How High Can Interest Rates Go Before Markets Break?

A Conditional Stress Analysis of U.S. Financial Markets and International Transmission

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Author Note

This paper converts an executed Ames Investment Systems stress-research package into APA-style academic form. The research cutoff is September 23, 2026. All simulation probabilities reported below are conditional frequencies under stated assumptions, not forecasts of real-world event probabilities.

Abstract

This study asks whether a defensible interest-rate level can be identified at which U.S. financial markets "break." Using market observations through September 23, 2026, historical episode analysis, balance-sheet stress arithmetic, a fundamental valuation engine, and a large conditional Monte Carlo laboratory, the study finds that a single universal breaking yield is not supported by the evidence. The verified 10-year U.S. Treasury yield at the research cutoff was 5.1142%. Under an illustrative fiscal and term-premium shock that also weakens earnings and raises risk premiums, an additional 50 to 100 basis points in the 10-year yield, sustained for 12 months, is associated with a simulated 40% to 89% probability of a 20% or larger month-end equity loss from the starting value. These are scenario frequencies, not calibrated forecasts. The same model produces materially lower stress under growth-led rate increases, demonstrating that the source, speed, curve shape, cash-flow response, leverage, and funding structure of a rate shock matter at least as much as the terminal yield. Duration repricing and leveraged collateral liquidity emerge as the fastest transmission channels, while refinancing and commercial real estate stress accumulate more slowly. Out-of-sample predictive tests fail to outperform a simple event-frequency benchmark, reinforcing the conclusion that the model is better suited to conditional stress analysis and risk monitoring than to point forecasting.

Keywords: interest rates, Treasury yields, financial stability, Monte Carlo simulation, liquidity, leverage, refinancing risk

How High Can Interest Rates Go Before Markets Break?

Financial-market discussions often reduce interest-rate risk to a single threshold question: How high can rates go before markets break? The phrasing is intuitively attractive because yields are observable, comparable across time, and mechanically linked to discounting. It is also incomplete. A given Treasury yield can reflect stronger real growth, persistent inflation, higher real rates, a larger term premium, fiscal-risk compensation, or some combination of these forces. Those paths imply different earnings trajectories, credit conditions, collateral demands, and policy responses. As a result, the relevant object is not one yield level but a state-dependent interaction among discount rates, cash flows, leverage, liquidity, and refinancing structure.

The market environment at the September 23, 2026 research cutoff makes that distinction consequential. The 10-year generic U.S. Treasury yield was 5.1142%, the 30-year yield was 5.3989%, and the 10-year real yield was 2.7664%. The federal funds target range had been raised to 3.75% to 4.00% one week earlier, while the S&P 500 price index stood at 7,706.03 and the VIX at 15.18 (Bloomberg L.P., 2026; Board of Governors of the Federal Reserve System [Federal Reserve], 2026b). These observations describe a high-rate starting point, but they do not by themselves establish financial instability. The Federal Reserve's May 2026 Financial Stability Report simultaneously described elevated equity valuations and low corporate spreads while also noting robust investment-grade credit quality and comparatively strong household balance sheets (Federal Reserve, 2026a). The tension between valuation sensitivity and aggregate resilience is central to the analysis.

This paper therefore treats "breaking" as a set of observable economic and market outcomes rather than a rhetorical label. Equity repricing is measured using 10%, 20%, and 30% loss thresholds. Credit stress is assessed through spread widening and bond-price losses. Market functioning is separated from asset-price declines by examining funding pressure, Treasury-market liquidity, and synthetic funding stress. Bank, commercial real estate (CRE), and refinancing outcomes are treated as stylized balance-sheet constraints rather than as a single systemic-crisis indicator. This distinction matters because a 20% equity decline can occur in an otherwise functioning market, while severe liquidity dysfunction can arise even when safe yields are falling.

The principal research question is whether the available evidence supports a universal interest-rate threshold for broad market failure. The answer is no. The study instead identifies conditional stress ranges and transmission mechanisms. In the central illustrative fiscal and term-premium scenario, a 50 to 100 basis point increase in the 10-year Treasury yield, sustained for 12 months and accompanied by weaker cash flows and higher risk premiums, produces a simulated 40% to 89% probability of a 20% or larger month-end equity loss. The same framework generates much smaller probabilities when the yield increase is associated with stronger growth. The result is not that 5.6% or 6.1% is a "break point." Rather, those levels become dangerous under particular combinations of real-rate pressure, risk-premium expansion, weak earnings, leverage, and constrained liquidity.

The contribution of the paper is therefore methodological as much as numerical. It integrates market observations, historical episodes, simple accounting identities, large-scale scenario simulation, reverse stress testing, and out-of-sample model checks. It also reports failed validation gates rather than suppressing them. That design supports a narrower but more defensible use case: conditional stress analysis, exposure ranking, and monitoring. It does not support a calibrated probability forecast of systemic crisis.

Conceptual Framework and Prior Evidence

Why a Single Yield Threshold Is Economically Weak

The first reason to reject a universal threshold is the decomposition of asset value. In a simple constant-growth valuation representation, price depends on expected cash flow and the gap between required return and long-run growth. A higher risk-free rate can reduce valuation through the discount-rate channel, but the effect can be partly or fully offset when the rate increase reflects stronger earnings or productivity. Conversely, a smaller rise in yields can be destabilizing when it coincides with deteriorating cash flows and a widening equity or credit risk premium. The interest rate is therefore one state variable inside a larger valuation system rather than a sufficient statistic for market fragility.

The second reason is that long-end yields contain multiple components. The New York Fed Adrian-Crump-Moench framework estimated a 10-year term premium of approximately 0.763 percentage points at the August 31, 2026 endpoint, with the fitted yield decomposed into an expected-rate component and a term premium (Federal Reserve Bank of New York [FRBNY], 2026). The decomposition is model dependent, but it illustrates why a 100 basis point move driven by expected growth and policy can have different implications from a 100 basis point move driven by term-premium or fiscal-risk repricing. Real yields are similarly informative but not sufficient, because market-implied inflation compensation contains liquidity and risk premiums rather than a pure inflation forecast.

A third reason is timing. Bernanke and Kuttner (2004) found that unexpected monetary-policy changes can move broad equity indexes on announcement days, but their event-study result concerns identified surprises over a short horizon. It cannot be extrapolated linearly into a multi-year forecast. Longer-horizon damage depends on the persistence of rates, the path of earnings, and the financing structure of borrowers. Fast rate moves can create immediate margin and collateral demands; slow persistence can instead accumulate through floating-rate debt and maturity walls.

Leverage, Liquidity, and Balance-Sheet Nonlinearity

Leverage can transform modest asset-price losses into severe funding demands. This mechanism is visible in the United Kingdom liability-driven investment episode of 2022, where rising gilt yields generated margin calls and forced sales by leveraged pension strategies. Aramonte and Rungcharoenkitkul (2022) emphasize that a pension scheme can experience improving long-run net worth while still facing acute cash-liquidity stress at the LDI vehicle level. The distinction between solvency and liquidity is therefore essential. A mark-to-market loss does not automatically imply insolvency, but the need to post collateral before assets can be liquidated can make otherwise solvent positions unstable.

The March 2023 failure of Silicon Valley Bank provides a related but institution-specific example. The Federal Reserve’s review found material interest-rate risk, a concentrated uninsured deposit base, removal of interest-rate hedges, and ineffective liquidity planning. Deposit outflows exceeded $40 billion on March 9, 2023 (Federal Reserve, 2023). The episode does not demonstrate that every bank fails at a particular Treasury yield. It demonstrates that duration losses become dangerous when they interact with runnable funding, weak hedging, and constrained liquidity access.

Current U.S. aggregates show both resilience and exposure. The Federal Deposit Insurance Corporation (FDIC, 2026) reported second-quarter 2026 banking-system assets of approximately $26.462 trillion, securities of $5.820 trillion, book equity of $2.628 trillion, deposits of $20.722 trillion, and gross unrealized securities losses of $326.7 billion. A stylized additional 100 basis point parallel rate increase applied to a securities portfolio with duration 5 produces an incremental gross mark of approximately $291 billion, or about 11.1% of reported book equity. That arithmetic is useful for scale, but it is not a prediction of regulatory capital depletion because hedges, accounting treatment, deposit-franchise value, earnings, and asset mix materially affect realized outcomes.

Historical Episodes and Causal Restraint

Historical episodes also argue against a one-dimensional threshold. In the selected 2013 taper-repricing window, the 10-year yield rose about 120 basis points while the broad equity index finished the window higher. In 2022, the selected window combined a roughly 225 basis point rise in the 10-year yield with a 20% terminal equity loss and a larger peak drawdown. During the 2020 funding crisis, safe yields fell while Treasury-market functioning and broad risky assets were severely stressed. The direction of rates is therefore not a necessary condition for market dysfunction.

These episodes are mechanism evidence, not matched causal experiments. The 1994 tightening cycle featured large bond-market repricing without a comparable broad-equity collapse. The 2000-2002 equity decline occurred while rates subsequently fell, creating reverse causality for any simple regression from rates to stocks. The 2004-2007 period combined policy tightening, housing and structured-credit leverage, and maturity mismatch even though long yields did not move one-for-one with the policy rate. The historical record supports the proposition that leverage, cash-flow expectations, funding structure, and shock speed condition the effect of rates; it does not identify a stable numerical break point across regimes.

Table 1

Market Conditions at the September 23, 2026 Research Cutoff

Measure	Value	Observation Date
Federal funds target upper bound	4.000%	Sep. 23, 2026
2-year Treasury generic	4.897%	Sep. 23, 2026
5-year Treasury generic	5.003%	Sep. 23, 2026
10-year Treasury generic	5.114%	Sep. 23, 2026
30-year Treasury generic	5.399%	Sep. 23, 2026
10-year real Treasury generic	2.766%	Sep. 23, 2026
S&P 500 price index	7,706.030	Sep. 23, 2026
VIX	15.180	Sep. 23, 2026
DXY	101.133	Sep. 23, 2026
IG OAS	0.77%	Sep. 22, 2026
HY OAS	2.68%	Sep. 22, 2026

Note. Bloomberg generic market observations were retrieved September 23, 2026. Public cross-checks were obtained from Federal Reserve and FRED sources. The 2-year Bloomberg generic versus H.15 comparison differed by 4.35 basis points, exceeding the study's predeclared 2-basis-point tolerance; the discrepancy was retained rather than averaged away.

Method

Research Design and Data Provenance

The study was designed as an executed conditional stress laboratory rather than a forecast exercise. The research package distinguishes four evidence categories: direct observations, external assessments, model outputs, and analyst judgment. This separation is important because numerical precision in a simulation does not imply comparable certainty about the economic structure that generated the result. The principal market calibration used 353 complete aligned monthly observations from February 1997 through August 2026. The incomplete September 2026 month was excluded from monthly calibration. Longer daily histories begin in 1990 where available, while TIPS, generic Treasury, and credit series have shorter comparable histories. Current ICE option-adjusted spread downloads available to the study began only in September 2023, so the analysis does not claim a long fitted credit-spread process.

Bloomberg data were used for the market snapshot and historical price/yield series, while public series and official assessments were used as cross-checks where available. The Federal Reserve Bank of St. Louis FRED platform supplied public macroeconomic, market, credit, and banking series with series-specific observation dates (Federal Reserve Bank of St. Louis, 2026). The New York Fed supplied the external ACM term-premium decomposition (FRBNY, 2026). The May 2026 Federal Reserve Financial Stability Report and the FDIC Quarterly Banking Profile supplied current vulnerability and bank-balance-sheet context (Federal Reserve, 2026a; FDIC, 2026).

The market snapshot was retrieved at 21:20:49 UTC on September 23, 2026. Same-date public comparisons for September 22 showed differences below 1 basis point for the 5-, 10-, 30-year, and real 10-year observations, but a 4.35 basis point difference for the 2-year observation. Because the 2-year discrepancy exceeded the predeclared 2-basis-point tolerance, the source check was marked as failed rather than reconciled by averaging. This treatment reflects the study's broader validation rule: conflicts that cannot be defensibly resolved remain visible.

Event Definitions

Equity repricing events were defined using the first monthly price at or below 90%, 80%, or 70% of the starting value, corresponding to 10%, 20%, and 30% starting-value losses. Maximum monthly peak-to-trough drawdowns at the same thresholds were tracked separately. These are conventional market-loss thresholds, not regulatory definitions. Returns exclude dividends, and monthly monitoring understates intra-month breaches.

Credit events were defined as an investment-grade price loss of at least 10% or an option-adjusted spread widening of at least 150 basis points, and a high-yield price loss of at least 15% or spread widening of at least 300 basis points. Market-functioning stress was monitored through a sustained SOFR-IORB spread above 25 basis points, Treasury depth below half of a normal benchmark with bid-ask spreads above twice normal, and a synthetic funding-stress index in simulation. Bank, refinancing, and CRE events were treated as stylized proxies: economic capital/assets below 6% or model deposit outflow above 15% for banks; cumulative model default fraction above 5%, high-yield OAS above 8%, or interest coverage below 1 for refinancing stress; and DSCR below 1 or LTV above 100% for CRE.

All cumulative event frequencies were computed over 1-, 3-, 6-, 12-, and 24-month horizons. Crucially, the bank, funding, refinancing, and CRE events are not merged into a single systemic-crisis label. Joint proxy frequencies can describe co-occurrence inside the model but cannot establish real-world contagion.

Valuation and Balance-Sheet Engine

The fundamental equity engine uses a Gordon-style accounting identity that separates cash-flow changes from changes in the net valuation gap. The core identity is shown in Equation 1.

$$P\_t / P\_0 = (E\_t / E\_0)(q\_0 / q\_t) \tag{1}$$

The baseline valuation gap q0 is assumed to be 4.5%. The variable q is the required-return-minus-long-run-growth gap, not the observed Treasury yield and not a separately estimated equity risk premium. Positive q is floored at 1.25% to avoid explosive or negative Gordon values. Historical equity returns are projected on contemporaneous 2- and 10-year yield changes; the residual is jointly resampled with curve, policy, inflation, activity, VIX, and dollar innovations. Forty percent of the cumulative equity residual enters the cash-flow index, which also receives a 6% annual baseline drift plus the scenario-specific earnings response. The remaining 60% affects q. This split is an analyst assumption rather than an empirically identified decomposition.

Treasury, investment-grade, and high-yield bond marks use exact zero-coupon repricing proxies at 8-, 7-, and 4-year maturities. The bond-price proxies omit coupon carry, changing maturity, taxes, trading costs, and issuer optionality. Mortgage-backed securities are handled separately using duration and convexity sensitivity rather than a fully option-adjusted pool valuation. Credit spread marks and realized default cash losses are kept separate to avoid mechanical double counting.

Balance-sheet stress is modeled through simple identities. Corporate refinancing begins with debt equal to six times initial EBITDA, a 6% initial coupon, varying floating-rate shares, and an exponential fixed-debt reset schedule. CRE analysis uses value = NOI/cap rate and DSCR = NOI/debt service. With the illustrative starting assumptions of a 5% cap rate, 65% LTV, 1.4 DSCR, and 6% coupon, an 8.4% refinancing rate would consume the starting DSCR buffer if NOI were unchanged. These calculations are exposure screens, not issuer-level forecasts.

Macro-Financial Scenario Transmission

The Monte Carlo engine resamples joint three-month historical blocks to preserve cross-variable dependence and some empirical clustering, tails, and jumps. Policy, 2-, 5-, 10-, and 30-year yields, real yields, inflation and activity changes, log VIX, and dollar shocks follow an AR(1)-style deviation persistence parameter of 0.85. Curve shocks differ by shape. A 100-basis-point reference shock maps one-for-one to the 10-year yield in the parallel and steepening structures, but only 50 basis points to the 10-year yield in the flattening structure. This distinction prevents reference-shock magnitudes from being mistaken for identical long-end moves.

The macro system is reduced form. It does not contain an independently estimated Taylor rule, a structural general-equilibrium feedback loop from inflation and growth to policy, or a separately simulated latent term-premium state. Term premium is used as external starting context and scenario interpretation. Named regimes are conditioning assumptions rather than probabilistic Markov states.

Amplification enters through a dimensionless funding index that combines imposed liquidity pressure, positive volatility and dollar shocks, and the speed of the move. Above an assumed threshold, leverage adds an equity-risk-premium wedge. Previous-month funding and high-yield stress depress next-month cash flows. An intervention switch can activate after a lagged 20% equity loss or severe funding proxy and then halves selected model credit, equity-risk-premium, and liquidity terms. It does not reverse the Treasury shock and therefore should be interpreted as a stylized support mechanism rather than a forecast of central-bank action.

Simulation Scale, Challengers, and Validation

The principal experiment contains 1,092 scenario configurations with 100,000 paths per configuration and all five horizons, for 109.2 million scenario-path evaluations. Shared random drivers improve cell-to-cell comparisons but do not create 109.2 million independent pieces of economic evidence. A separate 20-day collateral engine evaluates 36 shock, leverage, and intervention configurations with 100,000 paths each. That engine assumes no excess collateral buffer at inception, making margin calls nearly automatic; it is therefore used as a mechanism test rather than a real-world incidence model.

Alternative dependence specifications include Gaussian and Student-t(5) challengers using sample covariance, with bounded variance clustering in the Student-t version. A separate log-linear equity-duration challenger alters valuation convexity. Estimated-parameter sampling uncertainty is examined through 1,000 moving-block resamples of residual volatility. Structural uncertainty is examined through alternative valuation gaps, dependence families, sample choices, and credit/leverage multipliers. These ranges are sensitivity envelopes, not confidence intervals or posterior probability distributions.

An empirical correction-risk challenger uses regularized logistic models with the long-rate level, slope, three-month change, momentum, volatility, a level-by-speed interaction, and speed squared. Annual rolling refits begin in 2005 after at least 120 training observations, and each forward label must end before the first test origin. The fitted model is compared with an expanding event-frequency benchmark and a transparent Brownian first-passage approximation. This design is intended to test whether the scenario framework has predictive support rather than assuming that internal consistency is sufficient.

Table 2

Selected Scenario Assumptions per 100-Basis-Point Reference Shock

Narrative	Earnings/yr	ERP bp	HY bp	Real share	Liquidity	Leverage
Growth	3.5%	0	15	70%	0.10	1.00
Sticky	-1.5%	12	40	65%	0.25	1.00
Inflation	-2.5%	25	60	40%	0.40	1.00
Fiscal	-2.0%	40	80	80%	0.70	1.50
Stagflation	-5.0%	40	100	60%	0.60	1.30
Refinancing	-5.5%	30	130	70%	0.50	1.40
Liquidity	-2.0%	35	80	80%	1.50	2.00
Bank/CRE	-4.0%	35	100	70%	1.00	1.70
Dollar	-3.5%	30	90	75%	0.90	1.50
Stabilisation	-1.5%	12	40	65%	0.25	1.00

Note. All coefficients are analyst scenario assumptions, not estimated structural parameters or scenario probabilities. ERP = equity risk premium; HY = high yield.

Results

Conditional Equity Stress Across Scenarios

The central result is the strong dependence of equity stress on the economic narrative attached to the rate move. In selected abrupt, 24-month-hold scenarios evaluated at the 12-month horizon, a 100-basis-point parallel growth-led increase in the 10-year yield produces a 39.2% conditional frequency of a 20% or larger equity loss, with a median return of -3.8%. By contrast, a 100-basis-point fiscal/term-premium steepening scenario produces an 89.4% conditional frequency and a median return of -17.8%. A 100-basis-point liquidity-driven steepening scenario produces a 99.3% conditional frequency and a median return of -26.5%. These differences arise partly because the scenario design imposes different earnings, spread, liquidity, and leverage responses. They are model contrasts, not identified causal effects in nature.

The matched zero-additional-shock model produces a 13.8% 12-month frequency of a 20% starting-value equity loss. Under the study's deliberately simple decision rule, a "material" increase is defined as at least 10 percentage points above that matched baseline. The first grid crossing occurs at a 50-basis-point 10-year rise for the fiscal scenario, where the conditional frequency reaches 39.9%. The same 50-basis-point long-end rise produces 25.5% in the inflation narrative, 35.9% in stagflation, 46.6% in liquidity stress, 37.2% in bank/CRE stress, and 36.5% in dollar stress. The crossing is a screening threshold chosen by the analyst; it is not a statistically estimated discontinuity.

The range that motivates the headline conclusion therefore comes from the fiscal/term-premium scenario. Starting from a 10-year yield of 5.1142%, an additional 50 to 100 basis points corresponds to approximately 5.61% to 6.11%. Under the stated adverse cash-flow and risk-premium assumptions, that range is associated with about a 40% to 89% simulated probability of a 20% or larger month-end equity loss over 12 months. The study does not interpret 5.61% or 6.11% as universal breaking yields. The same yield range could be materially more benign under a stronger cash-flow path.

Table 3

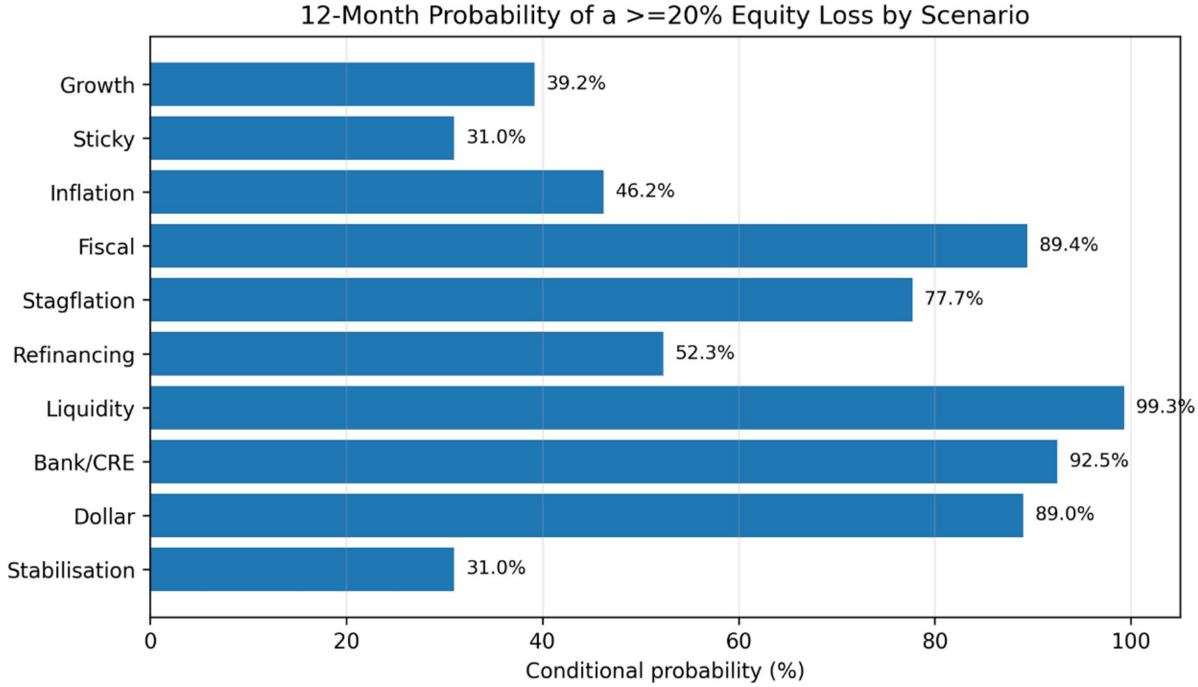
Selected 12-Month Conditional Simulation Results

Scenario	Curve	10y Rise (bp)	P20	Median	Worst 5% Mean	First Channel
Growth	Parallel	100	39.2%	-3.8%	-33.6%	Duration; cash-flow offset
Sticky	Flattening	50	31.0%	-3.7%	-34.4%	Floating debt / coupon reset
Inflation	Parallel	100	46.2%	-8.5%	-37.3%	Nominal duration and margins
Fiscal	Steepening	100	89.4%	-17.8%	-43.3%	Real/term premium; collateral
Stagflation	Parallel	100	77.7%	-16.8%	-42.8%	Cash flow plus credit/duration
Refinancing	Flattening	50	52.3%	-11.3%	-39.6%	Coverage and maturity wall
Liquidity	Steepening	100	99.3%	-26.5%	-49.0%	Repo/margin/ forced selling
Bank/CRE	Parallel	100	92.5%	-20.7%	-45.5%	Deposits / CRE refinancing
Dollar	Parallel	100	89.0%	-19.0%	-44.4%	Dollar collateral/funding
Stabilisation	Flattening	50	31.0%	-3.5%	-33.7%	Support after trigger

Note. P20 is the simulated cumulative frequency of a 20% or larger starting-value equity loss by month 12. These are conditional scenario frequencies, not real-world likelihood estimates.

Figure 1

Conditional 12-Month Probability of a 20% or Larger Equity Loss



Note. Selected abrupt scenarios evaluated at 12 months. Different scenario narratives impose different earnings, risk-premium, liquidity, and leverage responses; the bars should not be interpreted as causal estimates or unconditional forecasts.

Timing, Funding, and Intervention

The model suggests that traded duration and equity valuation can reprice faster than slower-moving balance-sheet stress. In the intentionally severe fiscal case with a 150-basis-point 10-year rise held for 24 months and no intervention, the conditional mean first monthly observation of a 20% equity breach is approximately one month among paths that breach. Joint equity-credit stress rises with horizon, and joint bank-funding proxy events accumulate more gradually. The event ordering should not be interpreted as a universal sequence because monthly observation creates ties and the high-frequency collateral engine uses different assumptions.

The matched intervention experiment illustrates a second distinction: support can reduce subsequent credit and funding deterioration without erasing losses that have already occurred. In the +100-basis-point fiscal case, the 12-month 20% equity-loss frequency is 89.4% without support and 89.3% with support, because many equity breaches occur before the intervention can affect the path. Yet the 12-month high-yield proxy event falls from 6.7% to 0.0% and the funding proxy from 19.0% to 3.8% under the stylized support rule. These magnitudes are assumed response effects, not estimates of a specific central-bank program.

This mechanism is consistent with the broader historical distinction between price adjustment and market dysfunction. The Federal Reserve's March 2020 actions explicitly targeted Treasury and agency MBS market functioning during a period in which safe yields were falling, underscoring that liquidity impairment is not synonymous with high nominal yields (Federal Reserve, 2020). A stress framework that treats equity loss, funding stress, and solvency as separate outcomes is therefore more informative than a single "market break" label.

Reverse Stress and Balance-Sheet Thresholds

Reverse stress tests provide a complementary way to interpret the scenario results. With unchanged cash flow and a 4.5% initial valuation gap, the required increase in the net discount gap for a price loss L is q0[1/(1-L) - 1]. The implied increases are 50 basis points for a 10% loss, 112.5 basis points for a 20% loss, and approximately 192.9 basis points for a 30% loss. These are valuation identities, not Treasury-yield targets. A real-yield change does not pass through one-for-one to the valuation gap, and cash-flow responses can dominate the result.

When adverse shocks are allowed to combine across real yields, earnings, and the equity risk premium, the smallest analyst-scaled solution for a 20% equity loss uses approximately 48.6 basis points of real-yield pressure, a 2.7% earnings loss, and a 48.6-basis-point equity-risk-premium increase. The optimization metric is a chosen scaled distance rather than a likelihood function. Therefore, "smallest" means smallest under the specified metric, not most probable in the real world.

Non-equity reverse calculations are also informative for exposure screening. Under the study's simplified assumptions, a Treasury proxy with an eight-year maturity requires approximately 139 basis points of combined yield increase for a 10% price loss. The CRE illustration requires about 240 basis points of refinancing-rate increase from a 6% starting coupon to move the starting 1.4 DSCR to 1.0 if NOI is unchanged. The stylized bank example, moving economic capital from 10% to 6% with 25% of assets in duration-5 securities, corresponds to an approximately 320-basis-point incremental rate shock. These numbers are not failure thresholds for real institutions; they are mechanical screens that identify where more detailed position-level data would be required.

Structural Uncertainty Dominates Monte Carlo Error

Pure simulation error is small relative to model uncertainty. With 100,000 paths, the maximum approximate 95% binomial half-width for a cell is about 0.31 percentage points. Repeating selected calculations with independent seeds and comparing 50,000 versus 100,000 paths produced differences well below a 1-percentage-point practical tolerance. Those checks establish numerical stability; they do not establish economic validity.

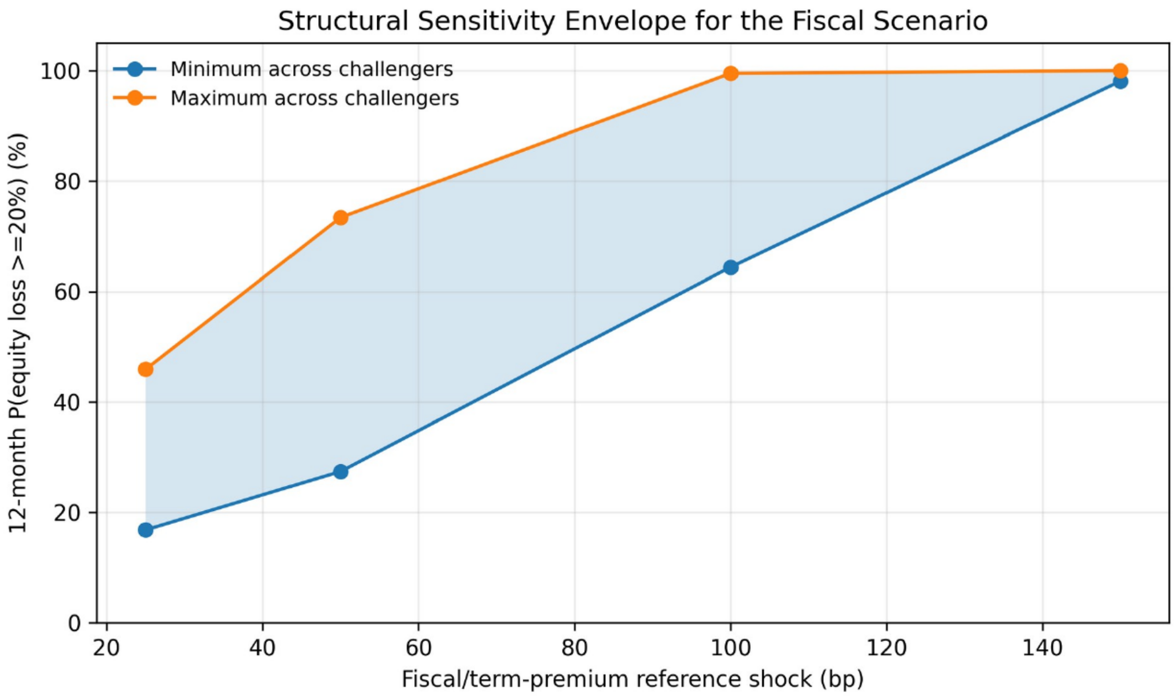
The larger uncertainty comes from assumptions and model structure. Across three dependence families and three valuation-gap assumptions, the 12-month fiscal-scenario probability of a 20% equity loss ranges from 16.8% to 45.9% for a 25-basis-point shock, 27.4% to 73.4% for 50 basis points, 64.4% to 99.5% for 100 basis points, and 98.1% to 100.0% for 150 basis points. The wide sensitivity envelope is a direct warning against treating a narrow Monte Carlo standard error as overall confidence.

Estimated residual-volatility uncertainty is smaller in the severe +150-basis-point fiscal case: 1,000 moving-block resamples generate volatility scales of roughly 0.918, 1.000, and 1.091

at the low, median, and high reference points, with the 20% equity-loss frequency remaining close to 100%. This stability reflects the severity of the imposed scenario, not certainty about its real-world incidence.

Figure 2

Fiscal-Scenario Structural Sensitivity Envelope



Note. Minimum and maximum 12-month P20 values across three dependence families and three valuation-gap assumptions. The width of the envelope represents assumption sensitivity, not a statistical confidence interval.

Predictive Validation

The most important validation result is negative. In a genuinely forward-labeled rolling test of a 20% equity loss over 12 months, the regularized logistic model produced a Brier score of 0.086 and a log score of 0.319 across 248 test observations with 20 events. The expanding-frequency benchmark achieved a lower Brier score of 0.078 and a lower log score of 0.299. Because lower scores are better, the fitted nonlinear model failed the predeclared predictive-skill gate. The volatility benchmark was worse still, with a Brier score of 0.098.

Normal-return benchmark interval coverage also deteriorated with horizon. The nominal 95% intervals covered 92.2% of one-month outcomes, 93.7% at three months, 93.3% at six months, 88.0% at 12 months, and 87.2% at 24 months. The long-horizon undercoverage is consistent with nonstationarity, fat tails, and regime shifts that are difficult to capture with a simple stationary return benchmark.

At the same time, numerous internal integrity tests passed: probability bounds, nested equity thresholds, horizon monotonicity, tail ordering, valuation identities, reverse-solver constraints, seed reproduction, convergence, market-date cutoff, and exclusion of the incomplete September month. The correct interpretation is therefore mixed. The machinery is reproducible and internally coherent, but the historical predictive evidence is not strong enough to promote the conditional scenario outputs into calibrated forecasts.

Table 4

Selected Validation Results

Test	**Status**	**Result**
Path counts	Pass	1,092 configurations; 100,000 paths each
Probability bounds	Pass	All probabilities finite and within [0, 1]
Nested equity thresholds	Pass	P10 >= P20 >= P30
Horizon monotonicity	Pass	Cumulative event probabilities nondecreasing
Seed reproduction	Pass	Independent 10,000-path repeat matched exactly
50k vs. 100k convergence	Pass	Maximum probability change 0.00045
Market cutoff	Pass	No observation after research cutoff
Predictive skill vs. frequency	Fail	Brier: logistic 0.086 vs. frequency 0.078
Same-date 2y source tolerance	Fail	4.35 bp discrepancy exceeded 2 bp rule
Systemic probability calibration	Not established	Insufficient institution-level run/loss data
Independent expert review	Not established	No separate human expert review executed

Note. The failed predictive gate is central to interpretation: successful code and accounting checks do not establish forecasting skill.

Discussion

A State-Dependent Breaking Range, Not a Breaking Yield

The evidence supports a conditional answer to the paper's title question. Rates can rise considerably without causing a broad market failure when the move is gradual, cash flows improve, leverage is contained, and funding remains stable. Conversely, a smaller long-end move can produce severe stress when real yields or term premiums rise abruptly while earnings weaken, risk premiums widen, and leveraged intermediaries face collateral calls. The most useful threshold is therefore not a single yield; it is the intersection of a rate move with balance-sheet and liquidity constraints.

The central fiscal/term-premium result should be read in precisely that form. A 10-year yield around 5.6% to 6.1% is not inherently a breaking level. In the model, that range becomes dangerous when paired with a deliberately adverse earnings and risk-premium response. The growth scenario demonstrates the opposite case: even a 100-basis-point parallel increase in the 10-year yield produces a much smaller 12-month stress frequency because stronger cash flows absorb part of the discounting shock. The scenario comparison is therefore a useful diagnostic of mechanism, not evidence that one narrative is more likely than another.

This distinction is consistent with current official assessments. The Federal Reserve's May 2026 report described valuation pressures and leverage vulnerabilities while also emphasizing robust investment-grade credit quality and comparatively strong household balance sheets (Federal Reserve, 2026a). The ECB similarly described markets as having remained comparatively orderly while warning that stretched valuations, thin nonbank liquidity buffers, and margin or redemption dynamics could amplify shocks (European Central Bank [ECB], 2026). The common implication is that resilience and fragility can coexist in different parts of the system.

Transmission Sequence and Exposure Ranking

The model and historical evidence point to a plausible sequence of transmission. Traded duration and long-duration equities can reprice immediately because required returns change continuously. Leveraged collateral positions can become binding within days if haircuts or margin requirements rise. Floating-rate borrowers and maturity walls deteriorate more slowly as debt service resets and refinancing volumes accumulate. Banks and CRE sit between these time scales: mark-to-market losses can be immediate, but realized capital and refinancing effects depend on deposit behavior, accounting classification, hedging, NOI, and maturity timing.

This sequencing implies different monitoring priorities by exposure. Treasury basis and repo strategies require intraday or daily attention to haircuts, collateral, and dealer capacity. Banks require deposit-flow, liquidity-buffer, and economic-value monitoring in addition to regulatory capital ratios. Private credit and leveraged loans require interest-coverage and amendment/PIK analysis because contractual modifications can delay recognition without removing economic stress. CRE requires joint monitoring of cap rates, NOI, DSCR, LTV, and the maturity calendar. Foreign dollar borrowers require dollar, cross-currency basis, collateral, and swap-line access monitoring.

The key operational distinction is between repricing and impairment. Lower asset prices with functioning repo, successful auctions, and available intermediation are painful but orderly. Market-functioning impairment requires evidence of execution or funding failure. Solvency stress requires losses that exceed genuine buffers or an inability to refinance. Collapsing those stages into one "break" variable would obscure the mechanisms that matter for risk management.

Monitoring Implications

The study's monitoring dashboard is designed around combinations of signals rather than isolated thresholds. A rapid 50-basis-point increase in nominal or real 10-year yields over roughly 20 trading days is treated as a rate-speed warning, while a cumulative 100-basis-point increase triggers deeper review. Credit review thresholds include high-yield OAS widening of 300 basis points or a level above 800 basis points, and investment-grade widening of 150 basis points. Persistent SOFR-IORB spreads above 25 basis points, and especially above 50 basis points, are treated as funding-pressure signals rather than as mechanical crisis calls.

Market functioning requires microstructure evidence. The operational Treasury trigger is depth below half of its rolling 20-day median combined with bid-ask spreads above twice normal. Because the research package did not include a live intraday depth feed, this element remains a required external input rather than a fully executed signal. Bank escalation focuses on large deposit outflows, insufficient liquidity relative to stressed outflows, and incremental duration marks relative to tangible equity. CRE escalation focuses on DSCR below 1.0, LTV above 100%, and a warning zone below 1.2 DSCR.

An adverse regime is more credible when several channels deteriorate together: rising real yields or term premium, wider credit spreads, weaker earnings or coverage, repeated repo premiums, and declining market depth. Conversely, improving earnings and cash coverage, stable deposits and collateral access, orderly auctions, normalizing volatility, and stable credit spreads despite higher yields would invalidate a simple bearish rate narrative. This combination-based logic is the practical implication of the paper's rejection of a single breaking yield.

International Transmission

International transmission enters primarily through dollar funding, global risk premia, and nonbank liquidity. A stronger dollar can increase the local-currency burden of dollar liabilities and widen hedging or funding bases for foreign borrowers. Margin and redemption mechanisms can also transmit stress across borders through common holdings and collateral. The ECB (2026) has emphasized the role of bank-nonbank connections and thin nonbank liquidity buffers in amplification, while the 2022 U.K. LDI episode provides a concrete example of how local institutional structures can interact with global bond-market repricing.

At the same time, the international analogies have limits. U.S. Treasury market structure, repo facilities, dealer balance sheets, pension regulation, and institutional portfolios differ from those in the United Kingdom and euro area. The paper therefore uses foreign episodes to identify mechanisms, not to import a crisis probability or a numerical tipping point into the United States.

Limitations

The first limitation is calibration. The study does not estimate physical or risk-neutral probabilities of systemic crisis. The Monte Carlo outputs are conditional frequencies under specified scenarios and assumptions. No likelihood is assigned to any of the ten scenario narratives, and the macro system is reduced form rather than a fully estimated general-equilibrium model. There is no independently re-estimated high-frequency monetary-policy surprise model, no fitted regime-transition process, and no separately simulated latent term-premium state.

Second, important institution-level data are missing. The research package does not contain a comprehensive issuer-level maturity and covenant database, a bank-level distribution of hedges and uninsured deposits, a private-credit default and recovery panel, a fund-flow network map, or an intraday Treasury depth, bid-ask, and haircut history. Bank, CRE, funding, and default outputs should therefore be read as illustrative mechanisms rather than calibrated failure probabilities.

Third, the monthly equity simulation misses intra-month corrections. The separate daily collateral model partly addresses high-frequency stress but cannot resolve intraday margin timing, endogenous dealer capacity, or legal netting. Its zero-surplus-collateral starting assumption makes margin calls extremely frequent by design, so it is informative about the severity and mechanics of forced selling rather than the real-world incidence of margin calls.

Fourth, several valuation and behavioral parameters are weakly identified or assumed. These include the equity cash-flow/residual split, the 6% baseline drift, the initial valuation gap, response coefficients, mean reversion, stress thresholds, bank asset mix, CRE assumptions, and intervention efficacy. Structural sensitivity is therefore more important than Monte Carlo sampling error. The wide fiscal-scenario probability envelope across dependence and valuation assumptions directly demonstrates this point.

Fifth, historical validation is constrained by overlapping forward outcomes and the small number of genuinely independent crisis episodes. The rolling logistic model underperformed a simple expanding-frequency benchmark, and normal-return interval coverage deteriorated at 12- and 24-month horizons. These failures materially limit the interpretation of the model as a forecasting device.

Finally, not all external and internal evidence could be fully retrieved. Some official web endpoints and two internal research content reads failed during the source-collection process, although metadata and alternative public sources were retained where possible. No forecaster track-record ranking or consensus probability was fabricated to fill those gaps. The appropriate next research priorities are point-in-time earnings and valuation data, institution-level funding and maturity distributions, and independent expert review before any forecast use.

Conclusion

No defensible universal interest-rate level can be identified at which financial markets mechanically break. The evidence instead supports a conditional framework in which the source, speed, persistence, and curve shape of a rate move interact with earnings, risk premiums, leverage, liquidity, and refinancing structure. In the study's illustrative fiscal/term-premium scenario, a sustained 50 to 100 basis point rise in the 10-year Treasury yield from a 5.1142% starting point - roughly 5.61% to 6.11% - is associated with a simulated 40% to 89% 12-month frequency of a 20% or larger month-end equity loss. That range is not a forecast and should not be presented as a hard market threshold.

The more robust conclusion concerns mechanism. Duration loses value when required yields rise; stronger cash flows can offset part of that loss; leverage converts modest valuation changes into large equity and collateral demands; runnable funding can turn mark-to-market losses into forced sales; and persistent high rates damage floating-rate and refinancing-sensitive borrowers over time. Historical episodes reinforce the importance of those channels because severe market dysfunction has occurred both with rising and falling safe yields.

For risk management, the practical implication is to replace the search for one "breaking yield" with a dashboard of interacting constraints. A rise in real yields or term premium is more concerning when credit spreads widen, earnings and coverage weaken, funding premiums persist, depth falls, and collateral or deposit buffers erode. The opposite combination - strong earnings, fixed-rate funding, adequate liquidity, stable spreads, and orderly intermediation - can allow markets to absorb substantially higher yields. The driver and the balance sheet matter more than the headline rate level.

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Appendix A

Operational Monitoring Dashboard

The following thresholds are operational review rules from the executed research package. They are not estimated physical boundaries and should not be interpreted as stand-alone crisis predictions.

Indicator	**Frequency**	**Review Threshold**	**Interpretation**
10y nominal/real and term premium	Daily; ACM on release	+50 bp in ~20 trading days; +100 bp cumulative	Rate-speed warning
2s10s and 2/5/10 curvature	Daily	Bear steepening with stable policy	Term-premium / supply concern
HY and IG OAS	Daily	HY +300 bp or >800 bp; IG +150 bp	Credit / refinancing repricing
SOFR - IORB	Daily	>25 bp for 3 days; >50 bp urgent review	Persistent secured-funding pressure
Treasury depth / bid-ask	Intraday / daily	Depth <50% of rolling 20d median and bid-ask >2x	Market-functioning impairment
VIX and rate volatility	Daily	VIX >30; >40 severe	Stress / hedging demand
Bank deposit outflow / liquidity	Weekly / monthly	>10% deposit outflow in week or buffer <30d stressed outflow	Runnable funding concentration
Bank economic equity / securities marks	Quarterly + shock refresh	Incremental duration marks >25% of tangible equity	Escalation for review
CRE DSCR / LTV	Quarterly + maturity events	DSCR <1.0; LTV >100%; warning DSCR <1.2	Cash-flow or collateral gap
Corporate ICR / maturities	Quarterly	ICR <1.5 warning; <1 cash deficit; refi within 12m	Debt service exceeds earnings
Dollar / cross-currency basis	Daily	Dollar +10% in 3m with basis beyond 2 historical SD	Dollar-funding channel

Note. A lone signal is insufficient. The adverse regime is more credible when rates, spreads, funding, market depth, and cash-flow coverage deteriorate together.

Appendix B

Reproducibility and Research Governance

The principal simulation used NumPy PCG64 seed 20260923, 1,092 configurations, 100,000 paths per configuration, and 24 monthly steps. A same-seed 10,000-path reproduction test passed exactly, and an independent seed was used for tail-stability checks. The daily collateral engine used a separate seed and 100,000 paths per configuration over 20 steps. Parameter uncertainty used 1,000 moving-block resamples. The research package records code and innovation-snapshot SHA-256 hashes, run counts, seeds, and execution times.

The archived workflow includes frozen numerical inputs, data dictionaries, source and evidence manifests, model results, validation checks, the monitoring dashboard, and execution scripts. Bloomberg-derived numerical inputs are suitable for private reproduction within the relevant entitlement environment but should not be treated as permission to redistribute vendor data. Reacquiring third-party data at a later date creates a new vintage rather than an exact reproduction of the September 23, 2026 research state.

The study explicitly records incomplete components: no independent human expert review, no current-market systemic probability calibration, no intraday validated margin model, no real-time macro-vintage predictive system, and no identified causal re-estimation of the monetary-policy surprise literature. These governance disclosures are part of the result because they define the appropriate scope of use.