Generative Ai for Stress Testing: Scenario Fabrication and Model Risk Governance in Capital Markets

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Abstract

This review explores the emerging application of Generative AI (GenAI) in fabricating synthetic scenarios for trading stress testing and model risk management. The central question is whether large language models can generate coherent, data-consistent "what-if" macroeconomic and market shock narratives that propagate across linked asset classes to support pre-trade risk assessment and algorithmic robustness testing. Existing research and practice are synthesized around three pillars: (i) prompting LLMs with macro triggers to create narrative-driven stress scenarios; (ii) calibrating these outputs against historical covariance structures to ensure internal consistency and plausibility; and (iii) integrating the scenarios into pricing engines and execution simulators to evaluate portfolio PnL distributions and tail risk dynamics. The review highlights methodological considerations, including transparency, reproducibility, and explainability in the generation and validation of synthetic stress libraries. Contributions include a proposed framework for embedding GenAI-driven stress testing into CCAR-style regulatory regimes and internal model validation processes, as well as pre-deployment sign-off for trading algorithms. By aligning generative scenario fabrication with established stress-testing practices, the paper argues for its potential to enhance resilience in capital markets, provided that governance, auditability, and model risk safeguards are rigorously maintained.

Keywords: Genai; Model Risk; Stress Testing; Synthetic Scenarios; Trading Algorithms