Risk aversion heterogeneity and contagion in endogenous financial networks

Mateusz Dadej

05-07-2023

Bank's balance sheet

- The model build on works of Aldasoro et. al (2017) and Bluhm and Krahnen (2014).

- It consists of N banks, each with the balance sheet satisfying following identity:

$$c_i + \sum_{j=1}^{N} l_{i,j} + e_i = d_i + \sum_{j=1}^{N} b_{i,j} + q_i$$

- Where asset side consists of cash c, external assets e and interbank loans $l_{i,j}$. On the other side there are deposits d, interbank liabilities $l_{i,j}$ and equity q_i.

Financial network representation

- The double indexation represents the interconectedness among banks. $l_{i,j}$ is the value of debt claim from bank i to bank j.
- Therefore, $\sum_{j=1}^{N} l_{i,j}$ is a portfolio of claims of bank i
- These assets are not necessarily limited to interbank loans, but can also include other contracts that posses credit risk.

Objective of banks

- The profit function of banks depend on external and interbank assets and their return, respectively r^e and r^I. As well as the cost of its funding, that depends on the default probability δ and loss given default ζ.

$$\pi_i = r_i^e e_i + r^I l_i - (\frac{1}{1 - \zeta\delta})r^I b_i$$

- The utility function of a bank is a standard CRRA function. With following expected value (obtained from taylor expansion):

$$\mathbf{E}[U(\pi, \sigma_i, \sigma_\pi)] = \frac{\pi^{1-\sigma_i}}{1 - \sigma_i} - \frac{\sigma_i}{2}\pi_i^{-1-\sigma_i}\sigma_\pi$$

- Where σ_i is the risk aversion of bank i and σ_π is the variance of the profit of bank i, give with:

$$e^2 * \sigma_{r_i^e} - (b_i * r_I)^2 * \zeta^2 * (1 - (\zeta * \delta))^{(} - 4) * \sigma_\delta$$

References

- Aldasoro, Iñaki and Delli Gatti, Domenico and Faia, Ester. "Bank networks: Contagion, systemic risk and prudential policy". Journal of Economic Behavior & Organization, 2017, vol. 142, issue C, 164-188
- Bluhm, Marcel, and Jan-Pieter Krahnen. "Systemic risk in an interconnected banking system with endogenous asset markets." Journal of Financial Stability 13 (2014): 75-94.