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Causal Data Science for Financial Stress Testing¹

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Abstract

The most recent financial upheavals have cast doubt on the adequacy of some of the conventional quantitative risk management strategies, such as VaR (Value at Risk), in many common situations. Consequently, there has been an increasing need for verisimilar financial stress testings, namely simulating and analyzing financial portfolios in extreme, *albeit* rare scenarios. Unlike conventional risk management which exploits statistical correlations among financial instruments, here we focus our analysis on the notion of *probabilistic causation*, which is embodied by Suppes-Bayes Causal Networks (SBCNs); SBCNs are probabilistic graphical models that have many attractive features in terms of more accurate causal analysis for generating financial stress scenarios.

In this paper, we present a novel approach for conducting stress testing of financial portfolios based on SBCNs in combination with classical machine learning classification tools. The resulting method is shown to be capable of correctly discovering the causal relationships among financial factors that affect the portfolios and thus, simulating stress testing scenarios with a higher accuracy and lower computational complexity than conventional Monte Carlo Simulations.

Keywords: Stress Testing, Graphical Models, Causality, Suppes-Bayes Causal Networks, Classification, Decision Trees

¹This is an extended version of the conference paper [1].

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