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HIDDEN SPREADING OF RISK IN INTERDEPENDENT COMPLEX NETWORKS – WHY THE 2008 FINANCIAL CRISIS WAS MORE SEVERE THAN OTHERS

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ABSTRACT

This project aims to explain why the 2008 crisis was more severe and different. To model this, I use the agent-based model and network analysis. In the model, I want to show that risk can move around between highly interconnected networks. Risk of the financial network can hiddenly spread in other networks. By this spreading, the bank failures resemble popping corn. Thus, more severe systemic risk can be caused by the pop-corn effect as a result of this hidden spreading.

The U.S. financial crisis began in 2008 and it quickly turned into the Great Recession(The Wall Street Journal 2010). Although people never perceived if as the worst recession since 1930s, its impact was the most severe since the Great Depression. The financial crisis seems to be a very different kind of shock. However, there is an argument that the 2008 crisis is in line with previous crises(Reinhart and Rogoff 2009). This project aims to explain why the 2008 crisis was more severe and different. Previous research in complexity theory has identified leverage, connectivity and concentration as a cause for contagious systemic risk(Gai, Haldane, and Kapadia 2011, Thurner 2011). However, this explanation seems insufficient given that the 2008 crisis hit the entire economic sectors. In fact, risk spread so fast that bank failures resembled the dynamics of popping corn unlike a typical cascading avalanche of cause and effect. To make headway in understanding this phenomenon, this project will investigate vulnerability and resilience dynamics in multiple interacting networks. This perspective promises to explain the popcorn effect via spreading systemic risk across interacting networks.

Systemic risk is difficult to quantify and model in complex networks. Thus, in my project, I will use a proxy to represent the relationship between node properties. The proxy is a significant correlation between the weights of nodes, which are transformed into distances in the networks(Lautier and Raynaud 2013).

To model the systemic risk of the 2008 financial crisis, we will assume two interdependent networks. The first network is a network of banks where the node's weight is equivalent to the balance sheet liquidity, based on FDIC data. The links stand for interbank relationships, such as loans across the network. The second network represents the housing market which has been identified as one of the key triggers of the crisis. Here, every node is a unit in the housing market. To simplify data acquisition, we will assume cities as the nodes in this graph with house prices based on HPI as node weights, and price correlations as links between cities. Each node in the two networks, bank and city, are connected via correlation of node weights, which is straightforward as house prices depend largely on bank leverage. The inter-network-correlation translates to a distance between nodes of two different networks. As correlations increase, the local distance between the interconnected networks goes down. While previous research focused on the correlations within

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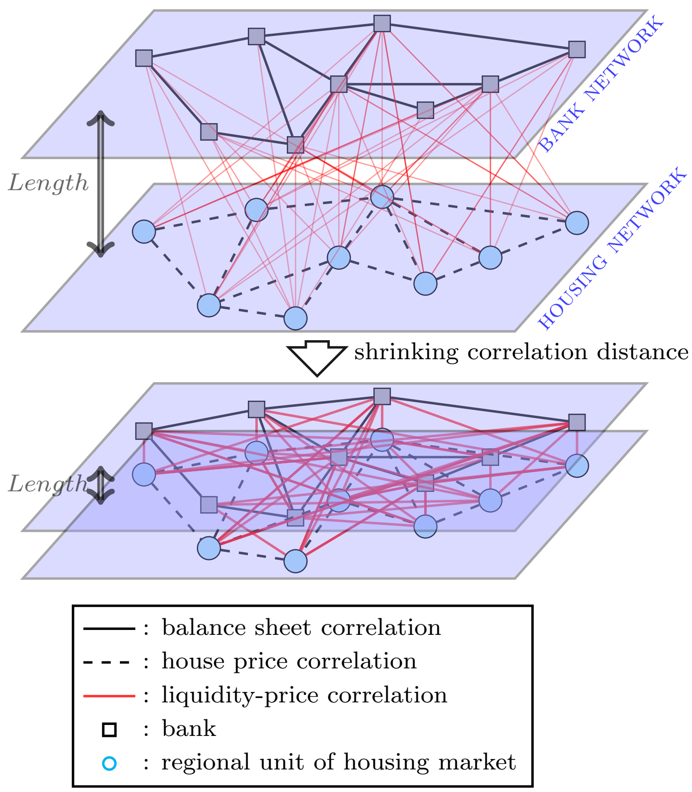
a single network, we emphasize the distance between networks in order to characterize the uniqueness of the 2008 crisis , explaining the popcorn effect as a result of hidden spreading.

The increase of correlation, or shrinking of distance between nodes/networks, means that a small failure can be transmitted to many nodes in another network fast and easily(Buldyrev, Parshani, Paul, Stanley, and Havlin 2010). In fact, with shrinking network distance, risk can move around between two networks, resulting in an increasingly devastating ping-pong effect. Even if a single network structure is resilient, this kind of risk can make it vulnerable. The key premise of my project is that ping-pong and cascading effects in multiple interdependent networks can explain the observed popcorn effect. This premise will be tested using empirical data covering the years from 2006 to 2008.



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