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Analyzing contagion in banking networks

I introduce a class of stylized banking networks and try to predict the size and frequency of contagion events. I find that the domino effect can be understood as an explicit iterated mapping on a set of edge probabilities that converges to a fixed point. A cascade condition is derived that characterizes whether or not an infinitesimal shock to the network can grow to a finite size cascade, in analogy to the basic reproduction number R_0 in epidemic modeling. It provides an easily computed measure of the systemic risk inherent in a given banking network topology. An analytic formula is given for the frequency of global cascades, derived from percolation theory on the random network. Two simple examples illustrate that edge assortativity can have a strong effect on the level of systemic risk as measured by the cascade condition. Although the analytical methods are derived for infinite networks, large-scale Monte Carlo simulations demonstrate the applicability of the results to finite-sized networks. Finally, we'll see that a simple graph theoretic quantity, graph assortativity, seems to best capture systemic risk.