Harnessing AI for Advanced Behavioral Scenario Analysis in Bank Treasury

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Integrating Macroeconomic Insights with Traditional Systems for Superior Risk and Liquidity Management

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Executive Summary

Bank treasuries face escalating risks from volatile macroeconomic events. Traditional systems, such as Murex and Nasdaq Calypso or others, provide **rules-based risk and liquidity engines,** but often overlook dynamic macro-behavior linkages. This paper shows how a thin AI layer translates macro indicators into behavioral levers and instrument impacts, and now, with an integrated explainer module, produces governance-ready narratives for ALCO. In our example, the baseline LCR is 310.8% with 180 survival days. Under the severe scenario, the LCR remains robust at 208.6% (above target), but survival tightens to **99 days**, **becoming the binding constraint** and implying an additional $6.47 billion in HQLA is needed to meet the 180-day target.

Problem & Stakes

Limited Integration of Macro Factors: Traditional systems rely on static assumptions, missing dynamic events such as rate hikes (e.g., Fed funds to 6.0%), credit spread widenings (e.g., Baa to 300 bps), rising unemployment (to 4.5% in Q4 2025), inflation spikes (e.g., PCE to 2.3%), or GDP slowdowns (to 1.6-1.7%), leading to underestimated risks and potential liquidity gaps up to $6.5 billion in severe scenarios.

High Opportunity Costs: Inaccurate scenarios result in over- or under-hedging, tying up capital inefficiently; banks could lose up to 22% in operational efficiency without AI-enhanced foresight (based on industry benchmarks as of 2023).

Regulatory Pressures: Basel III and stress testing requirements demand robust liquidity modeling; failures can incur fines up to 10% of turnover and reputational damage.

Operational Risks: Manual adjustments to scenarios delay responses, exposing treasuries to market volatility and potential survival day shortfalls from 180 to 99 days in crises.

Competitive Disadvantage: Peers adopting AI could achieve up to 50% better risk predictions, eroding market share in treasury services.

Global banking regulations, including Basel III's Liquidity Coverage Ratio (LCR) and Net Stable Funding Ratio (NSFR), mandate stress testing that incorporates macroeconomic shocks (Source: Bank for International Settlements, 2013-01-07). In 2025, with Federal Reserve rates at 5.25% and VIX at 18.2, markets exhibit tightening credit (investment-grade spreads at 190 bps), heightening the need for advanced modeling. AI integration aligns with emerging guidelines from the European Central Bank on using machine learning for risk management (Source: ECB, 2025-07-28).

Market/Regulatory Context

Solution Overview

An AI-powered behavioral scenario layer complements existing platforms. It ingests macro signals, proposes behavioral parameters (deposit runoff, wholesale non-roll, margin), applies instrument impacts, and computes KPIs on dated cashflows. The new explainer module then converts results into consistent, audit-ready summaries for ALCO/CFO packs. (Source: BIS LCR 2013—75% inflow cap.)

Term	Plain Meaning	Why It Matters
Liquidity Coverage Ratio (LCR)	HQLA / worst 30d net outflow	Short-term resilience; regulatory buffer
Survival Days	Days until cumulative net outflow exceeds HQLA	Longer-horizon resilience
Behavioral Levers	Deposit runoff, wholesale not-roll, margin	Realistic stress beyond static rules
Instrument Impacts	Prepay, not roll, extend, margin call	Material changes to dated cashflows

Code & Reproducibility

A public proof-of-concept implementing the scenario generator, instrument-impact logic, HQLA/LCR calculators, and the ALCO explainer is available on GitHub: https://github.com/abalgir/AI-Behavioral-Assumptions-Scenario. The repo includes sample portfolios, JSON outputs, and scripts to reproduce the figures in this paper.

Architecture / How It Works

Core AI Components

The engine maps macro signals to behaviors, applies instrument impacts, and rolls dated cashflows into KPIs. It preserves Basel mechanics (e.g., 75% inflow cap) while allowing scenario creativity.

AI-Generated Explainer Module (New)

Beyond numbers, the explainer converts scenario JSON into executive-ready narratives. This reduces manual pack-writing, enforces consistency, and improves governance and auditability. Outputs can be Markdown (for docs) or Word (for board packs). (ECB on explainability, 2025-07-28)

Macro Environment

In the current economic landscape, the Federal Reserve's decision to maintain the federal funds rate at 5.25% reflects a cautious approach to managing inflation while supporting economic growth. The US 10-year yield at 4.4% indicates a relatively stable term structure, suggesting that investors are pricing in moderate growth expectations and potential rate stability in the medium term. The VIX at 18.2 signals a level of market volatility that, while elevated, remains manageable, indicating that investors are not overly fearful but are still wary of potential disruptions. Credit spreads, with investment-grade spreads at 190 basis points and high-yield spreads at 410 basis points, suggest a tightening credit tone, reflecting increased risk aversion among investors and a potential impact on liquidity conditions. As such, we must remain vigilant in our funding strategies to ensure adequate liquidity in the face of these evolving market dynamics.

Scenario Analysis and Interpretation

AI Explainer — Executive Summary (Data: AI scenario engine + ALCO explainer.)

- - Across scenarios, LCR decreases from 310.8% (baseline) to 208.6% (Severe Financial Crisis).
- - Survival days binds only in Severe, dropping to 99 days.
- - Dollar gap to target appears only in Severe: $6,469,260,000.

Baseline: LCR 310.8%, HQLA $37,300,000,000, worst 30d $12,000,000,000, survival 180, peak cum $30,000,000,000. No binding.

Mild Economic Slowdown: LCR 305.8%, worst 30d $12,198,981,000, peak cum $31,895,460,000. Binding: none; Gap: $0.

Base Case Recession: LCR 279.9%, worst 30d $13,324,712,083, peak cum $35,207,687,500. Binding: none; Gap: $0.

Severe Financial Crisis: LCR 208.6%, worst 30d $17,880,947,333, peak cum $43,769,260,000. Binding: survival; Gap: $6,469,260,000.

Table 2: KPI Comparison Across Scenarios

Scenario	LCR (%)	Survival Days	Gap (USD)
Baseline	310.8	180	0
Mild Economic Slowdown	305.8	180	0
Base Case Recession	279.9	180	0
Severe Financial Crisis	208.6	99	6,469,260,000

Evidence • BIS LCR (2013): https://www.bis.org/publ/bcbs238.pdf | Fed SEP (2025-09-17): https://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20250917.pdf | ECB (2025-07-28) on ML explainability.

Closing Perspective

For ALCOs and CFOs, the point is not to replace deterministic engines; it is to augment them. A thin AI layer can propose scenarios, quantify instrument impacts, and draft the governance-ready story—all while preserving Basel definitions and your existing platforms. Most institutions start by running this stream in parallel for one or two ALCO cycles. The comparative clarity typically resolves the adoption question on its own.

Selected Sources

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