A Dynamic Approach to Optimizing Interventions and Mitigating Contagion Impacts in Financial Networks

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Abstract

We review prior research and mathematical models examining the clearing of liabilities within financial networks, the network dynamics that affect members' abilities to clear, and the role of financial contagion in propagating defaults across a network. Implementing the Banks as Tanks model introduced by Sonin and Sonin (2017, 2020) as a coding solution to derive a network's clearing payment vector as defined by Eisenberg and Noe (2001), we explore clearing outcomes for a network's members based on initial information about each's cash and debt positions. Extending dynamics observed in the Banks as Tanks model and others, we also extend these models' analysis of outcomes to examine the factors impacting the effectiveness of attempts to rescue defaulting members through provision of outside funding and investment. Our primary contribution is development of a framework to identify optimal interventions a regulator may impose to prevent defaults caused by a bank's own illiquidity or by financial contagion from other defaulting banks. Secondary contributions include evaluation of the impact of network structure on intervention cost through simulations and our evaluation of methods for simplification of ergodic network or sub-network structures. Our analysis also provides a framework for further analysis of interventions within more complex networks.

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