

Big Data Finance 2017: Network-based stress testing

6 easy pieces on financial contagion

Let us consider a financial system of three banks $\mathcal{B} = \{A, B, C\}$ with balance sheets consisting of: external assets and liabilities, and interbank assets and liabilities, namely $\mathcal{F} = \{\mathcal{B}, \mathbf{A}^{(e)}, \mathbf{L}^{(e)}, (L_{ij})_{ij}^{|\mathcal{B}|}\}$.

The following exercises focus on solvency contagion and credit deterioration. Liquidity contagion and fire-sales are not explicitly considered.

In all exercises the banking system $\mathcal{F} = \mathcal{F}^{BDF}$ is defined by the liabilities matrix

$$L = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 3 \\ 2 & 0 & 0 \end{bmatrix},$$

the external assets

$$\mathbf{A}^{(e)} = \begin{bmatrix} 20 \\ 20 \\ 10 \end{bmatrix},$$

and external liabilities

$$\mathbf{L}^{(e)} = \begin{bmatrix} 17 \\ 18 \\ 8 \end{bmatrix}.$$

The initial shock on the external assets is uniform and of a relative amount equal to 10%.

I. EX.1 FURFINE

Ex-post clearing with no recovery. Compute the equity losses of the banking system \mathcal{F}^{BDF} , in case of zero recovery on default.

II. EX.2 EISENBERG AND NOE

Ex-post clearing and full endogenous recovery. Compute the equity losses of the banking system \mathcal{F}^{BDF} , in case of full endogenous recovery on default.

III. EX.3 ROGERS AND VERAART

Ex-post clearing and partial endogenous recovery. Compute the equity losses of the banking system \mathcal{F}^{BDF} , in case of partial endogenous recovery on default, accounting for interbank and market fire-sales.

IV. EX.4 DEBTRANK

Ex-ante local uncertainty, no endogenous recovery, and linear credit deterioration. Compute the equity losses of the banking system \mathcal{F}^{BDF} , in case of zero recovery on default and linear credit deterioration, accounting for interbank mark-to-market assessment conditioned on a uniform change in external assets of a bank's counterparties.

V. EX.5 ENDOGENOUS DEBTRANK

Ex-ante low local uncertainty, full endogenous recovery, and non-linear credit deterioration. Compute the equity losses of the banking system \mathcal{F}^{BDF} , in case of zero recovery on default and linear credit deterioration, accounting for interbank mark-to-market assessment conditioned on a geometric Brownian motion for external assets of a bank's counterparties. Effective volatility $\sigma = 10^{-5}$.

VI. EX.6 ENDOGENOUS DEBTRANK

Ex-ante local uncertainty, partial endogenous recovery, and non-linear credit deterioration. Compute the equity losses of the banking system \mathcal{F}^{BDF} , in case of zero recovery on default and linear credit deterioration, accounting for interbank mark-to-market assessment conditioned on a geometric Brownian motion for external assets of a bank's counterparties. Effective volatility $\sigma = 0.1$, effective recovery rate $\beta = 0.7$.

VII. BIBLIOGRAPHY

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