Complexity DTC Mini-project Proposal:
Buy / Sell Propagation across a Financial Network

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Background

The 2008 financial crisis has highlighted the fundamental importance of the financial markets to all our lives. After nearly three decades of unprecedented expansion, the credit crisis knocked nearly $16trn from the value of global financial assets and plunged much of the world into a deep recession[1].

Epidemiologists have long known that the dynamics of infection transmission crucially depend on population structure; for example, if the population is linked by a configuration model network then a key epidemiological variable called the *basic reproductive ratio*[2] is $R_0 = T\,(\mathrm{mean}(k) + (\mathrm{var}(k)/\mathrm{mean}(k)) - 1)$, where k is the node degree and T is the probability of transmission across a link.

Given the importance of the financial system, it is important to develop a greater understanding of its structure and dynamics. This project aims to provide insights for improving economic and financial stability by identifying systemic risks resulting from network topology, making use of modelling techniques from epidemiology.

Project

This mini-project aims to investigate the network topology of the financial markets[3]. It will be necessary to simulate a variety of network topologies and behavioural characteristics to attempt to replicate the stylised properties of the real financial markets[4,5]. Nodes represent financial actors, who are in one of two states corresponding to buying or selling, and links represent potential routes of influence. In the simplest case, this will lead to dynamics isomorphic to the network SIS model[6,7,8], but will be extended to include more general behaviour[9]. The aim is then to investigate the robustness of this simulated market to changes in topology and trading behaviour. The primary methodology will be stochastic simulation based on realistic data, with scope for the development of more general, formal results as a secondary aim.

The project will build upon principles in epidemiology, network theory, behavioural finance, statistical inference and statistical mechanics. In terms of deliverables, this project could potentially provide an explanation for the observed leptokurtic behaviour observed in financial market asset returns and help develop a more stable financial system[10,11]. As such, results will find downstream users in financial institutions and regulators.

References

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