Reputation, Liability Structure and Capital Strain

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Abstract

We examine how reputation affects capital requirements for financial intermediaries with long-term liabilities in incomplete markets. While reputation is mostly viewed as alleviating financial constraints, we show that reputation improvements can increase capital strain. Combining text-based reputation measures with a structural asset-liability framework, we find stronger reputation reduces policyholder run risk but extends effective liability duration. Given scarce long-duration safe assets, this mismatch amplifies interest-rate and convexity risks, raising required capital under risk-sensitive regulations like C-ROSS II and Solvency II. Our results highlight an overlooked balance-sheet channel through which intangible assets shape capital constraints.

Keywords:

Reputation, Liability Duration, Capital Requirements, Financial Intermediaries, LLMs

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1. Introduction

Corporate reputation has long been regarded as an intangible asset capable of stabilizing customer behavior and mitigating information asymmetry (Fombrun and Shanley, 1990; Shapiro, 1983; Dang *et al.*, 2020). Consequently, in financial intermediation theory, reputation is generally hypothesized to be a mitigator of capital strain: a superior reputation fosters higher customer loyalty, weakens financing constraints, and reduces capital strain (Diamond, 1989; Fombrun and Shanley, 1990; Ota *et al.*, 2019; Dhingra and Krishnan, 2021). However, this classical view implicitly relies on a critical but often overlooked premise, that the risks on a firm's liability side arising from reputational changes can be fully hedged in a complete market.[1] Once a market experiences a scarcity of long-duration safe assets,[2] this premise no longer holds.

We propose a new perspective: in an incomplete market characterized by a scarcity of long-duration assets, reputation is a risky asset requiring a trade-off between returns and costs. Its impact on capital manifests through a trade-off between two opposing forces. First, the mitigation effect: Improved reputation reduces customer behavioral risks (e.g., corporate divestment, bank runs, or insurance lapses), thereby lowering the component of regulatory capital associated with behavioral risk. Second, the amplification effect: Changes in customer behavior driven by reputational improvement alter the duration of liabilities. In a market structure where long-duration safe assets are scarce, this amplifies interest rate sensitivity and convexity risk, thus increasing capital requirements for inherent risks. When the amplification effect dominates, an improved reputation may paradoxically lead to increased capital strain. We define this phenomenon as the *Reputation Paradox*.

To test this hypothesis, we focus on empirical evidence from China's life insurance industry. On one hand, the stability of non-bank financial intermediaries - particularly life insurers holding massive long-term liabilities - has become a core issue in global financial regulation due to their scale and high interconnectedness within the financial system (IMF, 2025). On the other hand, as financial intermediaries managing long-term liabilities, life insurers provide a unique opportunity to observe the transformation of reputation from a pure asset into a risky asset due to the scarcity of long-duration assets.

[1] The classical view assumes market completeness, implying firms can always find matching assets to hedge liability risks. In reality, markets are typically incomplete (Hart, 1975).

[2] In emerging markets, or during specific periods in developed markets, there is a severe scarcity of long-duration safe assets (Caballero et al., 2017).

The China's life insurance market provides an ideal setting for observing these frictions. China not only boasts the world's second-largest insurance market, but its C-ROSS regulatory framework also maintains a high degree of risk sensitivity, consistent with the EU's Solvency II (UNION, 2009; CBIRC, 2021), allowing it to keenly capture capital consumption caused by duration mismatch. Simultaneously, the relative lag in the development of the China's bond market provides a clear scenario of scarcity of long-duration safe assets for our study.

To verify the *Reputation Paradox*, we combine large-scale textual data with firm-level financial disclosures to construct a reputation-driven framework. We process more than 200,000 insurance-related news articles using large language models (LLMs) and transformer-based text classification to build annual reputation indices for 65 Chinese life insurance companies. Using this measure, we examine how reputational changes affect insurers' liability structure.

To address endogeneity concerns, we implement a Bartik instrumental variable based on aggregate litigation growth interacted with firms' historical regulatory penalty exposure. The empirical results show that reputational improvements significantly reduce surrender activity while increasing insurance reserve values, indicating stronger policy persistence and a larger stock of long-term obligations. These findings provide preliminary evidence that reputation reshapes both the flow and stock of insurers' liabilities.

We then incorporate the estimated liability responses into an asset-liability management framework to quantify how reputation-driven liability persistence translates into duration risk and regulatory capital outcomes. In particular, we simulate the evolution of liability cash flows under alternative reputational scenarios using a representative long-duration insurance contract and embed these dynamics into insurers' balance sheets. This integrated approach enables us to trace the transmission of reputational shocks from policyholder behavior to duration mismatch and ultimately to capital strain.

The simulation results support the existence of the *Reputation Paradox*, where improved reputation leads to increased capital strain. Our empirical tests also support this finding. Regarding the underlying mechanism, we identify three decisive factors: the degree of asset-liability duration mismatch, the product risk structure, and the risk sensitivity of the regulatory regime. Further research reveals that this effect also erodes the company's actual capital through changes in the fair value of liabilities, creating a

double squeeze on solvency, a phenomenon that persists across different insurance products.

This paper contributes to three strands of the literature. First, we improve our knowledge on reputation's mechanism in incomplete markets. Existing research generally views reputation as a risk-free intangible asset that reduces information asymmetry and enhances customer stickiness (Shapiro, 1983; Diamond, 1989; Fombrun and Shanley, 1990; Ota *et al.*, 2019), acting as a stabilizer during crises (Jong *et al.*, 2025). Our research reveals the dual nature of reputation in incomplete markets: when long-duration assets are scarce, reputational improvement can increase capital strain. Specifically, while previous insurance studies explored surrender behavior and capital buffers (Chang and Schmeiser, 2022; Kiermayer, 2022), they did not treat reputation as a driver of capital strain fluctuations. Our work fills this gap, proving that reputation management strategies intended to maintain confidence (Eling and Schmeiser, 2010) may inadvertently exacerbate capital strain and affect financial soundness when markets are incomplete.

Second, this study advances the literature on capital strain in financial institutions. Existing research primarily focuses on capital strain originating from asset-side volatility and liability-side run risks, emphasizing the role of capital in absorbing asset value declines and managing short-term funding risks (Allen and Gale, 2004; Diamond and Rajan, 2001; Hanson *et al.*, 2015). Some literature has begun to address duration mismatch risks in institutions with long-term liabilities, noting that insurers and pension funds face structural interest rate risk when long-duration safe assets are scarce (Ellul *et al.*, 2011; Koijen and Yogo, 2015). However, these studies generally view reputation as an asset that stabilizes customer behavior without considering how it alters the effective duration of liabilities. We integrate reputation into the balance sheet and capital constraints, revealing that it not only affects behavioral risk but also amplifies interest rate sensitivity and convexity risk by extending liability duration, thereby serving as a significant mechanism affecting minimum capital requirements.

Third, this paper contributes to research on insurance economics and life insurance. Koijen and Yogo (2022) mentioned that the modern life insurance market operates in an environment of big data and machine learning, where insurers may hold information advantages over consumers regarding mortality and surrender behavior, raising new questions about risk classification and capital regulation. Farinha *et al.* (2023) further suggest that insurance market equilibria are highly sensitive to information disclosure

and risk distribution. Furthermore, as key institutional investors in the corporate bond market, the asset allocation and capital constraints of life insurers have significant spillovers on asset prices and the real economy (Philippon, 2009; Ellul *et al.*, 2011; Chodorow-Reich *et al.*, 2021). Recent shifts in capital structure, such as private equity reshaping life insurer risk exposure through regulatory arbitrage (Kirti and Sarin, 2024), underscore the necessity of using life insurers as empirical evidence for studying capital strain.

The remainder of this paper is organized as follows. Section 2 introduces data and preliminary evidence. Section 3 provides simulation design and results. Section 4 discusses the underlying mechanisms. Section 5 conducts further analysis, including the impact on actual capital and a comparison of product types, and Section 6 concludes.

2. Data and Preliminary Evidence

This section describes the data, measurement strategy, and preliminary empirical evidence underlying our analysis of corporate reputation and insurers' liability dynamics. We first introduce the firm-level dataset combining media-based textual information, financial disclosures, and macroeconomic conditions. We then describe the construction of corporate reputation measures using large-scale media coverage and machine-learning-based text classification based on large language models (LLM). Next, we discuss the institutional role of policy surrender in life insurance markets. Finally, we present empirical evidence on the relationship between reputation and policyholder surrender behavior, establishing the key channel through which reputational shocks affect insurers' balance sheets.

2.1 Data

Our analysis is based on a firm-level panel of 65 China's life insurance companies spanning the period from 2011 to 2021. The sample period is chosen to align with an important regulatory transition in China's insurance market. The Insurance Law of the People's Republic of China was substantially revised in 2009 and implemented in 2010, strengthening consumer protection and enhancing regulatory supervision.[3] Because insurers and policyholders required time to adjust to the new framework, 2011 represents the first full year in which market behavior can be observed under the revised

[3] The official text of the law is available from the China's National Financial Regulatory Administration website: https://www.nfra.gov.cn/cn/view/pages/ItemDetail.html?docId=879931&itemId=4248&generaltype=0.

regulatory environment. Focusing on the post-2011 period therefore allows the analysis to capture insurer and policyholder dynamics in a relatively stable institutional setting.

The dataset combines information from three complementary sources. First, firm reputation is measured using insurance-related financial news coverage obtained from 209,186 media news reports via the China Stock Market & Accounting Research (CSMAR) database. Second, surrender values and insurance reserve values are manually collected from the annual reports of insurance companies. These reports provide detailed disclosures on policyholder behavior and liability positions, allowing us to construct firm-level measures of surrender activity and the stock of insurance reserves that capture the evolution of insurers' contractual obligations over time. Third, firm-level financial variables and macroeconomic indicators are collected from the CSMAR database and the City Statistical Yearbooks, enabling us to link policyholder behavior and balance-sheet conditions.

2.2 Corporate Reputation

Corporate reputation is inherently latent and difficult to observe directly from financial statements. Traditional approaches rely on surveys or perception-based indices, which are costly to construct and typically unavailable at the firm-year level over long horizons (Walsh and Beatty, 2007; Lange et al., 2011). By contrast, financial news media provide continuous and rich textual information that reflects public perceptions of firm credibility, and long-term viability.

The primary empirical challenge lies in transforming large volumes of unstructured media text into a consistent and replicable firm-level indicator. To address this issue, we adopt a hybrid approach that combines large language model (LLM) annotation with an active learning framework. We first use an LLM to label a core set of insurance-related news articles according to their reputational content. This labeled sample is then employed to train three transformer-based classifiers, Chinese-BERT-wwm, Chinese-RoBERTa-wwm-ext, and Chinese-MacBERT, which are computationally efficient and well suited for large-scale text classification.

The trained models are subsequently applied to a broader corpus of unlabeled articles. Instances for which model predictions diverge are identified as ambiguous cases and returned to the LLM for additional annotation. This iterative procedure

continues until classification performance stabilizes, yielding a validated corpus of 16,604 articles. Cross-validation indicates an ensemble classification accuracy of 74.6 percent, suggesting that the approach provides a reliable characterization of reputational sentiment in insurance-related media coverage.

Using this validated corpus, we construct four alternative firm-level annual reputation indices. The first measure, Reputation_LLM, is directly derived from the LLM-based annotations of media sentiment. The remaining three measures, Reputation_BERT, Reputation_RoBERTa, and Reputation_MacBERT, are generated using the predictions from the respective transformer models trained within the active learning framework. Each index aggregates sentiment-adjusted media mentions at the firm-year level and captures time-varying public perceptions of insurer credibility. Appendix A provides the detailed descriptions of LLM model training and validation.

2.3 Surrender in Insurance Contracts

Policy surrender is a defining feature of life insurance contracts and represents a key source of liability uncertainty for insurers. Unlike many financial instruments with fixed maturity structures, life insurance policies typically embed policyholder exit options that allow contracts to be terminated prior to maturity in exchange for a surrender value. As a result, surrender behavior directly affects insurers' liability cash flows and the timing of contractual obligations.

From the policyholder's perspective, surrender decisions reflect changes in liquidity needs, investment opportunities, and perceptions of insurer quality. In particular, reputation can influence surrender through expectations about insurers' financial stability and long-term contract performance. When policyholders perceive an insurer as credible and financially sound, they are more likely to maintain contracts, whereas negative perceptions may trigger early termination. Consequently, surrender behavior constitutes a natural behavioral margin through which reputational shocks can affect insurers' liability dynamics.

From a financial intermediation perspective, policy surrender plays a role analogous to withdrawals in banking or redemptions in mutual funds. Because

surrender decisions determine whether long-term liabilities remain in force, they directly influence insurers' funding stability and liability duration. Lower surrender rates extend the effective maturity of liabilities and increase exposure to long-horizon interest rate and convexity risk, while higher surrender rates shorten liability duration and generate liquidity outflows. Understanding surrender behavior is therefore essential for evaluating how reputational shocks translate into balance-sheet risk and capital requirements for institutions with long-term obligations.

In this study, surrender behavior is measured using surrender values, defined as the total monetary amount of policies surrendered in a given firm-year. This measure captures realized contract discontinuation and reflects both the frequency and size of surrender decisions. Compared with surrender rates, surrender values provide a more comprehensive indicator of liability cash-flow adjustments, particularly in markets where policy sizes and product structures vary across insurers.

2.4 Reputation and Liability Outcomes

Reputation can affect insurers' balance sheets through multiple liability channels. On the flow side, reputational improvements may stabilize policyholder behavior and reduce surrender activity, altering the timing of liability cash outflows. On the stock side, persistent in-force policies increase the present value of future benefit obligations, leading to higher insurance reserves. Examining both dimensions is therefore essential for understanding how reputation reshapes the structure and duration of insurers' liabilities.

First, we examine the results in policyholder surrender behavior. If reputation shapes policyholders' perceptions of insurer solvency and contract credibility, improvements in reputation should reduce surrender activity by strengthening incentives to maintain long-term policies. Conversely, reputational deterioration may trigger contract termination and generate liability cash-flow volatility. Identifying this behavioral elasticity provides the empirical foundation for linking reputation to insurers' liability duration and capital requirements.

To isolate the effect of reputation on surrender, we control for a set of firm-level

and macroeconomic factors that may independently influence policyholder behavior. Firm-level controls include policyholder dividend expenditures, investment income, commission and fee expenses, net premiums earned, total assets, and new business premiums. These variables capture differences in underwriting intensity, product characteristics, asset performance, and firm size that may affect surrender decisions. In addition, macroeconomic controls including GDP growth, unemployment rate, consumer price inflation, and per capita disposable income growth, account for economic cycles influencing insurance demand.

Table 1 presents summary statistics for the key variables. Surrender values display substantial cross-sectional and time-series variation, with a mean of 7.539 and a standard deviation of 15.520, indicating considerable heterogeneity in policyholder exit behavior across insurers. The four reputation measures exhibit similar dispersion despite differences in scaling, suggesting that media-based reputation is both firm-specific and dynamic. Control variables also show meaningful variation, reflecting differences in insurer size and macroeconomic exposure.

[Table 1 about here]

We begin with two-way fixed effects (TWFE) regressions of the form:

$$Surrender_{it} = \beta Reputation_{it} + X_{it}'\gamma + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where $Surrender_{it}$ denotes surrender values for firm i in year t, $Reputation_{it}$ represents the firm's reputation index, X_{it} is the vector of control variables, and $\mu_i$and $\lambda_t$denote firm and year fixed effects, respectively.

A key concern is that reputation may be endogenous. Unobserved firm characteristics, such as managerial quality or product design, may jointly affect reputation and surrender behavior. In addition, surrender activity itself may influence media coverage, generating reverse causality. To address these issues, we implement a two-stage least squares approach based on a shift-share (Bartik) instrumental variable (Goldsmith-Pinkham *et al.*, 2020; Borusyak *et al.*, 2022). The Bartik instrument is constructed as:

$$Bartik_{it} = LitigationGrowth_t \times PenaltyShare_i^{base} \quad (2)$$

where $LitigationGrowth_t$denotes the aggregate growth rate of litigation in the

insurance sector and $PenaltyShare_i^{base}$ represents each firm's historical share of regulatory penalties in the base year 2011. The instrument exploits variation in firms' exposure to sector-wide information shocks. Litigation waves shape the information environment surrounding insurers and influence media sentiment, while firms with greater baseline regulatory exposure experience stronger reputational responses.

The Bartik instrument exploits the informational role of litigation in shaping insurers' reputational perceptions. Litigation waves attract media attention and alter the information environment, while firms with greater historical exposure to regulatory penalties respond more strongly to such sector-wide shocks, supporting instrument relevance. Conditional on firm and year fixed effects, aggregate litigation growth is largely orthogonal to contemporaneous contract fundamentals, and baseline penalty shares are predetermined with respect to current surrender decisions. Because policyholder exit behavior responds primarily to perceptions of insurer quality rather than direct changes in litigation activity, the instrument plausibly isolates exogenous variation in reputation. Under these assumptions, the first-stage regression is given by:

$$Reputation_{it} = \pi Bartik_{it} + X_{it}'\delta + \mu_i + \lambda_t + u_{it} \quad (3)$$

and the second-stage regression is:

$$Surrender_{it} = \beta \widehat{Reputation}_{it} + X_{it}'\gamma + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

The coefficient β captures the causal effect of reputation on surrender behavior. A negative β is expected, as higher reputation stabilizes policyholder expectations regarding insurer quality and reduces early contract termination, thereby lowering surrender activity.

Table 2 presents the empirical estimates of the effect of reputation on surrender. Panel A presents the reduced-form TWFE results, showing a robust negative association between reputation and surrender values across all reputation measures. The estimated coefficients range from -0.045 to -0.052, indicating that insurers with stronger reputational standing experience lower policyholder exit behavior. And Panel B reports the first-stage results. The Bartik instrument significantly predicts firm reputation in all specifications, confirming instrument relevance. The positive coefficients suggest that firms with greater baseline regulatory exposure experience stronger reputation

responses to aggregate litigation shocks, consistent with the interpretation of litigation as an information-environment shock. Panel C presents the two-stage least squares (2SLS) estimates. The Bartik IV coefficients are substantially larger in magnitude, ranging from -0.159 to -0.175, indicating surrender with respect to reputation appears economically meaningful. Therefore, improvements in corporate reputation significantly reduce policyholder surrender activity, providing the key channel through which reputation affects insurers' liability structure.

[Table 2 about here]

While surrender behavior captures the flow adjustment of liabilities, reputation may also affect the stock of insurers' obligations through changes in insurance reserves. Because reserves reflect the present value of future policy benefits for in-force contracts, lower surrender rates induced by reputational improvements imply that a larger share of policies remains active, increasing insurers' long-term liability commitments. Examining the relationship between reputation and reserves therefore provides a complementary perspective on how reputational dynamics shape insurers' balance sheets.

We also use the TWFE and 2SLS strategy with Bartik IV to assess reputation and insurance reserves, replacing surrender values with insurance reserve values as the dependent variable. The identification strategy continues to rely on the Bartik instrument constructed from aggregate litigation growth interacted with firms' baseline penalty exposure, allowing us to isolate exogenous variation in reputation embedded in the information environment.

Table 3 reports the empirical results. The reduced-form estimates indicate a positive association between reputation and insurance reserves across all reputation measures. The first-stage results remain consistent with those reported earlier, confirming the relevance of the Bartik instrument. The two-stage least squares estimates show that improvements in reputation lead to statistically significant increases in insurance reserve values, with coefficients ranging from 0.005 to 0.006. These results suggest that reputational improvements increase the persistence of in-force policies and thereby expand the stock of insurers' long-term obligations.

[Table 3 about here]

From an economic perspective, the reserve results complement the surrender findings by highlighting a stock-adjustment mechanism. Whereas lower surrender

reduces liability outflows in the short run, the resulting extension of policy duration raises the present value of future benefits and increases reserve requirements. The surrender and reserve evidence indicates that reputation stabilizes policyholder behavior while simultaneously enlarging insurers' liability exposure, providing the empirical foundation for the duration-driven capital effects quantified in Section 3.

3. Simulation Design and Results

We have shown that corporate reputation affects insurers' liabilities through both surrender behavior and insurance reserves. These findings indicate that reputational improvements increase policy persistence, reducing liability outflows while expanding the stock of long-term obligations. Such liability adjustments alter the maturity structure and risk profile of insurers' balance sheets, suggesting that reputation can influence capital outcomes through duration-driven channels.

To quantify these balance-sheet implications, this section translates the empirical estimates into liability dynamics and evaluates their impact on regulatory capital. Because surrender behavior and reserve accumulation jointly determine the effective maturity of life insurance liabilities, reputation-driven changes in liability persistence can extend liability duration and widen asset–liability mismatches. We therefore develop a simulation framework that incorporates representative contract features, asset allocation, and solvency rules to examine how reputational shocks propagate from liability adjustments to capital requirements. The following subsections describe the mapping from empirical estimates to liability cash flows, model calibration, baseline capital effects, and sensitivity analyses.

3.1 Simulation Design

The simulation design translates the empirically identified reputational effects into liability scenarios that characterize the evolution of insurers' balance sheets under alternative reputational environments. We begin by constructing a baseline liability path that reflects expected surrender behavior and reserve levels evaluated at average firm characteristics. This baseline captures the typical pattern of liability cash flows and serves as the reference case for subsequent scenario analysis.

We then introduce reputational shocks by considering deviations in reputation relative to its baseline level. Using the estimated relationships between reputation, surrender, and reserves, these shocks generate adjustments in liability dynamics that

reflect changes in policy persistence. Improvements in reputation lead to lower predicted surrender and higher reserve levels, while reputational deterioration produces the opposite pattern.

These scenario-based adjustments translate into alternative liability cash-flow paths and effective duration profiles. Lower surrender and higher reserves imply longer policy persistence and delayed liability runoff, whereas higher surrender accelerates contract termination and shortens liability maturity. Embedding these alternative liability paths into the balance sheet yields the liability cash-flow structures that serve as inputs for the calibration and capital simulations presented in the following subsections.

3.2 Calibration

To quantify the balance-sheet implications of reputation-driven liability dynamics, we calibrate the simulation framework using a representative long-duration life insurance contract. Specifically, we adopt an endowment-type product as the baseline model point, reflecting the protection-oriented and maturity-intensive liabilities that characterize China's life insurance market. The contract design captures key features of policy persistence, reserve accumulation, and embedded surrender options, making it well suited for evaluating how reputation-induced liability adjustments affect duration and capital requirements. Table 4 summarizes the parameterization of the representative contract.

[Table 4 about here]

The calibration follows three considerations. Liability valuation and capital assessment are conducted within the regulatory framework of the China Risk-Oriented Solvency System (C-ROSS II), ensuring that reserve calculations and solvency requirements are consistent with prevailing regulatory standards. Liability-side assumptions, including product characteristics, expense structures, and baseline surrender behavior, are aligned with industry practices to maintain empirical relevance. Asset-side parameters are calibrated using historical data from Chinese financial markets, reflecting realistic portfolio composition, expected returns, and volatility patterns relevant for insurers' asset–liability management. Together, these calibration choices provide a realistic economic environment in which reputation-driven surrender adjustments translate into liability duration changes and capital responses, with detailed parameter values and additional calibration information reported in Appendix C.

3.3 Baseline Capital Effects of Reputation

We begin by examining the impact of reputation improvements on minimum capital requirements (MCR). We first isolate liability-side effects and then incorporate asset-side risks. Figure 1 reports changes in individual components of liability-side capital requirements relative to the baseline total MCR, as reputation deviates from its mean by up to three standard deviations. Improvements in reputation lead to a pronounced decline in surrender risk capital, consistent with the stabilizing effect of reputation on policyholder behavior.

[Figure 1 about here]

At the same time, capital requirements associated with mortality risk and liability-side interest rate risk increase substantially. Lower surrender rates imply that a larger share of policies remains in force for longer durations, increasing insurers' exposure to long-horizon mortality, critical illness, and interest rate risks. As a result, total liability-side MCR increases on net.

We next incorporate asset-side risks and re-evaluate the effect of reputation changes on overall MCR. The results are presented in Figure 2. The increase in market risk capital driven by a widening asset–liability duration gap substantially exceeds the reduction in surrender risk capital. These results reinforce the reputation paradox: reputation improvements reduce behavioral risk but amplify balance-sheet risk through liability duration.

[Figure 2 about here]

3.4 Sensitivity Analysis

To assess the robustness of our findings, we conduct sensitivity analyses with respect to key actuarial assumptions, including mortality rates, surrender rates, expense ratios, and discount rates. Mortality, surrender, and expense assumptions are varied by ±10 percent relative to baseline values. Discount rates are adjusted by ±50 basis points around the baseline risk-free rate.

The results in Figure 3 show that while changes in these assumptions affect the magnitude of the MCR increase induced by reputation improvements, they do not alter its direction. The reputation paradox remains robust across all scenarios. Notably, the effect is particularly pronounced in low discount rate environments. Lower interest rates increase both the duration and convexity of liabilities (Ahlgrim *et al.*, 2004), thereby amplifying the sensitivity of interest rate risk to reputation-induced reductions

in surrender rates.

[Figure 3 about here]

The simulation results demonstrate that improvements in reputation can increase capital pressure in the presence of long-duration liabilities and incomplete markets. We also estimate econometric models using firm-level panel data. The empirical evidence supports the simulation results: improvements in reputation are associated with higher capital strain for life insurance companies.

4. Mechanisms

Both the simulation and empirical results provide consistent evidence for the existence of the reputation paradox. This section examines the mechanisms through which the paradox arises and identifies the conditions under which it is amplified. We focus on three core elements that govern the transmission of reputation into capital outcomes: (i) asset-liability duration mismatch, (ii) product risk structure, and (iii) regulatory regime. We study each element through a sequence of targeted simulation exercises.

4.1 Asset-Liability Duration Mismatch

To assess the role of duration mismatch, we construct liability structures with different initial duration gaps by varying two contractual parameters that directly determine liability duration: the premium payment period and the coverage horizon.

Premium Payment Period. In life insurance contracts, a shorter premium payment period concentrates premium inflows at the early stages of the policy, while benefit payments are distributed far into the future. This structure naturally generates long-duration liabilities. By contrast, longer payment periods align premium inflows more closely with future benefit outflows, thereby shortening effective liability duration.

We simulate premium payment periods ranging from 2 to 20 years and examine how reputation improvements affect minimum capital requirements under each specification. Figure 4 summarizes the results. The horizontal axis reports the length of the payment period; moving from left to right corresponds to longer payment periods, shorter effective liability duration, and a progressively smaller asset–liability duration mismatch.

[Figure 4 about here]

The results reveal two systematic patterns. In absolute terms, the capital response to reputation improvements first increases and then gradually declines as the payment period lengthens. In relative terms, the proportional change in minimum capital requirements declines monotonically. These patterns reflect the interaction between reputation-driven behavior and the underlying liability structure. Products with short payment periods are characterized by long liability duration and large initial duration gaps. When reputation improves, lower surrender rates further extend liability duration. In incomplete markets, where long-duration hedging assets are scarce, this extension disproportionately amplifies exposure to interest rate risk, resulting in higher capital requirements. As the payment period lengthens and liability duration shortens, the scope for this amplification diminishes, and the capital impact of reputation correspondingly weakens.

Coverage Horizon. Coverage horizon is another key determinant of liability duration. Longer coverage horizons shift benefit payments further into the future, increasing the average timing of liability cash outflows and thus extending liability duration. Shorter coverage horizons, by contrast, imply earlier cash flows and shorter-duration liabilities.

To isolate this effect, we hold the premium payment period fixed and vary the coverage horizon from 10 years to whole life, gradually moving from short-term to long-term protection. For each specification, we compute the impact of reputation improvements on minimum capital requirements. Figure 5 summarizes the results. In absolute terms, the increase in minimum capital requirements associated with reputation improvements rises monotonically with the coverage horizon. When the coverage horizon exceeds approximately 35 years, the capital response accelerates sharply; below this threshold, changes in minimum capital requirements remain close to zero. In relative terms, the proportional change in minimum capital requirements exhibits a similar increasing pattern, with some fluctuation at shorter horizons driven by smaller baseline capital levels.

[Figure 5 about here]

These patterns reflect the interaction between reputation-driven behavior and

market incompleteness. Longer coverage horizons embed greater liability duration and convexity. When reputation improves and surrender rates decline, this long-duration structure is further extended. In markets where long-duration hedging assets are scarce, insurers cannot fully offset the resulting increase in interest rate exposure on the asset side. Beyond a sufficiently long horizon, reputation-induced extensions of liability duration therefore translate into a disproportionate widening of asset–liability duration mismatch, giving rise to the reputation paradox.

4.2 Product Risk Structure

We next examine how product risk structure shapes the magnitude of the reputation paradox. We distinguish between behavioral risk, which arises from policyholder decisions and responds to changes in firm reputation, and fundamental risk, which is embedded in the financial structure of insurance contracts and reflects their sensitivity to market fluctuations, particularly interest rate risk driven by duration and convexity.

The strength of the reputation paradox depends on the interaction between behavioral and fundamental risk rather than on either component alone. For life insurance products, this interaction is governed by the protection component of the contract. Products with higher protection components embed greater fundamental risk, causing identical reputation shocks to translate into larger capital responses. To study this channel, we conduct two sets of simulation exercises that vary risk coverage and surrender penalties, respectively.

Risk Coverage. Risk coverage is a central measure of the protection component of an insurance product. Higher risk coverage implies stronger insurance characteristics and greater exposure to contingent benefit payments, thereby embedding higher fundamental risk. By contrast, products with lower risk coverage place greater weight on savings or investment features and exhibit lower intrinsic sensitivity to market fluctuations.

We take the risk coverage of the baseline policy as the reference point and normalize it to 100 percent. Holding total policy payouts constant, we vary risk coverage from 0 to 200 percent and simulate the effect of reputation changes on

minimum capital requirements at each level. Figure 6 shows that following reputation improvements, the increase in minimum capital requirements declines monotonically as risk coverage decreases. The proportional change in capital requirements exhibits a similar narrowing pattern, converging toward zero. Symmetrically, under reputation deterioration, the reduction in capital requirements also shrinks as risk coverage declines. These results indicate that the protection component of a product is a key determinant of the magnitude of the reputation paradox.

[Figure 6 about here]

The mechanism is consistent with the framework developed earlier. High-coverage products embed long duration and high convexity, making liability values particularly sensitive to interest rate movements. Reputation improvements reduce surrender behavior and further extend this long-duration structure, disproportionately widening asset–liability duration gaps. As a result, regulatory capital requirements increase more sharply for products with higher protection components.

Surrender Penalties. Unlike risk coverage, which directly affects fundamental risk, surrender penalties operate through the behavioral channel. By increasing the cost of surrender, penalties reduce policyholders' responsiveness to changes in firm reputation and dampen behavioral risk. When surrender penalties are sufficiently high, even favorable reputation shocks have a limited effect on liability duration, as the opportunity cost of policyholder adjustment increases.

We use the surrender penalty rate from 0 to 1 percent and simulate the effects of reputation improvements and deteriorations on minimum capital requirements under each specification. Figure 7 shows that with the reputation improvements, the increase in minimum capital requirements rises monotonically with the penalty rate. Under reputation deterioration, capital requirements decline as well, with the magnitude of the reduction increasing in the penalty rate but remaining relatively small. These patterns indicate that embedded surrender penalties play an important role in shaping the transmission of reputation shocks into capital outcomes. Lower penalty rates attenuate the capital impact of reputation changes, while higher penalty rates amplify the reputation paradox.

[Figure 7 about here]

The mechanism reflects a shift in the balance between behavioral and fundamental risk. Higher surrender penalties impose a stronger economic constraint on policyholder behavior, limiting the extent to which reputation improvements reduce surrender rates. At the same time, changes in surrender penalties do not affect the increase in fundamental risk associated with longer liability duration. As a result, the offsetting role of behavioral risk weakens, and reputation-driven extensions of liability duration translate more directly into higher capital requirements. When surrender penalties are low, behavioral adjustments more effectively counterbalance changes in fundamental risk, thereby mitigating the reputation paradox.

4.3 Regulatory Regime

The preceding analyses show that the reputation paradox operates through duration mismatch and product risk structure. Whether these internal balance-sheet risks ultimately translate into observable capital pressure, however, depends critically on how regulation identifies, measures, and capitalizes risk. Different regulatory frameworks vary substantially in their sensitivity to duration and interest rate exposure. As a result, the extent to which reputation-induced liability adjustments are converted into binding capital requirements is inherently shaped by regulatory design. To assess the economic relevance and boundary conditions of the reputation paradox, it is therefore necessary to examine it across alternative regulatory regimes.

We conduct a comparative analysis across three frameworks that represent distinct regulatory philosophies in global insurance markets: China's risk-oriented solvency regime (C-ROSS II), Europe's Solvency II framework, and the U.S. risk-based capital (RBC) system. These regimes differ markedly in their treatment of interest rate risk and duration mismatch, providing a natural environment to study how regulation mediates the capital effects of reputation. Holding the underlying asset–liability structure fixed, we apply each regulatory framework in turn and simulate the impact of reputation improvements on minimum capital requirements. This approach isolates the role of regulatory rules from balance-sheet composition.

Figure 8 reports the results. Under the risk-sensitive regimes, C-ROSS II and Solvency II, reputation improvements lead to substantial increases in minimum capital requirements. In contrast, under the U.S. RBC framework, the capital response to reputation changes is minimal and economically negligible. In this regime, the reputation paradox is substantially attenuated or disappears altogether. These patterns indicate that regulatory design constitutes a fundamental boundary condition for the emergence and severity of the reputation paradox, which primarily manifests under modern, risk-sensitive solvency frameworks.

[Figure 8 bout here]

The underlying mechanism follows directly from how these regimes internalize balance-sheet risk. C-ROSS II and Solvency II rely on detailed stress testing to capture the sensitivity of asset and liability values to market movements. When reputation improvements extend liability duration and widen duration gaps, these exposures are explicitly identified and translated into higher capital charges. By contrast, the RBC framework applies relatively coarse measures of interest rate risk and exhibits limited sensitivity to duration changes. As a result, reputation-driven adjustments on the liability side do not propagate into capital requirements with the same force, muting the reputation paradox under this regulatory structure.

5. Further Discussion: Short-term Capital Strain versus Long-term Value Creation

The preceding analysis demonstrates that reputation improvements can increase capital strain in the short run (the “reputation paradox”). This naturally raises a central question: if reputation building temporarily raises capital requirements and tightens solvency positions, why do insurers voluntarily invest resources in maintaining reputation? The answer lies in the intertemporal dynamics of reputation: there exists a trade-off between immediate regulatory costs and long-term franchise value. This section provides multi-period simulation evidence showing that although reputation improvements tighten capital constraints initially, they generate sustained increases in economic value over longer horizons, thereby offering an economic rationale for reputation management

activities.

5.1 Panel Vector Autoregression and Multi-period Simulation

To capture the dynamic propagation of reputational shocks, we estimate a panel vector autoregression (PVAR) model linking reputation and surrender behavior over a 10-year horizon. The PVAR framework accommodates feedback among variables and captures both the direct effects of reputational improvements and their indirect propagation through liability persistence.

The procedure is as follows. First, we compute firm-year changes in reputation relative to baseline and feed these shocks into a recursively identified PVAR system. The estimation yields impulse response functions that trace the evolution of surrender deviations - defined as the percentage difference in surrender values from baseline - over ten forward periods. Figure 9 shows the resulting path of surrender deviations, which varies systematically with the magnitude of the initial reputational shock. The horizontal axis reports the years following the onset of the reputational shock; moving from left to right corresponds to Year 1 through Year 10. A positive reputational shock (improvement) generates a negative surrender deviation, indicating reduced policyholder exit, with the effect decaying gradually over time.

[Figure 9 bout here]

Using these surrender deviation paths, we calibrate the liability cash flows for a representative life insurer under alternative reputational scenarios. Specifically, we adjust the baseline surrender curve by the period-specific percentage deviations derived from the PVAR impulse responses. The adjusted surrender patterns then determine the evolution of in-force policies, which in turn affect two key outcomes: minimum capital requirements (MCR) and embedded value (EV). Before presenting the simulation results, we first clarify the concept of embedded value and its role in this dynamic analysis.

5.2 Embedded Value

Embedded value (EV) is a standard metric in the life insurance industry that measures the present value of future profits embedded in a company's in-force book of business,

plus adjusted net asset value (European Insurance CFO Forum, 2005). Unlike accounting book value, which reflects historical costs, EV captures the economic value of long-term insurance contracts by discounting expected future cash flows from premiums, claims, expenses, and investment returns. For life insurers, EV is widely used to assess shareholder value creation because it accounts for the multi-period nature of policy obligations.

In the dynamic analysis of this study, EV serves as a forward-looking indicator of the benefits of policy persistence: lower surrender rates keep policies in force longer, thereby extending the stream of future profits embedded in the block of business. Thus, EV directly quantifies the long-term economic gains from reputation improvements, providing a direct contrast with the short-run increase in MCR - a key to resolving the "reputation paradox" puzzle.

5.3 Multi-period Simulation of MCR and EV

Figure 10 presents multi-period simulation results for in-force policies, MCR, and EV under alternative reputational scenarios over a 10-year horizon. Each subplot contains multiple curves corresponding to different magnitudes of reputational shocks.

[Figure 10 bout here]

In the short term (Years 1 - 3), following a positive reputational shock, surrender rates decline sharply, reducing liability outflows and increasing the stock of in-force policies. However, as shown in Panel B of Figure 10, MCR rises significantly during the first three years—consistent with the reputation paradox documented earlier: extended liability duration and asset-liability mismatch amplify interest rate risk capital charges. At the same time, Panel C shows that EV initially declines relative to the baseline. This short-term EV reduction reflects two forces. First, higher MCR implies that more capital is tied up to satisfy regulatory requirements, reducing distributable earnings. Second, the present value of future profits may be weighed down by the increased cost of capital and the decrease in lapse gain. Thus, over the first three years, reputational improvement appears to impose both capital strain and modest economic drag.

In medium to long term, the pattern reverses from the beginning around year four, Reduced surrender rates keep policies in force for longer, generating a larger and more persistent stream of future premiums and profits. In-force policies (Panel A) remain at a higher level relative to the baseline, while the incremental capital required to support this larger block of business grows at a decelerating rate. As a result, EV turns positive and rises steadily from year four onward.

This dynamic pattern illustrates a clear intertemporal tradeoff. The capital strain induced by reputation improvements is front-loaded, reflecting immediate adjustments in asset-liability mismatch and regulatory charges. The economic benefits, by contrast, accrue gradually, as enhanced policy persistence translates into a larger and more valuable long-term profit stream. Importantly, the EV gains in later years more than offset the early-stage capital costs, implying that reputation building activities are economically rational from a shareholder value perspective despite their near-term regulatory consequences.

5.4 Implications for Reputation Management

Insurers continue to invest in reputation building because the long-term value creation effect dominates the short-term capital strain. The reputation paradox is inherently a transient phenomenon: minimum capital requirements increase initially, but embedded value rises significantly over a multiyear horizon. Reputation serves as a strategic asset that stabilizes liability structures and reduces customer churn, generating predictable long-term cash flows that are valuable even if they temporarily tighten regulatory constraints. In practice, long-term-oriented insurers weigh the immediate cost of capital against the franchise value of customer retention.

6. Conclusion

This paper studies how corporate reputation affects capital requirements for financial intermediaries with long-term liabilities in incomplete markets. While reputation is commonly viewed as an intangible asset that stabilizes customer behavior and relaxes capital constraints, this view implicitly assumes that reputation-induced liability risks can be fully hedged. We show that this assumption need not hold. In settings

characterized by long-duration liabilities and a scarcity of long-term safe assets, improvements in reputation can increase capital strain, a phenomenon we refer to as the reputation paradox.

Using the Chinese life insurance market as an empirical setting, we develop a three-stage framework that integrates LLM measures of corporate reputation, causal estimation of policyholder surrender behavior, and actuarial ALM under risk-sensitive regulatory standards. We find that reputation improvements significantly reduce surrender behavior, but at the same time lengthen effective liability duration. The resulting increase in asset-liability duration mismatch raises interest-rate-sensitive capital charges and dominates the mitigating effect of lower behavioral risk. As a consequence, minimum capital requirements increase following reputation improvements. This pattern is robust across major long-term insurance products and is not driven by changes in pricing, asset allocation, or other supply-side factors.

We further show that the magnitude of the reputation paradox depends on liability duration, product risk structure, and regulatory design. The effect is stronger for products with longer duration and higher protection components, and it is most pronounced under risk-sensitive solvency regimes such as C-ROSS II and Solvency II. In contrast, under the U.S. risk-based capital framework, which exhibits limited sensitivity to duration risk, the effect is substantially weaker. Moreover, reputation improvements may also reduce actual capital under adverse interest rate scenarios, leading to a deterioration in solvency ratios through a simultaneous increase in required capital and decline in actual capital.

These findings help clarify how intangible assets interact with balance-sheet structure and regulatory frameworks to shape the financial soundness of institutions with long-term liabilities. Although our analysis focuses on life insurers, the mechanisms we find are likely to apply more broadly to other financial institutions with long-duration obligations, such as pension plans and annuity providers, and highlight the capital consequences of reputation improvements under specific market and regulatory environments.

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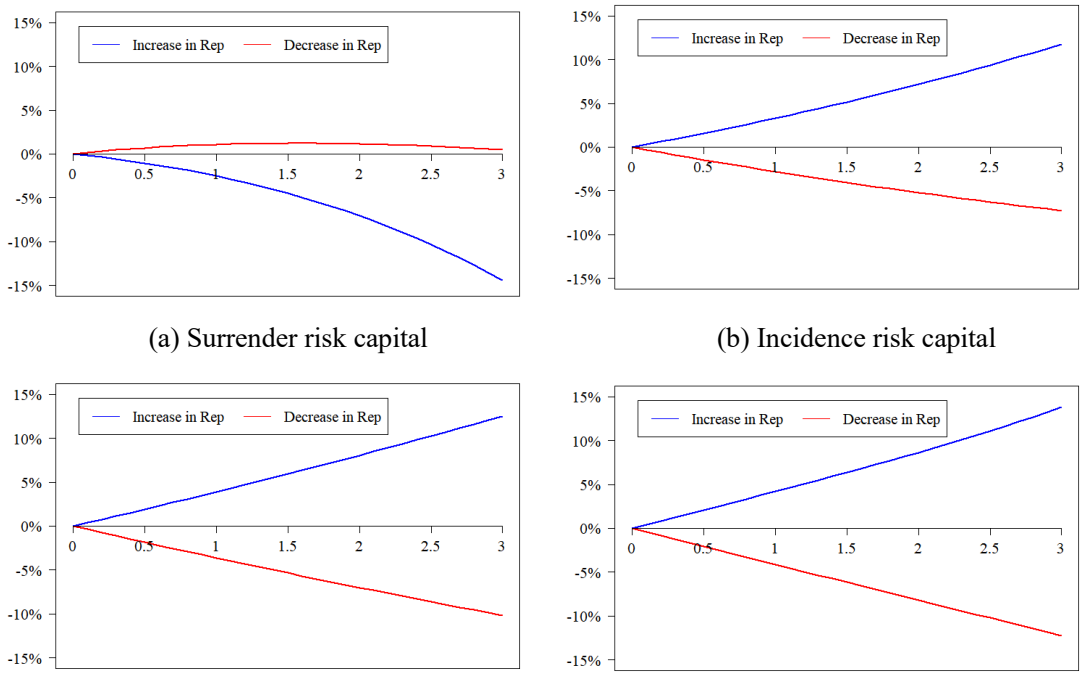
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Tables and Figures



(a) Surrender risk capital

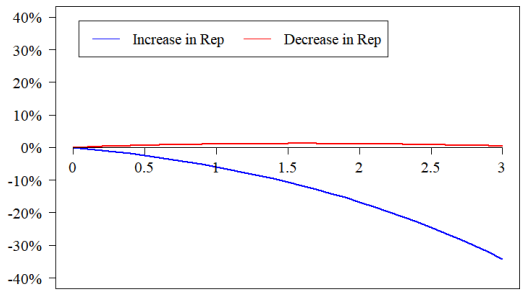
(b) Incidence risk capital

(c) Liability-side interest rate risk capital

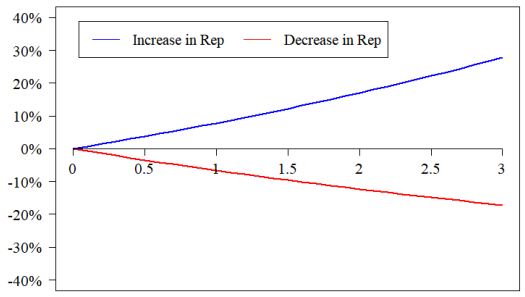
(d) Total MCR

Figure 1. Liability-Side Minimum Capital Responses to Reputation Risks

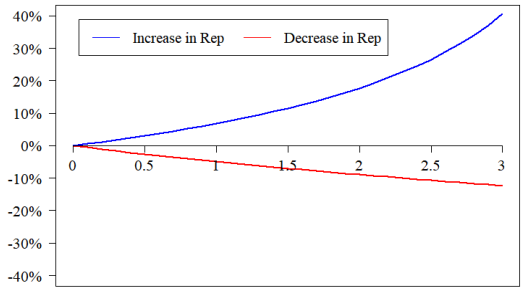
Notes: The figure reports simulated percentage changes in liability-side minimum capital requirements (MCR) relative to baseline total MCR as reputation deviates from its mean by 0 to 3 standard deviations. The subplots correspond to surrender risk capital, incidence risk capital, liability-side interest rate risk capital, and total MCR. Blue lines denote reputation improvements, while red lines denote reputation deteriorations.



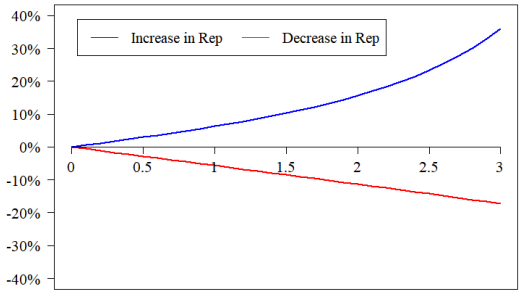
(a) Surrender risk capital



(b) Incidence risk capital



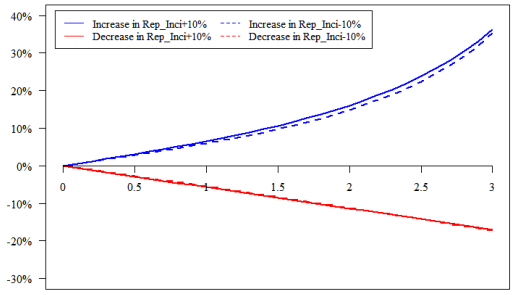
(c) Market risk capital



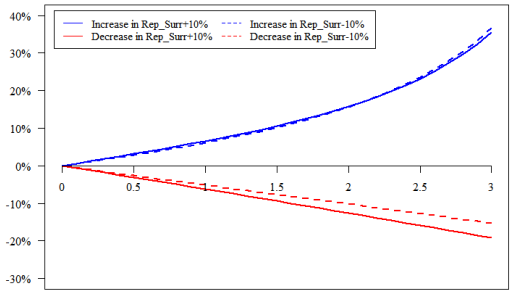
(d) Total MCR

Figure 2. Minimum Capital Responses to Reputation Risks with Asset-Liability Interaction

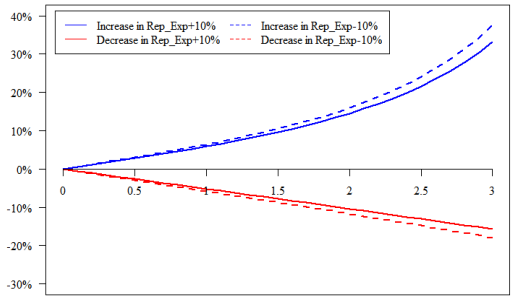
Notes: This figure reports simulated percentage changes in minimum capital requirements (MCR) relative to baseline total MCR as reputation deviates from its mean by 0 to 3 standard deviations, incorporating both liability-side and asset-side risks. The subplots correspond to surrender risk capital, incidence risk capital, market risk capital, and total MCR. Blue lines denote reputation improvements, while red lines denote reputation deteriorations.



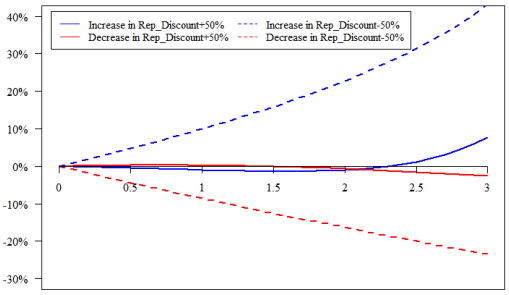
(a) Sensitivity tests for incidence rates



(b) Sensitivity tests for surrender rates



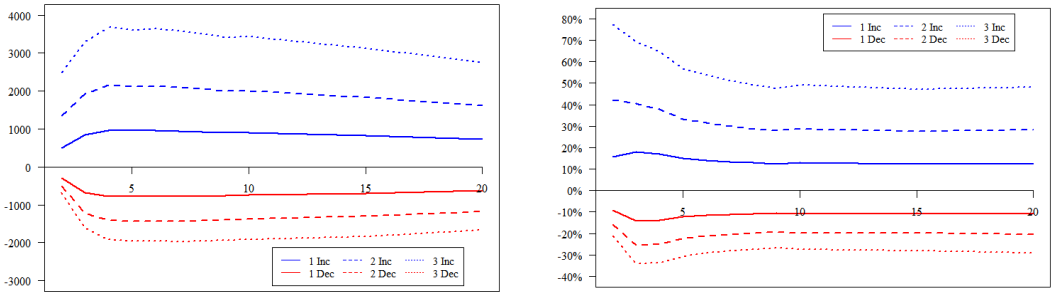
(c) Sensitivity tests for expense rates



(d) Sensitivity tests for discount rates

Figure 3. Sensitivity Analysis of Minimum Capital Responses to Reputation Risks

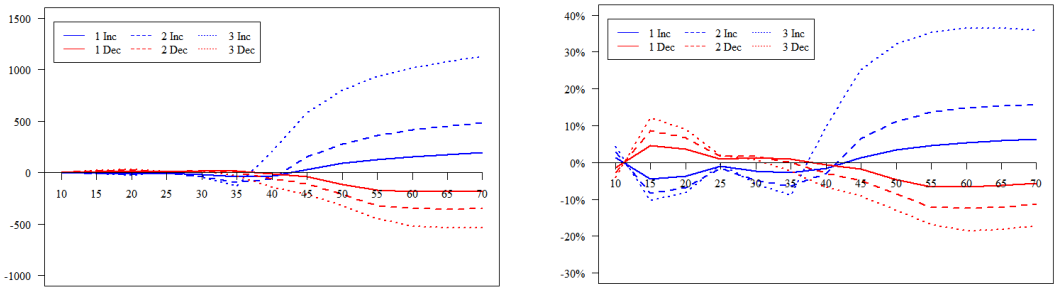
Notes: This figure reports simulated percentage changes in minimum capital requirements relative to baseline total MCR under alternative actuarial assumptions as reputation deviates from its mean by 0 to 3 standard deviations. The four subplots correspond to sensitivity tests for incidence rates, surrender rates, expense rates, and discount rates. Incidence, surrender, and expense rates are perturbed by plus or minus 10 percent relative to baseline assumptions, while discount rates are adjusted by plus or minus 50 basis points. Solid lines represent baseline assumptions, and dashed lines represent alternative assumptions. Blue lines denote reputation improvements, while red lines denote reputation deteriorations.



(a) Absolute changes in minimum capital (b) Relative changes in minimum capital

Figure 4. Transmission of the Reputation Paradox through Premium Payment Duration

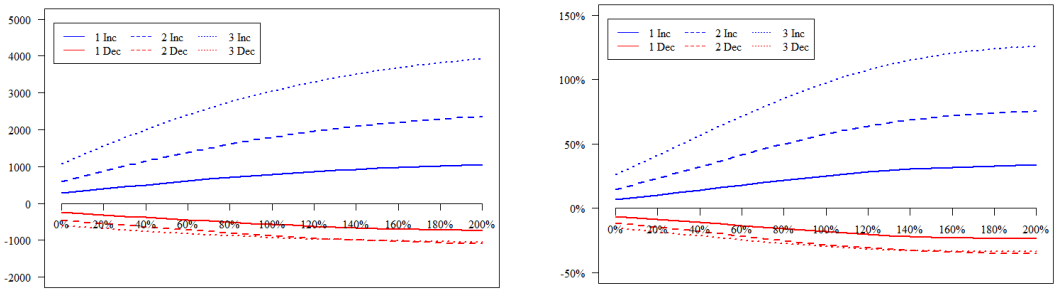
Notes: This figure reports simulated changes in minimum capital requirements across alternative premium payment periods. The horizontal axis shows the length of the payment period ranging from 2 to 20 years, with longer periods corresponding to shorter effective liability duration and smaller duration mismatch. The panel (a) reports absolute changes in minimum capital, and the panel (b) reports relative changes scaled by baseline total minimum capital. Blue lines denote reputation improvements and red lines denote reputation deteriorations. Different line styles correspond to reputation deviations of one, two, and three standard deviations from the mean.



(a) Absolute changes in minimum capital (b) Relative changes in minimum capital

Figure 5. Transmission of the Reputation Paradox through Coverage Duration

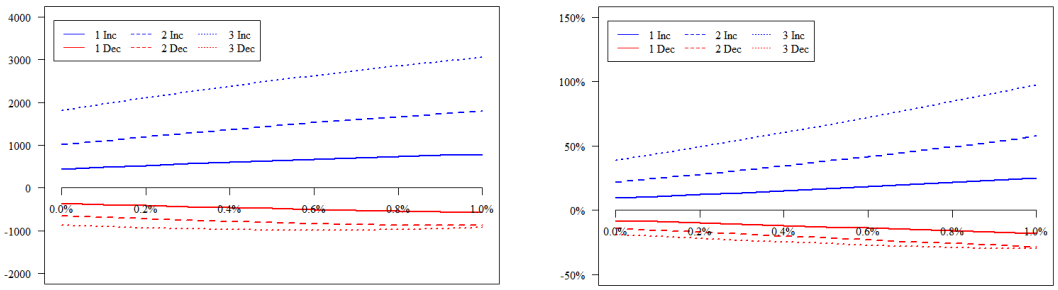
Notes: This figure reports simulated changes in minimum capital requirements across alternative coverage durations. The horizontal axis shows the length of the coverage period, with longer coverage corresponding to longer effective liability duration and greater duration mismatch. The panel (a) reports absolute changes in minimum capital, and the panel (b) reports relative changes scaled by baseline total minimum capital. Blue lines denote reputation improvements and red lines denote reputation deteriorations. Different line styles correspond to reputation deviations of one, two, and three standard deviations from the mean.



(a) Absolute changes in minimum capital (b) Relative changes in minimum capital

Figure 6. Risk Coverage and the Strength of the Reputation Paradox

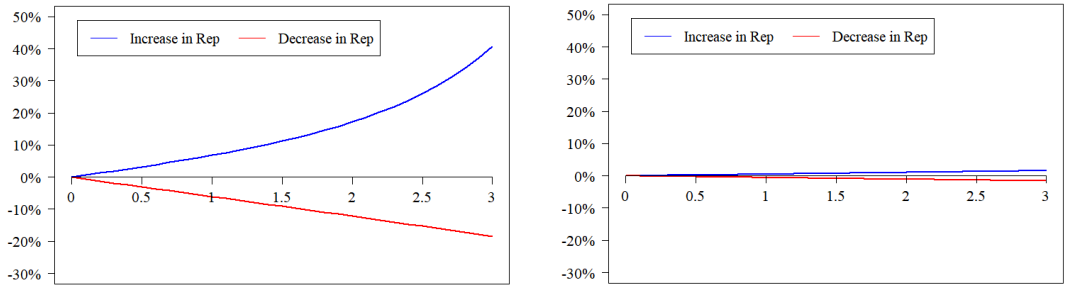
Notes: This figure reports simulated changes in minimum capital requirements across alternative levels of risk coverage. Risk coverage is normalized to one hundred percent at the baseline level and varies from zero to two hundred percent while holding total policy outlays constant. Panel (a) reports absolute changes in minimum capital, and panel (b) reports relative changes scaled by baseline total minimum capital. Blue lines denote reputation improvements and red lines denote reputation deteriorations. Different line styles correspond to reputation deviations of one, two, and three standard deviations from the mean.



(a) Absolute changes in minimum capital (b) Relative changes in minimum capital

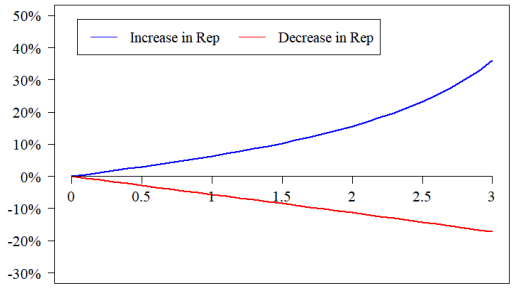
Figure 7. Surrender Penalties and the Strength of the Reputation Paradox

Notes: This figure reports simulated changes in minimum capital requirements across alternative levels of surrender penalties. The surrender penalty parameter varies from zero to one percent relative to baseline assumptions. Panel (a) reports absolute changes in minimum capital, and panel (b) reports relative changes scaled by baseline total minimum capital. Blue lines denote reputation improvements and red lines denote reputation deteriorations. Different line styles correspond to reputation deviations of one, two, and three standard deviations from the mean.



(a) Solvency II

(b) RBC



(c) C-ROSS

Figure 8. Regulatory Regimes and Capital Responses to Reputation Risks

Notes: This figure reports simulated percentage changes in minimum capital requirements under alternative regulatory regimes as reputation deviates from its mean by 0 to 3 standard deviations. The subplots correspond to Solvency II, the US risk-based capital framework, and the Chinese risk-oriented solvency regime C-ROSS. Simulations are conducted holding the underlying asset–liability structure fixed while applying each regulatory rule set. Blue lines denote reputation improvements and red lines denote reputation deteriorations.

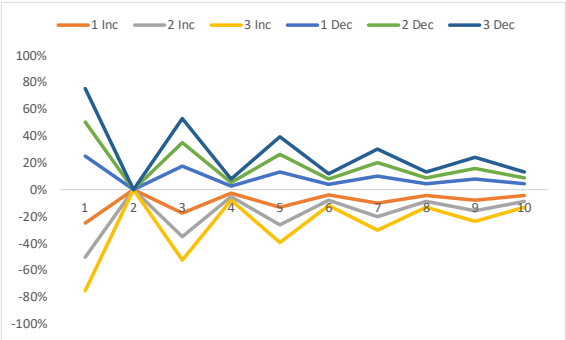
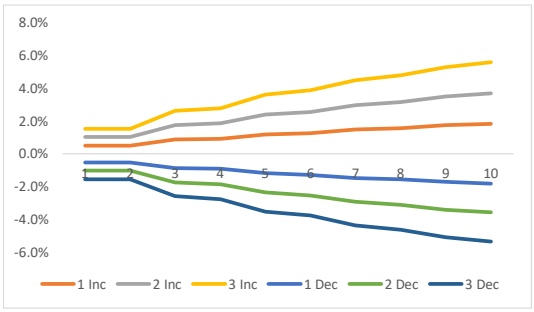
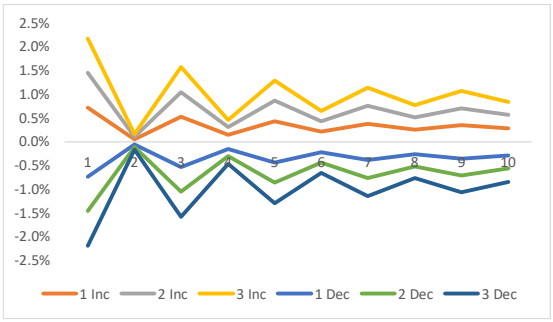


Figure 9. Relative Changes in Surrender Deviations under Reputational Shocks

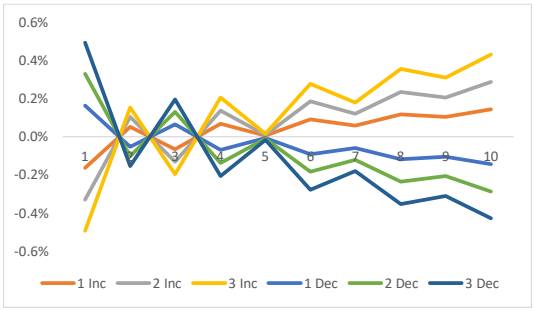
Notes: The horizontal axis reports the years following the onset of the reputational shock; moving from left to right corresponds to Year 1 through Year 10. The vertical axis shows the percentage deviation of surrender values from the baseline. Blue lines denote reputation improvements, and red lines denote reputation deteriorations. Different line styles correspond to reputation deviations of one, two, and three standard deviations from the mean.



(a) Relative Changes in In-force Policies



(b) Relative Changes in Minimum Capital Requirements



(c) Relative Changes in Embedded Value

Figure 10. Relative Changes in In-force Policies, Minimum Capital Requirements, and Embedded Value under Reputational Shocks

Notes: This figure reports simulated percentage changes in (a) cumulative in-force policies, (b) minimum capital requirements (MCR), and (c) embedded value (EV) relative to baseline over a 10-year horizon, based on the surrender deviation paths from Figure 9. The horizontal axis reports the years following the onset of the reputational shock; moving from left to right corresponds to Year 1 through Year 10. Blue lines denote reputation improvements, and red lines denote reputation deteriorations. Different line styles correspond to reputation deviations of one, two, and three standard deviations from the mean.

Table 1. Summary Statistics

Variable	Source	Obs.	Mean	S.D.
Panel A. Dependent Variables:				
Surrender values	A	442	7.539	15.520
Insurance reserve values	A	442	10.055	2.032
Panel B. Regressor of Interest:				
Reputation_LLM	B	442	15.740	73.507
Reputation_BERT	B	442	14.681	70.808
Reputation_RoBERTa	B	442	17.548	77.515
Reputation_MacBERT	B	442	14.523	70.134
Panel C. Control Variables:				
Policyholder dividend expenditures	A	442	42.070	92.745
Investment Income	A	442	11.577	28.776
Commission and Fee Expenses	A	442	4.741	11.952
Net Premiums Earned	A	442	41.160	89.832
Total Assets	A	442	245.754	604.587
New Business Premiums	A	442	18.086	33.020
GDP Growth rate	C	442	0.094	0.048
Unemployment rate	C	442	3.986	0.163
Consumer Price Index	C	442	0.021	0.006
Per capita disposable income growth rate	C	442	0.084	0.021

Notes: A: Insurance Company Financial Disclosures; B: Textual Data from Media News Reports in CSMAR Database; C: City Statistical Yearbooks.

Table 2. Effects of Reputation on Surrender Values

	(1)	(2)	(3)	(4)
Panel A: Reduced Form	Surrender values			
Reputation (based on four types of LLM measurements)	-0.049***	-0.045***	-0.052***	-0.051***
	(0.013)	(0.013)	(0.013)	(0.013)
Panel B: First Stage	Reputation_ LLM	Reputation_ BERT	Reputation_ RoBERTa	Reputation_ MacBERT
Bartik IV (Growth in total litigation weighted by penalty shares)	1.614*	1.526*	1.654*	1.581*
	(0.947)	(0.905)	(0.976)	(0.900)
Panel C: 2SLS	Surrender values			
Reputation (based on four types of LLM measurements)	-0.164**	-0.175**	-0.159**	-0.166**
	(0.070)	(0.075)	(0.068)	(0.071)
Control variables	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Outcome mean	7.539	7.539	7.539	7.539
Observations	442	442	442	442
R^2	0.744	0.732	0.751	0.747

Notes: This table reports the estimated impact of corporate reputation on surrender values using a Bartik IV approach. Panel A presents the reduced-form estimates, where the dependent variable is the log of surrender values and the independent variable is the Bartik IV. Panel B reports the first-stage results, where four different versions of the reputation index, generated via LLM, BERT, RoBERTa, and MacBERT using an active learning framework, are regressed on the Bartik IV. The Bartik IV is constructed as the interaction between the aggregate growth rate in litigation and the baseline share of insurance industry penalties. Panel C presents the 2SLS estimates. Control variables include policyholder dividend expenditures, investment income, commission and fee expenses, net premiums earned, total assets, new business premiums, and macroeconomic indicators (GDP growth, unemployment rate, CPI, and per capita income growth). Firm-level and year-level fixed effects are included in all specifications. Robust standard errors clustered at the firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3. Effects of Reputation on Insurance Reserve Values

	(1)	(2)	(3)	(4)
Panel A: Reduced Form	Insurance reserve values			
Reputation (based on four types of LLM measurements)	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Panel B: First Stage	Reputation_ LLM	Reputation_ BERT	Reputation_ RoBERTa	Reputation_ MacBERT
Bartik IV (Growth in total litigation weighted by penalty shares)	1.614*	1.526*	1.654*	1.581*
	(0.947)	(0.905)	(0.976)	(0.900)
Panel C: 2SLS	Insurance reserve values			
Reputation (based on four types of LLM measurements)	0.006*	0.006*	0.005*	0.006*
	(0.003)	(0.003)	(0.003)	(0.003)
Control variables	NO	YES	NO	YES
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Outcome mean	10.055	10.055	10.055	10.055
Observations	442	442	442	442
R^2	0.964	0.963	0.964	0.964

Notes: This table reports the estimated impact of corporate reputation on insurance reserve values using a Bartik IV approach. Panel A presents the reduced-form estimates, where the dependent variable is the log of insurance reserve values and the independent variable is the Bartik IV. Panel B reports the first-stage results, where four different versions of the reputation index, generated via LLM, BERT, RoBERTa, and MacBERT using an active learning framework, are regressed on the Bartik IV. The Bartik IV is constructed as the interaction between the aggregate growth rate in litigation and the baseline share of insurance industry penalties. Panel C presents the 2SLS estimates. Control variables include policyholder dividend expenditures, investment income, commission and fee expenses, net premiums earned, total assets, new business premiums, and macroeconomic indicators (GDP growth, unemployment rate, CPI, and per capita income growth). Firm-level and year-level fixed effects are included in all specifications. Robust standard errors clustered at the firm level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4. Parameters for Simulation

Parameter	Specification
Premium payment period	Single premium
Policy term	Whole life
Issue age	35
Gender	Male
Premium	100,000 CNY
Pricing interest rate	2%
Benefit structure	Death or critical illness benefit paid at the sum assured, and policy terminates upon claim

Notes: This table reports the parameter settings of the representative insurance contract used as the baseline model point in the simulations. The contract is calibrated to capture long-duration, protection-oriented liabilities commonly observed in the China's life insurance market and serves as the reference case for all subsequent analyses.