Cascading Failure Model and New Perspective on 1990s Japanese Banking Crisis

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We investigate the 1990's Japanese banking crisis by using bank-asset bipartite network and apply a model of risk propagation, Cascading Failure Model (CFM) [1] to simulate the Japanese banking crisis. We successfuly detect 80% of actual bankrupted banks with a 20% of error margin [2]. In this simulation, we use bank balance sheet data of almost all the Japanese banks for fiscal year (FY) 1994 just before the onset of the banking crisis. We investigate the trend of temporal changes of assert portfolios for failed banks as well as for survived banks,
and find that the proportion of "Loans on bills" assets, which is used for long term financing of debtors, has decreased significantly just before the financial crisis, in the case of survuved banks, in contrast to bankrupted banks. We confirm, by the CFM simulation, that the difference in "Loans on bills" temporal change clearly separates survived and failed banks, and shows a bifurcating point in the parameter space of model

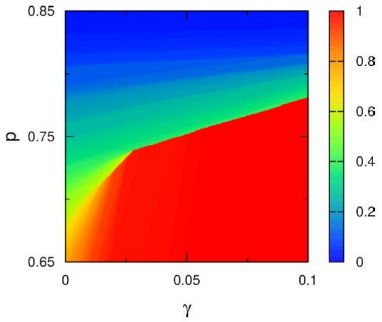

Figure 1 Proportion of simulation detected bankrupted banks in parameter space.

(Fig. 1). By using CFM on a bipartite bank-asset network, we could detect assets that significantly affect the cascading failure of banks during financial crises.

We investigate the beginning of crisis as well as the entire crisis period by using CFM [3]. Under the assumption that the systemic effect of crisis is long enough to be averaged over the crisis propagation period, we solve the CFM analytically and find that "Corporate bond" asset is crucially responsible to spreading systemic risk in the bank network. This research result shows a simple mathematical model and simulation that enables us to better understand the financial system dynamics. Furthermore, it sheds light on importance of data-driven investigation. Because of its simplicity, the proposed methodology could be useful not only in economics but also in number of other disciplines and systems that are characterized by spreading and propagation dynamics.

References

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