

On dynamic systemic risk models and mechanisms

Gechun Liang
Department of Statistics, University of Warwick

The global financial crisis in 2008 reminded us about the risk of collapse of an entire financial system due to the interlinkages and interdependencies within the system. In a financial system/network with many firms, each firm may have nominal liabilities to other firms in the system. As opposed to breakdowns in individual firms, systemic risk refers to the risk of breakdowns in an entire financial system.

According to the Bank for International Settlement (BIS), systemic risk is defined as “the risk that failure of a participant to meet its contractual obligations may in turn cause other participants to default with a chain reaction leading to the broader financial difficulties.”

In this project, the student is asked to build a dynamic systemic risk based on the early work of [2] (see also [3] [4] [5] for its recent development). A mathematical introduction of the Eisenberg-Noe model can also be found in my lecture notes [1]. Compared to all the existing static systemic risk models, the dynamic model to be developed will allow us to study the dynamics of bank defaults and their simulations.

The student is expected to be familiar with stochastic calculus and PDEs, including local times and associated PDEs with Neuman boundaries, and preferably their numerical solutions and simulations.

References

- [1] Liang, G. (2019): Lecture notes on systemic risk and credit risk, *Lecture notes*.
<https://drive.google.com/file/d/1vHUJ8opgV9-bY7kiY2TAjOWExiwYswkS/view>
- [2] Eisenberg, L., and Noe, T.H. (2001): Systemic risk in financial systems, *Management Science*, 47(2), 236-249.
- [3] Rogers, L. C., and Veraart, L. A. (2013): Failure and rescue in an interbank network. *Management Science*, 59(4), 882-898.
- [4] Acemoglu, D., Ozdaglar, A., and Tahbaz-Salehi, A. (2015): Systemic risk and stability in financial networks, *American Economic Review*, 105(2), 564-608.
- [5] Chen, N., Liu, X., and Yao, D. D. (2016): An optimization view of financial systemic risk modeling: Network effect and market liquidity effect. *Operations Research*, 64(5), 1089-1108.