Agent-based simulation analysis of economic crises

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Abstract

In this paper, we use agent-based modeling (ABM) in order to analyze how local defaults of supply chain participants (firms and banks) propagate through the dynamic supply chain network and interbank networks and form avalanches of bankruptcy. We focus on the linkage dependence among agents (firms and banks) at the micro-level and estimate the impact on the macro activities. The financial transactions are governed by a set of rules based on the balance sheets of agents. Combining agent-based modeling with the network creation model can shed light on understanding the primary role of banks in lending to the wider real economy. Understanding the linkage dependency among firms and banks can help in the design of regulatory paradigms that rein in systemic risk while enhancing economic growth.

Keyword: agent-based economics, financial network, systemic risk

Historically financial markets were driven by the real economy and in turn they also had a profound effect on it. In recent decades, a massive transfer of resources from the productive sector to the financial sector has been one of the characteristics of global economic systems. This process is mainly responsible for the growing financial instability. Understanding the feedback between these two sectors leads to a deeper understanding of the economic systems.

The current global financial crisis and economic fluctuations emphasize the need of alternative frameworks and methodologies to be able to replicate such phenomena in order to a deeper understanding the mechanism of economic crisis and fluctuation based on the linkage analysis between production and finance sectors.

We investigate the linkage between financial markets and the real economy. In our model, firms may ask for loans from banks to increase their production rate and profit. Our model can simulate the behavior of interacting heterogeneous firms and banks. We especially investigate the effect of credit linkages on the firms' activities to explain some key elements occurred during the recent economic and financial crisis. In particular, we study the repercussions of inter-bank connectivity on the economic growth, business cycle fluctuations, grow and shrink of firms and banks bankruptcy waves. Emphasis must be put on the reproducibility of experiments to validate the results as a scientific result.

We emphasize the strength of the simulation-based approach. For the data-driven approach based on empirical data, many scholars use a collection of daily snapshots of the interbank money market. However, even central banks and regulators have only a dim view of the interconnections between banks at a moment in time, and thus the systemic risk in the financial networks, and each bank's contribution to this risk, are poorly known.

A natural starting point is to utilize complementary approach to data-driven approach, basing their systemic risk measures on accessing and interpreting data on balance sheets and trading. Our model can generate a huge number of data by simulating the behavior of interacting heterogeneous firms and banks, and these real-time activities reflect empirically observed stylized facts. The question of why banks form empirically observed networks that are prone to systemic risk may also address the cue of understanding of how effectively the financial sector performs its economic functions. Our approach can shed light on understanding the primary role of banks in lending to the wider economy, how banks are likely to interact, as well as the optimal design of resilient networks.

Reference

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