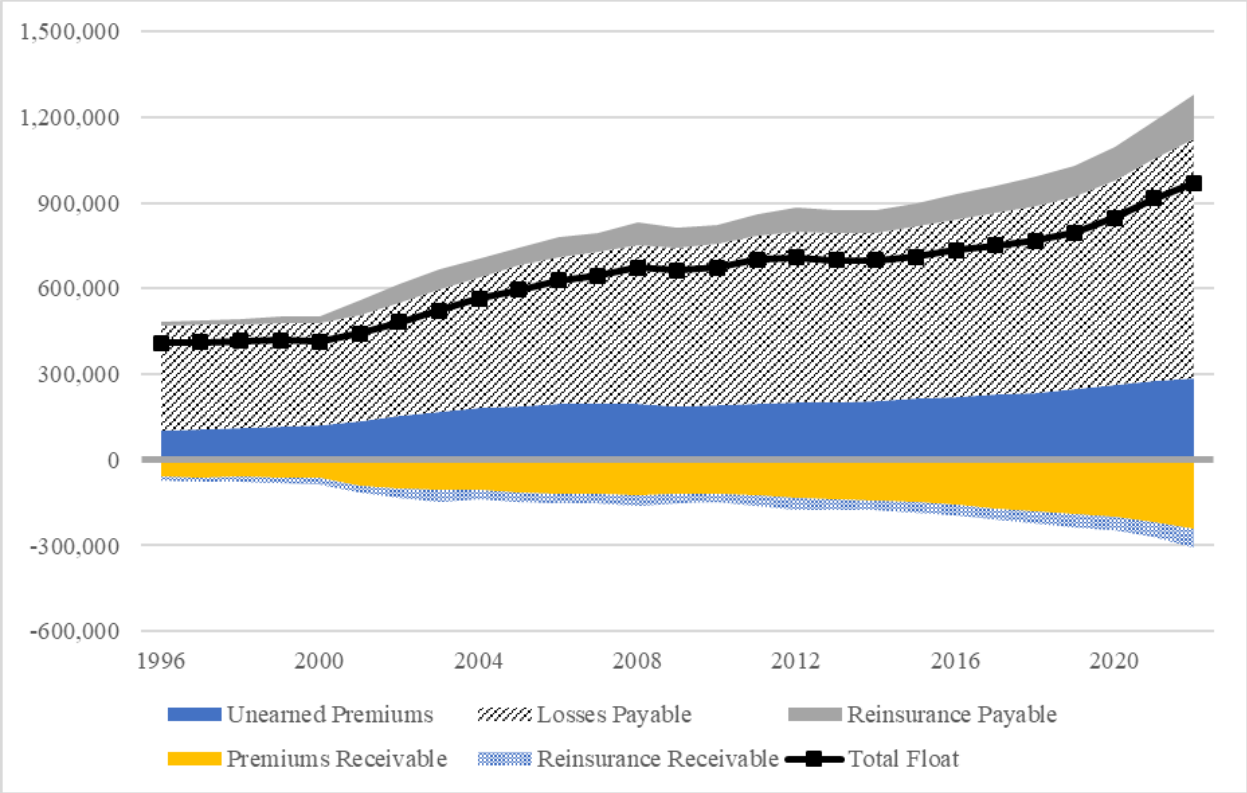
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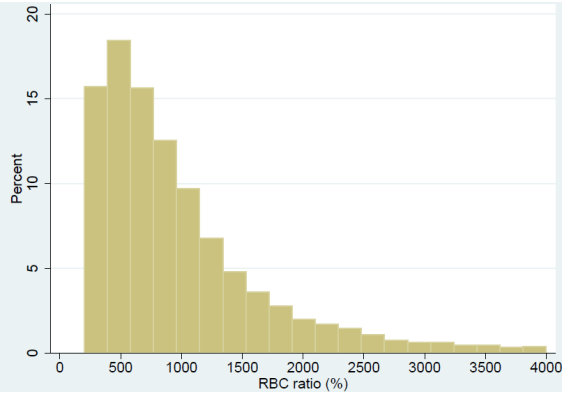
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Figure 1: Float and its components over time

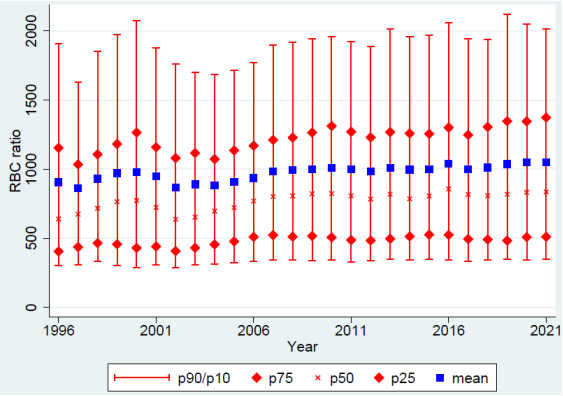


Notes: The figure plots dollar float and its components, summed across all P&C insurers, over the period from 1996 to 2021.

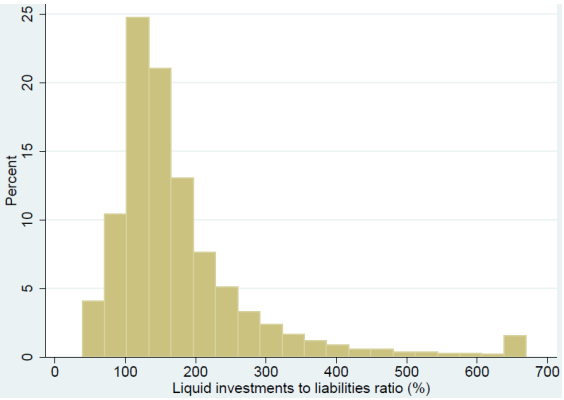
Figure 2: Distributions of financial strength and unexpected losses in other businesses



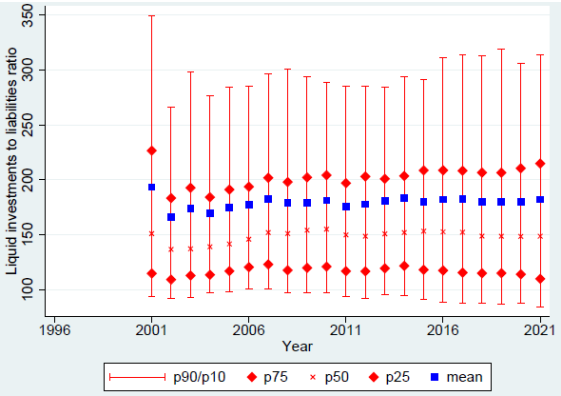
(a) RBC ratio



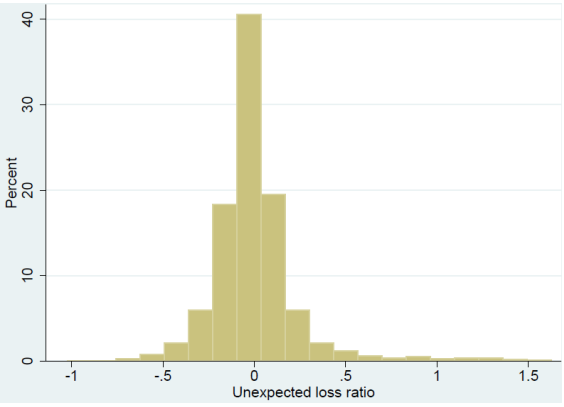
(b) RBC ratio over time



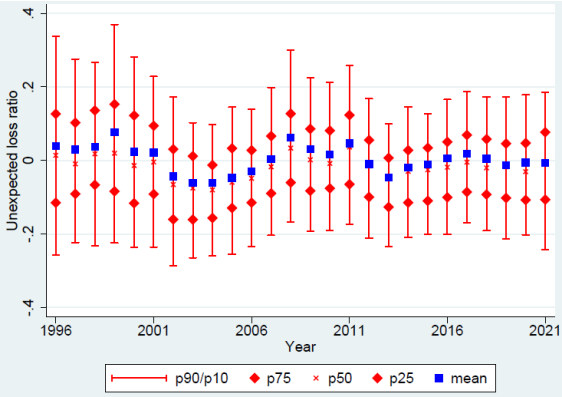
(c) Liquid investments to liabilities ratio



(d) Liquid investments to liabilities ratio over time



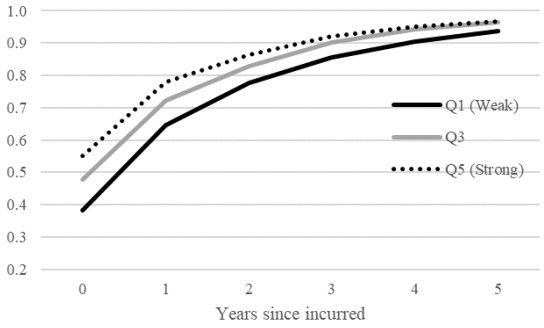
(e) Unexpected loss ratio of other business lines



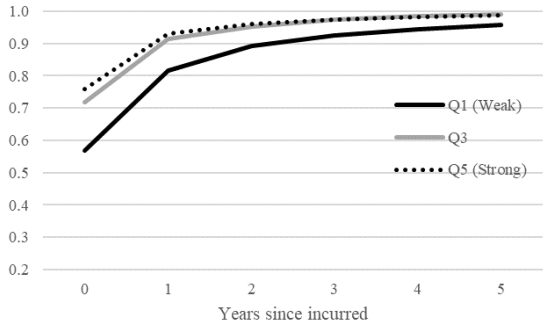
(f) Unexpected loss ratio of other business lines over time

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 loss ratio in business lines other than homeowner and farm owner (HF), private passenger auto liability (PA), worker compensation (WC), commercial auto-liability (CA), and commercial multi-perils (CM) (panels (e) and (f)). 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 loss ratio is calculated as the residual from regressing the loss ratio on firm fixed effects.

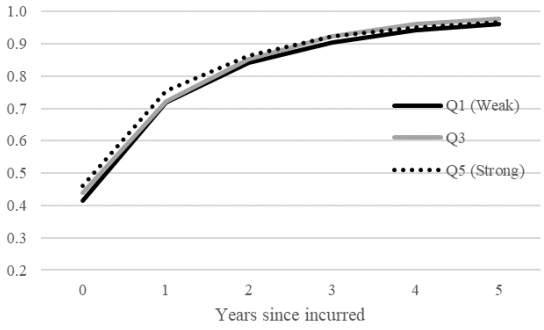
Figure 3: Cumulative fraction of losses paid since incurred for firms sorted by RBC ratio



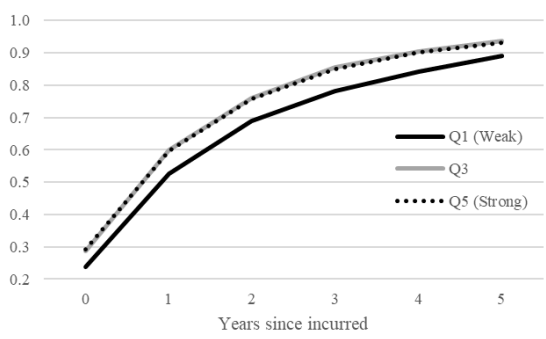
(a) All



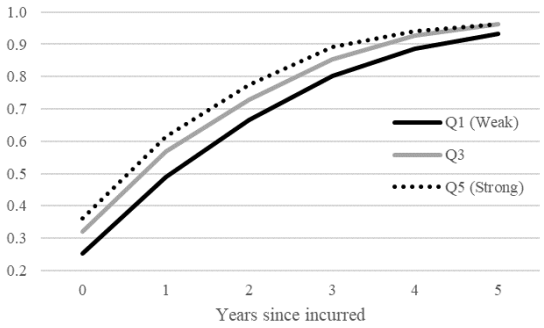
(b) HF



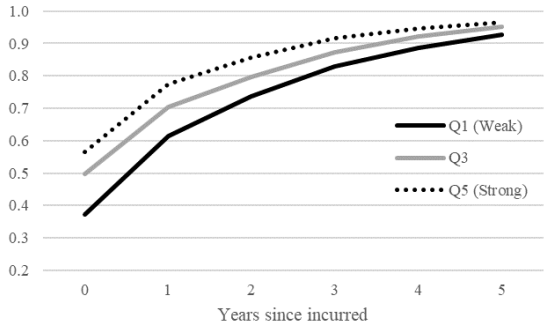
(c) PA



(d) WC



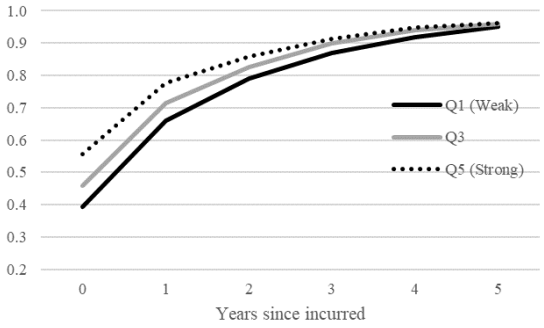
(e) CA



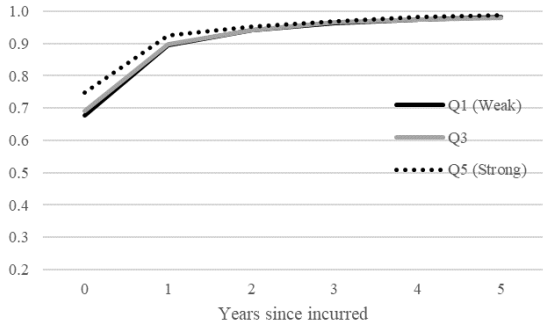
(f) CM

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.

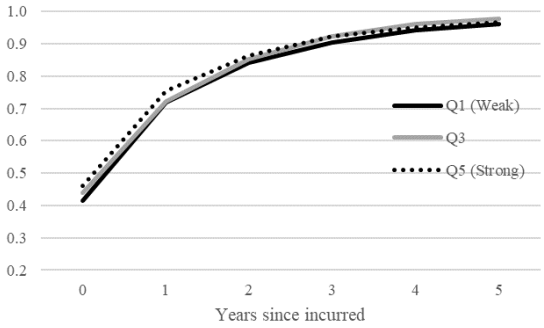
Figure 4: Cumulative fraction of losses paid since incurred for firms sorted by liquid investments to liabilities ratio



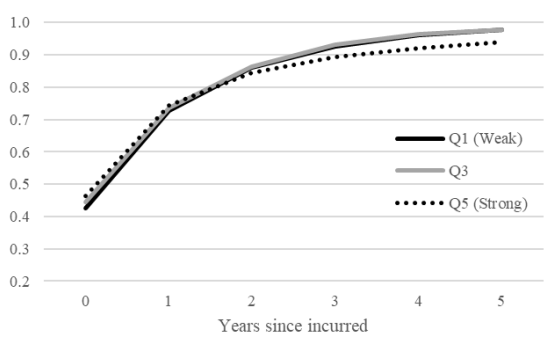
(a) All



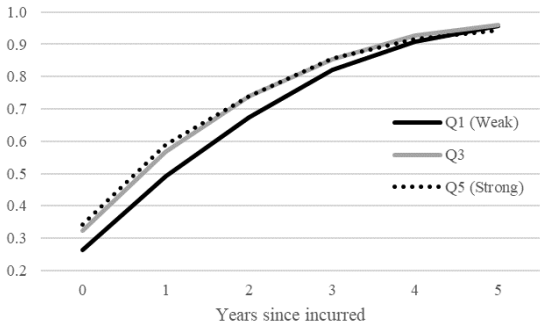
(b) HF



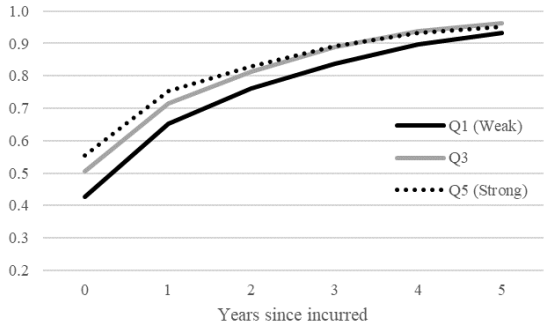
(c) PA



(d) WC



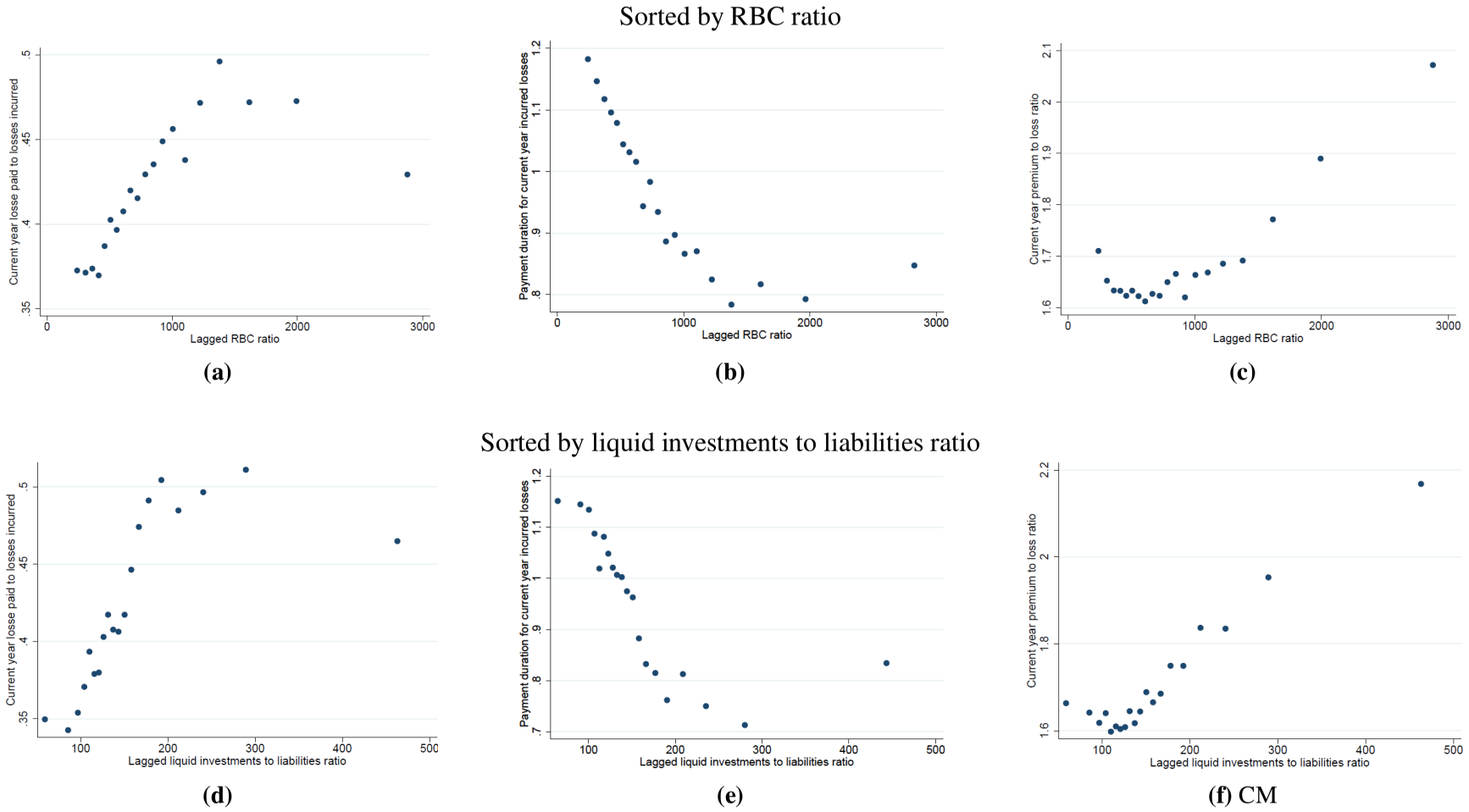
(e) CA



(f) CM

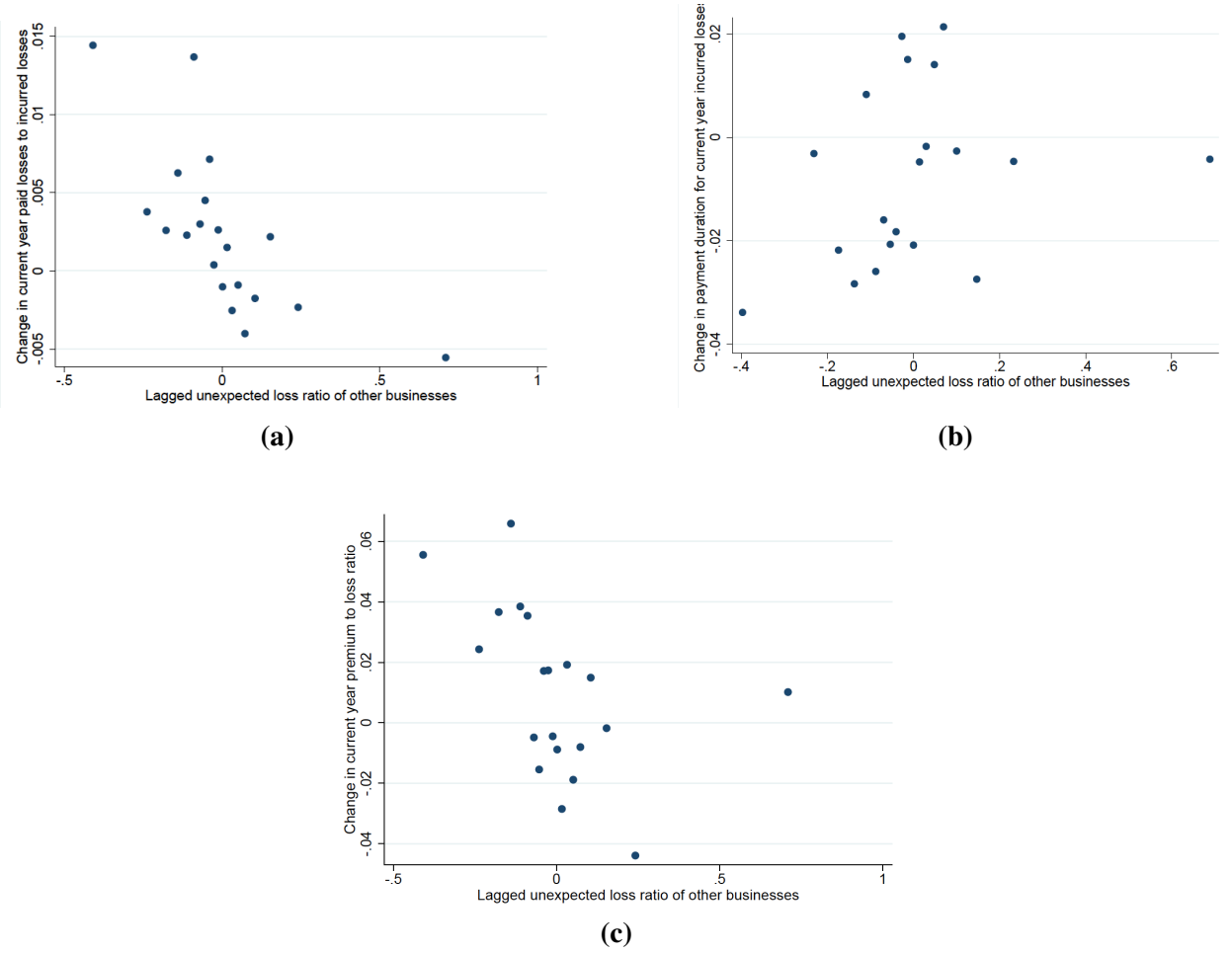
Notes: The figure plots, by quintile of liquid investments to liabilities ratio, the average cumulative losses paid up to year t as a fraction of the total paid losses, where $t = 0$ is the year in which the losses are reportedly incurred. The total paid losses are assumed to equal the cumulative losses 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 5: Financial strength, loss payment speed, and pricing



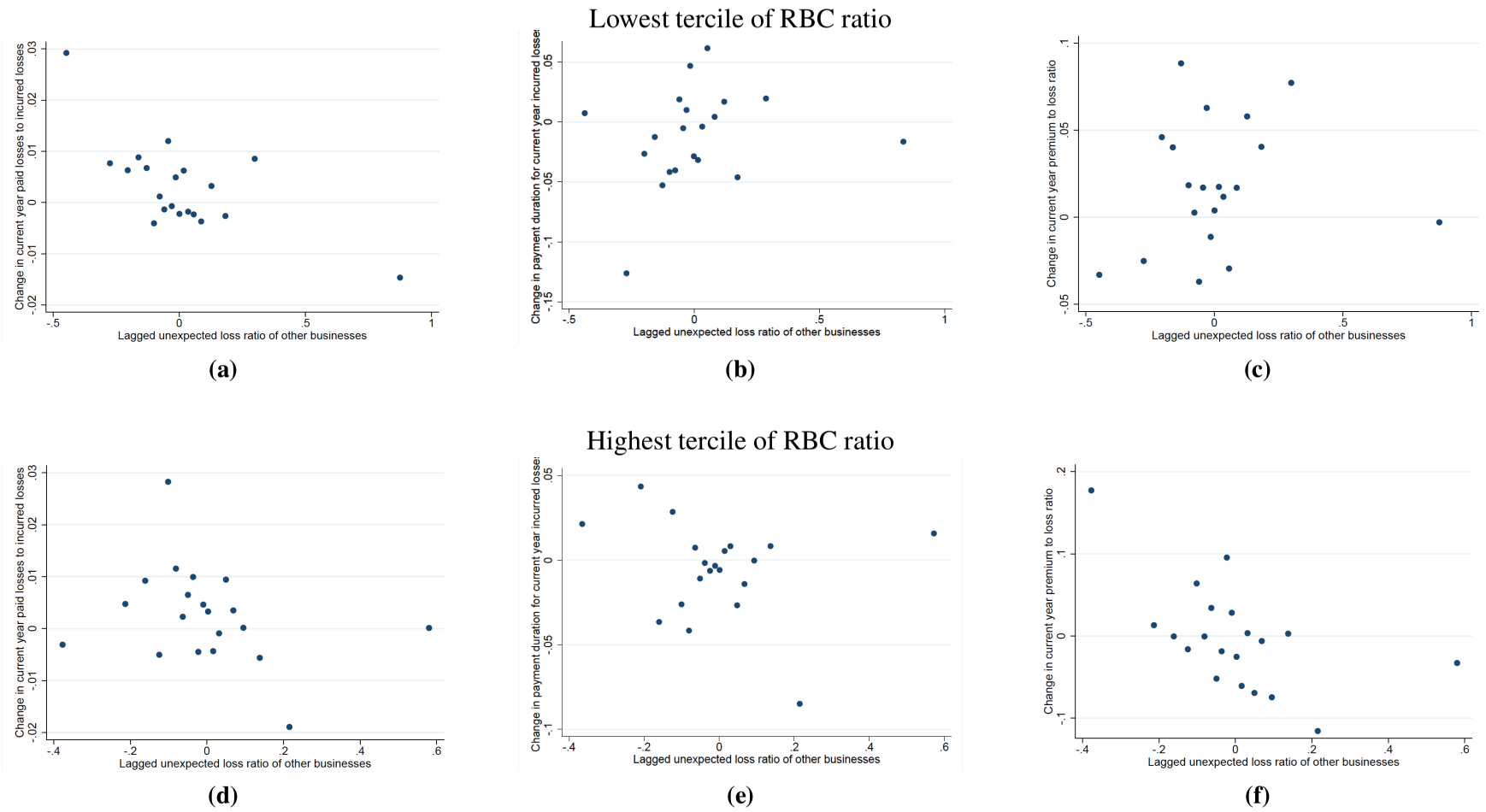
Notes: The figure presents bin-scatter plots relating financial health measures in year $t-1$ to loss payment speed and insurance pricing for the combined five long-tailed business lines in year t. Measures of financial health include RBC ratio (panels (a) - (c)) and liquid investments to liabilities 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 6: Unexpected losses and changes in loss payment speed and pricing



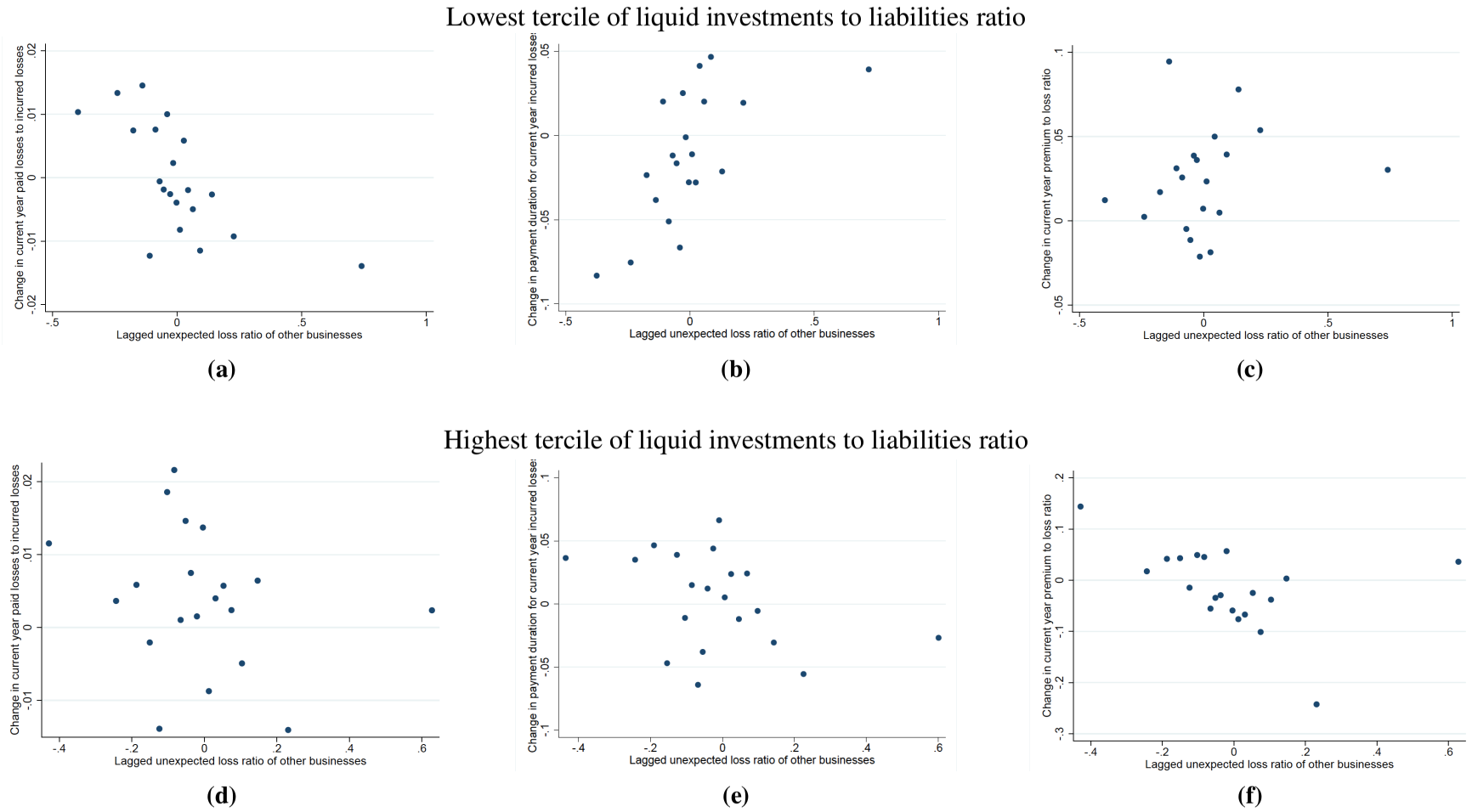
Notes: The figure presents bin-scatter plots relating the unexpected loss ratio of other business lines in year $t-1$ to the changes in loss payment speed and insurance pricing for the combined five long-tailed business lines from years $t-1$ to t. The unexpected loss ratio of other business lines is calculated as the residual from regressing the loss ratio of other business lines on firm fixed effects and the loss ratio of the five long-tailed business 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 payment duration (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 loss ratio of other business lines and the average payment speed or pricing of all observations in the bin.

Figure 7: Responses to unexpected losses and RBC ratio



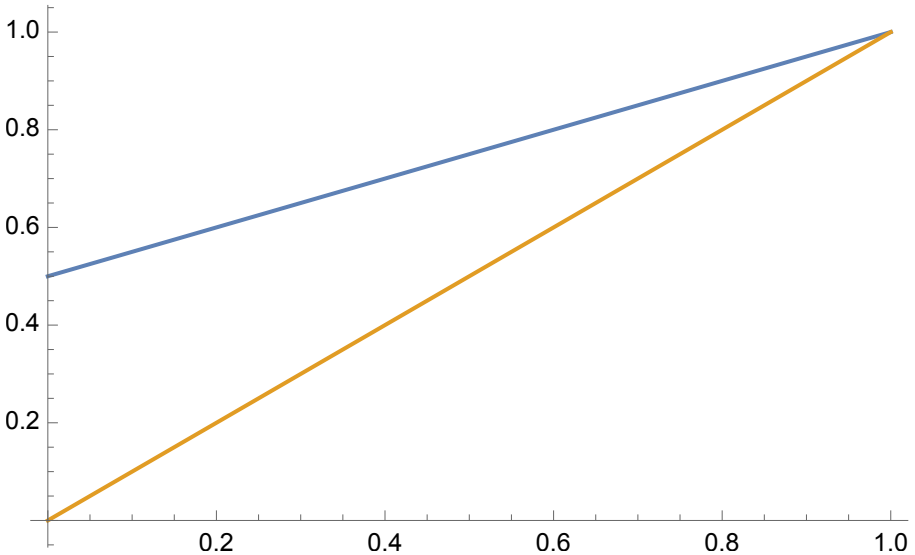
Notes: The figure presents, separately for firms in the lowest and highest terciles of RBC ratio, bin-scatter plots relating the unexpected loss ratio of other business lines in year $t-1$ to loss payment speed and insurance pricing for the combined five long-tailed business lines in year t. The unexpected loss ratio of other business lines is calculated as the residual from regressing the loss ratio of other business lines on firm fixed effects and the loss ratio of the five long-tailed business lines (own business lines). 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 unexpected loss ratio of other business lines. The coordinate for each bin is given by the average unexpected loss ratio of other business lines and the average payment speed or pricing of all observations in the bin.

Figure 8: Responses to unexpected losses and liquid investments to liabilities ratio



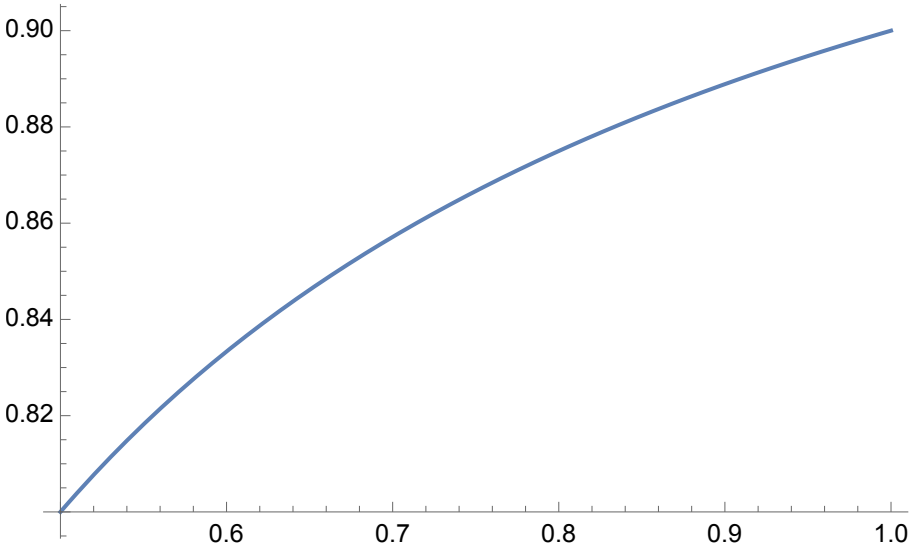
Notes: The figure presents, separately for firms in the lowest and highest terciles of liquid investments to liabilities ratio, bin-scatter plots relating the unexpected loss ratio of other business lines in year $t-1$ to loss payment speed and insurance pricing for the combined five long-tailed business lines in year t. The unexpected loss ratio of other business lines is calculated as the residual from regressing the loss ratio of other business lines on firm fixed effects and the loss ratio of the five long-tailed business lines (own business lines). 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 unexpected loss ratio of other business lines. The coordinate for each bin is given by the average unexpected loss ratio of other business lines and the average payment speed or pricing of all observations in the bin.

Figure 9: Optimal delay as a function of ρ



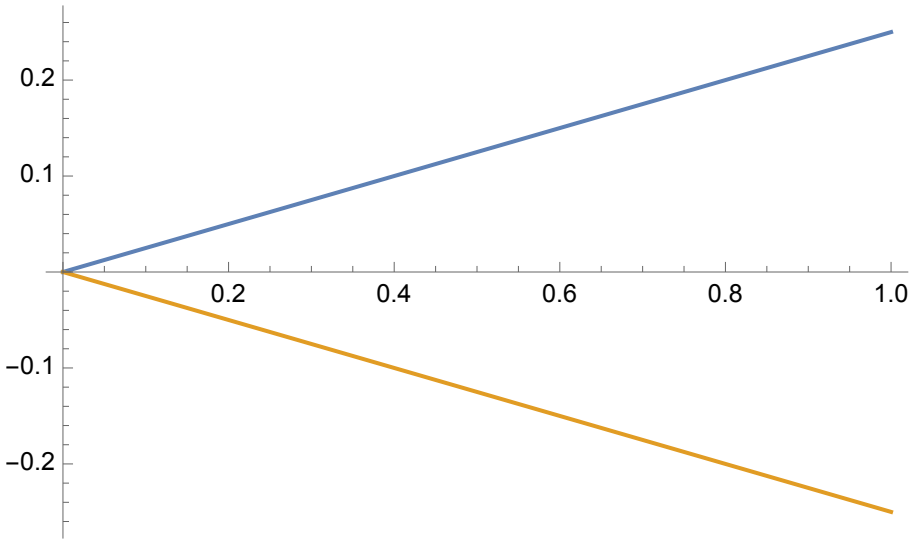
Notes: The figure shows the optimal payment θ^* as a function of $\rho \in [0, 1]$ for two parameter specifications: $\theta^* = \theta^*(\rho, 0.5, 1)$ (orange) and $\theta^* = \theta^*(\rho, 1, 1)$ (blue).

Figure 10: Optimal delay as a function of reputational cost ξ



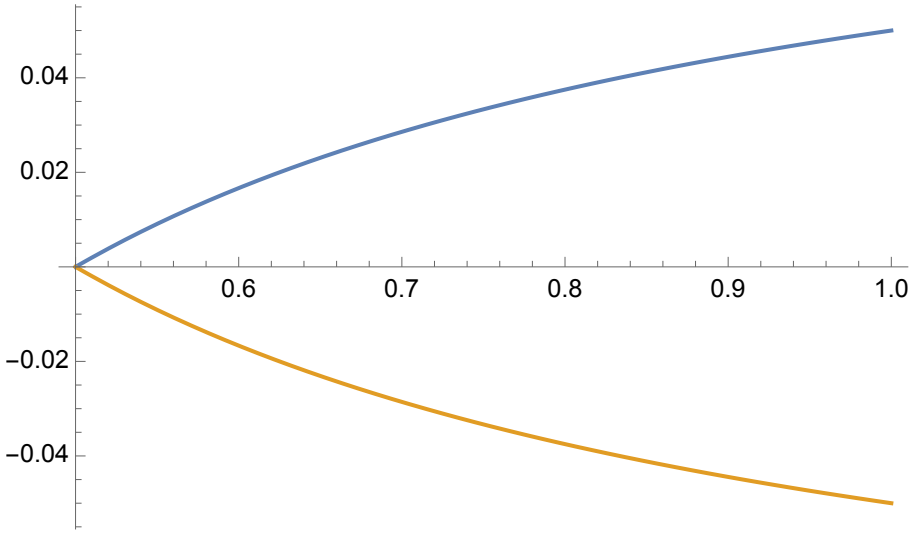
Notes: The figure shows the optimal payment $\theta^*(0.8, \xi_h, 1)$ as a function of the legal cost $\xi_h \in [0.5, 1]$.

Figure 11: Cross-subsidy as a function of impatience



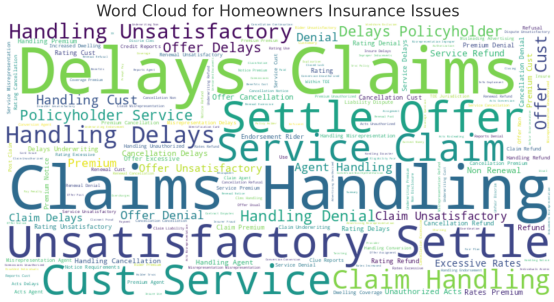
Notes: The figure shows the extent of the cross-subsidy from unsophisticated to sophisticated as a function of $1-\rho$ for $\xi_l = 0.5, \xi_h = 1, c = 1$. The blue line shows the payment to the sophisticated in period 1 *in excess* of the ex-ante expected payment, and the orange line shows the negative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

Figure 12: 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 13: Word cloud from complaint reasons



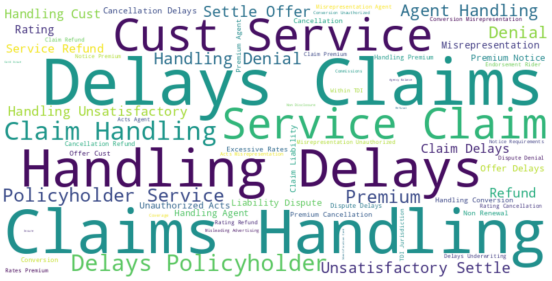
(a) Homeowners



(b) Automobile



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



(d) Liability



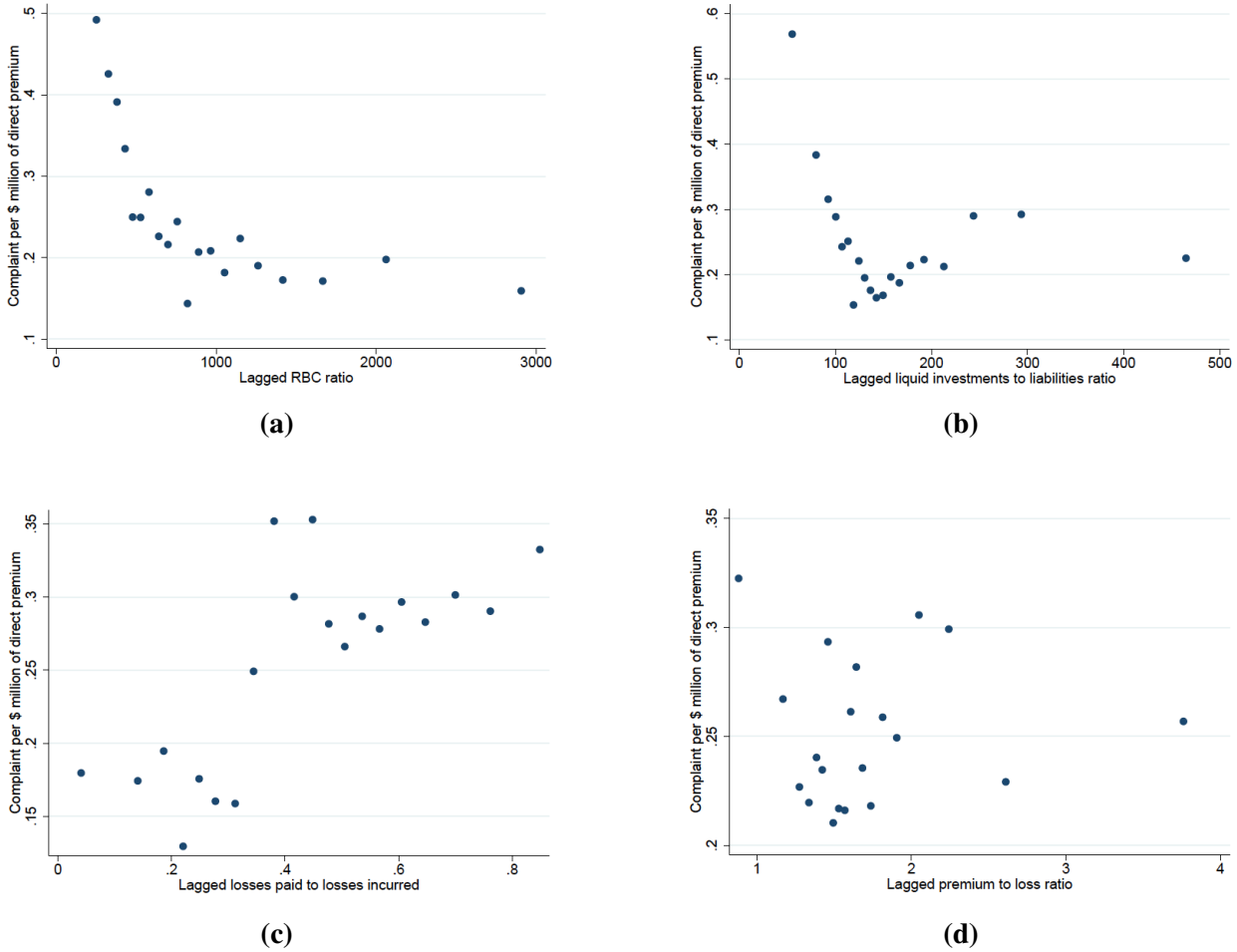
(e) Accident and health



(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 14: Customer complaints, financial strength, loss payment speed, and pricing



Notes: The figure presents bin-scatter plots relating measures of financial health, loss payment speed, and pricing in year $t-1$ to 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.

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 (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 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 payment duration (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 Payment duration (years) (2)	Δ Premium to loss ratio (3)
Loss ratio of "own" businesses	-0.048***	0.161***	1.849***
	(0.013)	(0.051)	(0.086)
Controls			
RBC ratio (decimal)	-0.000	-0.001	0.003
	(0.000)	(0.002)	(0.002)
Liquid investments to liabilities (decimal)	0.002	0.046**	0.023
	(0.004)	(0.019)	(0.021)
log(Net total assets)	0.014**	-0.046	-0.136***
	(0.006)	(0.030)	(0.034)
log(Net premiums)	-0.007	0.040	0.062**
	(0.006)	(0.026)	(0.027)
Share of long-tailed businesses	0.026**	-0.074	0.220***
	(0.012)	(0.054)	(0.070)
Firm fixed effects	YES	YES	YES
Year fixed effects	YES	YES	YES
Observations	9,883	7,468	9,883
R-squared	0.060	0.048	0.287

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 (columns (1)-(3)), change in payment duration (columns (4)-(6)), and change in premium to loss ratio (columns (7)-(9)) in long-tailed businesses in the current year on loss ratio of other non-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			Δ Payment duration (years)			Δ Premium to loss ratio		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Loss ratio of "other" businesses	-0.024***	-0.023**	-0.024*	0.054**	0.114***	0.136***	0.018	0.046	0.025
	(0.006)	(0.010)	(0.013)	(0.023)	(0.042)	(0.043)	(0.025)	(0.040)	(0.047)
Loss ratio of "other" businesses		-0.000			-0.007*			-0.004	
× RBC ratio		(0.001)			(0.004)			(0.004)	
Loss ratio of "other" businesses			-0.000			-0.050**			-0.005
× Liquid investments to liabilities			(0.008)			(0.022)			(0.027)
Loss ratio of "own" businesses	-0.041***	-0.042***	-0.041***	0.150***	0.147***	0.148***	1.846***	1.845***	1.846***
	(0.014)	(0.014)	(0.014)	(0.053)	(0.053)	(0.052)	(0.088)	(0.088)	(0.088)
RBC ratio (decimal)	-0.000	0.000	-0.000	-0.001	0.003	-0.001	0.003	0.004	0.003
	(0.000)	(0.001)	(0.000)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)
Liquid investments to liabilities	0.000	0.000	0.000	0.047**	0.046**	0.072***	0.024	0.024	0.026
(decimal)	(0.005)	(0.005)	(0.005)	(0.019)	(0.019)	(0.020)	(0.022)	(0.022)	(0.028)
log(Net total assets)	0.018***	0.018***	0.018***	-0.055*	-0.056*	-0.054*	-0.133***	-0.133***	-0.133***
	(0.007)	(0.007)	(0.007)	(0.031)	(0.031)	(0.030)	(0.035)	(0.035)	(0.035)
log(Net premiums)	-0.011*	-0.011*	-0.011*	0.047*	0.046*	0.044*	0.057**	0.056**	0.056**
	(0.006)	(0.006)	(0.006)	(0.027)	(0.027)	(0.026)	(0.028)	(0.028)	(0.028)
Share of long-tailed businesses	0.026**	0.027**	0.026**	-0.077	-0.072	-0.072	0.228***	0.230***	0.228***
	(0.013)	(0.013)	(0.013)	(0.054)	(0.055)	(0.054)	(0.070)	(0.070)	(0.070)
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	9,766	9,766	9,766	7,394	7,394	7,394	9,766	9,766	9,766
R-squared	0.063	0.063	0.063	0.047	0.048	0.048	0.287	0.287	0.287

Table 6: Unexpected losses, 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)) and change in premium to loss ratio (columns (3) and (4)) in long-tailed businesses in the current year on change in complaints per $ million of direct premiums and its interaction with loss ratio of other non-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		Δ Premium to loss ratio	
	(1)	(2)	(3)	(4)
Lagged Δ complaints to direct premiums	-0.009	-0.040**	-0.020	0.013
	(0.009)	(0.017)	(0.042)	(0.070)
Loss ratio of "other" businesses		-0.026**		0.055
		(0.011)		(0.042)
Lagged Δ complaints to direct premiums		0.069***		-0.105
× Loss ratio of "other" businesses		(0.024)		(0.110)
Loss ratio of "own" businesses	-0.054*	-0.049	2.544***	2.553***
	(0.031)	(0.031)	(0.165)	(0.167)
Controls				
RBC ratio (decimal)	-0.001	-0.000	-0.003	-0.003
	(0.001)	(0.001)	(0.005)	(0.005)
Liquid investments to liabilities (decimal)	0.001	-0.001	0.053	0.046
	(0.011)	(0.011)	(0.051)	(0.052)
log(Net total assets)	0.021	0.027	-0.219	-0.218
	(0.016)	(0.017)	(0.136)	(0.135)
log(Net premiums)	-0.015	-0.024	0.098	0.092
	(0.014)	(0.015)	(0.086)	(0.085)
Share of long-tailed businesses	0.020	0.025	0.758***	0.747***
	(0.027)	(0.027)	(0.147)	(0.148)
Firm fixed effects	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES
Observations	3,593	3,553	3,593	3,553
R-squared	0.069	0.075	0.409	0.410