Regulating Financial Networks: A Flying Blind Problem

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2021 RiskLab/BoF/ESRB Conference on Systemic Risk Analytics
July 1–2, 2021

Research Question

How can policymakers regulate a network of interdependent financial institutions when they are fundamentally uncertain about its susceptibility to contagion?

What I do

Develop a framework to understand the behavior of such policymakers.

- Institutions are linked via an opaque network of exposures.
- At times of crisis, cascades of distress may occur as a result of contagion.
- Policymaker—who imposes preemptive restrictions on certain institutions to maximize expected output—is uncertain about the susceptibility of the network to contagion.

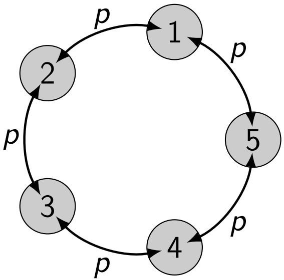
What do we learn?

- Uncertainty alters institutions' behavior and can compound market equilibrium inefficiencies.
- While increasing network transparency might decrease uncertainty, it is not always welfare improving.
- Optimal regulation forces institutions to internalize their expected systemic footprint.
- The socially optimal level of transparency strikes the right balance between the social costs associated with reducing uncertainty and the expected benefits associated with implementing more effective regulation.

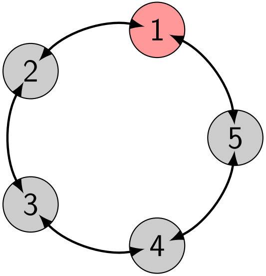
Baseline model

- Two-period economy with n risk-neutral banks whose payoffs are linked via an exogenous network of exposures.
- Two assets: cash and an illiquid asset.
- Every bank is endowed with one dollar.
- Timeline:
    - At $t = 0$ (normal times), banks select their portfolio to maximize expected profits.
    - At $t = 1$ (times of crisis), adverse shocks propagate and payoffs are realized.

Exposures can propagate adverse shocks at times of crisis



$t = 0$
normal times



$t = 1$
times of crisis

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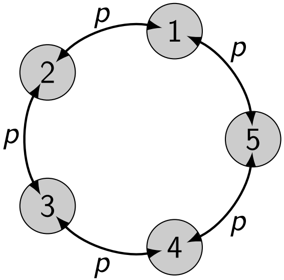
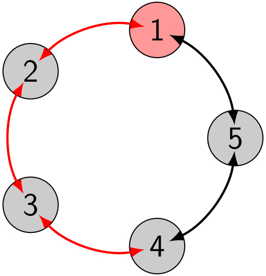


$t = 0$
normal times



$t = 1$
times of crisis

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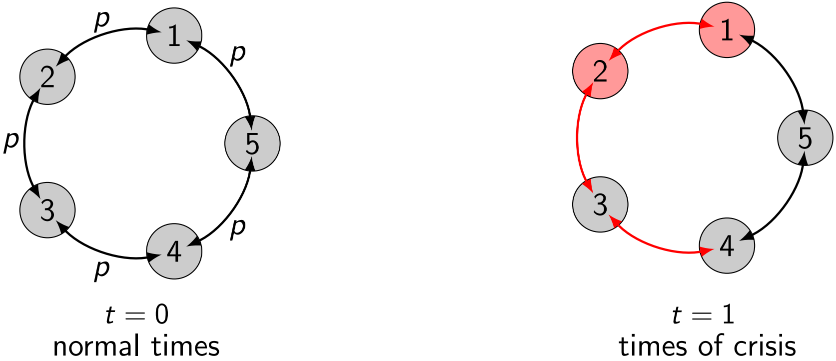
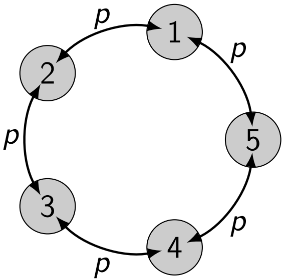
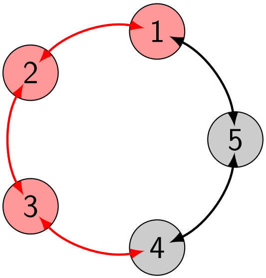


Exposures can propagate adverse shocks at times of crisis

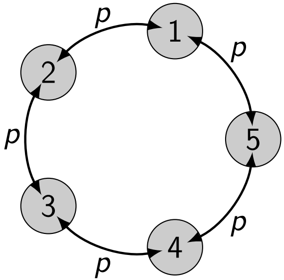


$t = 0$
normal times

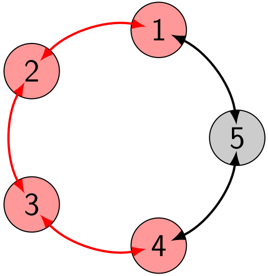


$t = 1$
times of crisis

Exposures can propagate adverse shocks at times of crisis



$t = 0$
normal times



$t = 1$
times of crisis

Baseline model

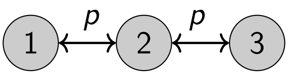
- Two frictions: limited liability and bankruptcy costs (κ).
- A planner imposes preemptive restrictions on banks' portfolios at $t = 0$ to maximize expected total output.
  - Planner does not know the precise value of p.
  - While planner is uncertain about p, she can learn about it through a costly information technology.
- **Design problem:** To choose how much transparency to attain and how to regulate banks' portfolios with such information.

Additional assumptions

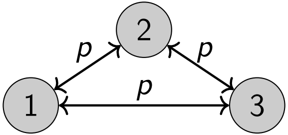
- **Banks' problem.** Let x_i denote the fraction bank i invests in the illiquid asset. x_i is chosen to maximize $\mathbb{E}\left(\pi_i|\mathbf{x}\right) \equiv x_i \left(1 - \mathbb{P}\left(\text{bank } i \text{ fails}\right)\right)$; $\mathbf{x} \equiv \left(x_1, \cdots, x_n\right)'$.

- **Flying Blind Problem.** $p \in \{p_L, p_H\}$ with $p_L < p_H$. $\mathbb{P}(p_L) = \phi$ with $0 \leq \phi \leq \frac{1}{2}$.

- **Today's presentation.** Focus on two network architectures



Line architecture



Triangle architecture

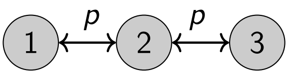
The simpler case: p is known

Banks' location and network architecture matters

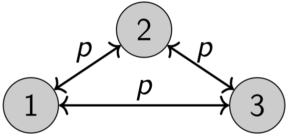
Equilibrium behavior: Assume $p \geq 2/3$. The market equilibrium is then

- Line architecture: $x_1 = x_3 = \frac{3}{2}\left(1 - \frac{p}{2}\right)$ and $x_2 = \frac{3}{2}\left(1 - p\left(1 - \frac{p}{2}\right)\right)$
  $\implies x_{1,3} \geq x_2$ location matters

- Triangle architecture: $x_1 = x_2 = x_3 = \frac{3}{2}\left(\frac{1}{1+p(1+p)}\right)$
  $\implies x_i^{\text{triangle}} \leq x_i^{\text{line}}$ architecture matters

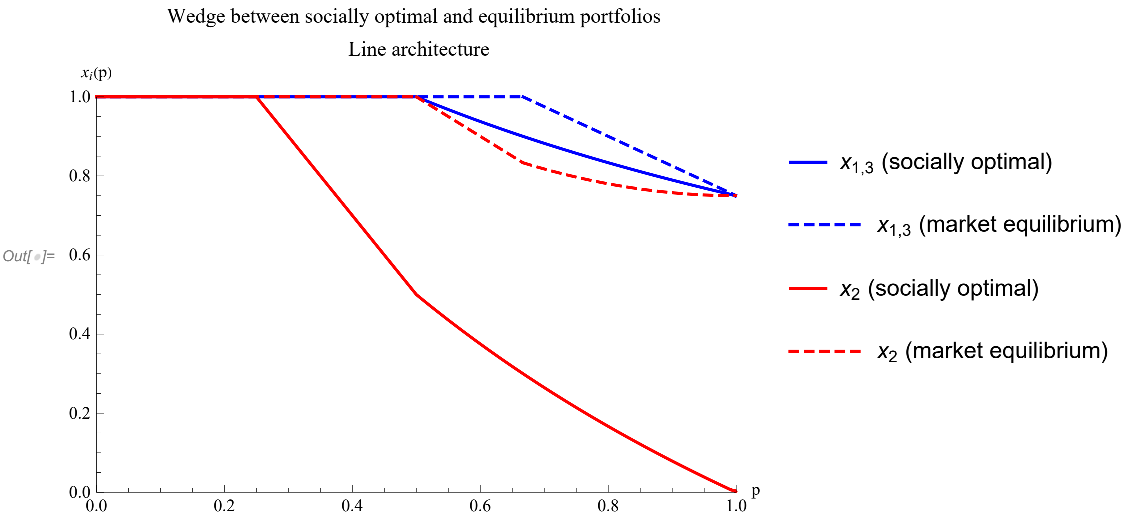


Line architecture



Triangle architecture

Market equilibrium can be socially inefficient



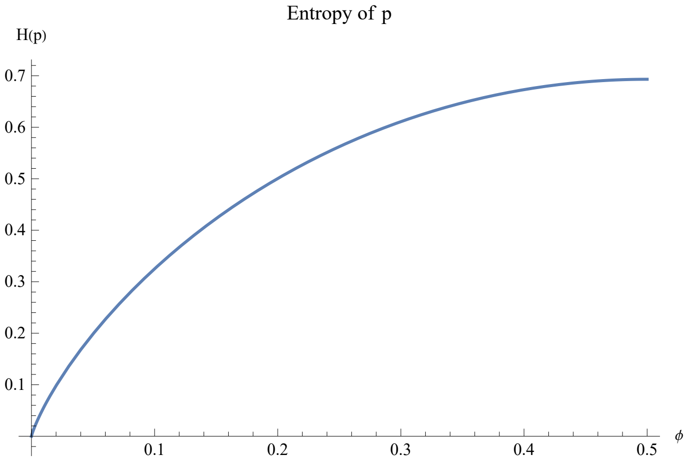
The Flying Blind Problem

(p is unknown)

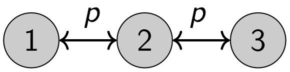
Capturing model uncertainty via entropy

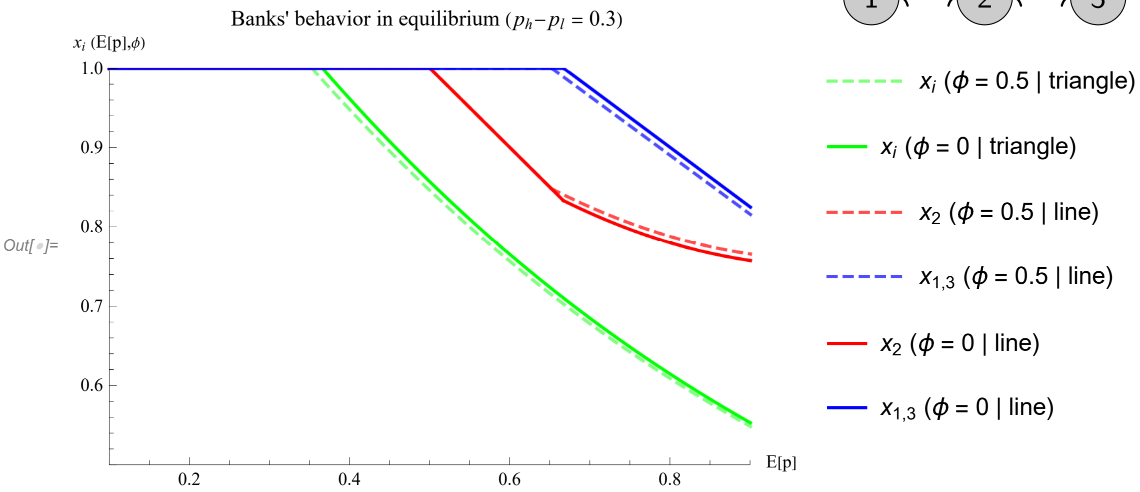
$p \in \{p_L, p_H\}$ with $p_L < p_H$. $\mathbb{P}(p_L) = \phi$ with $0 \leq \phi \leq \frac{1}{2}$.

$$H(p) \equiv -\phi log(\phi) - (1-\phi) log(1-\phi)$$

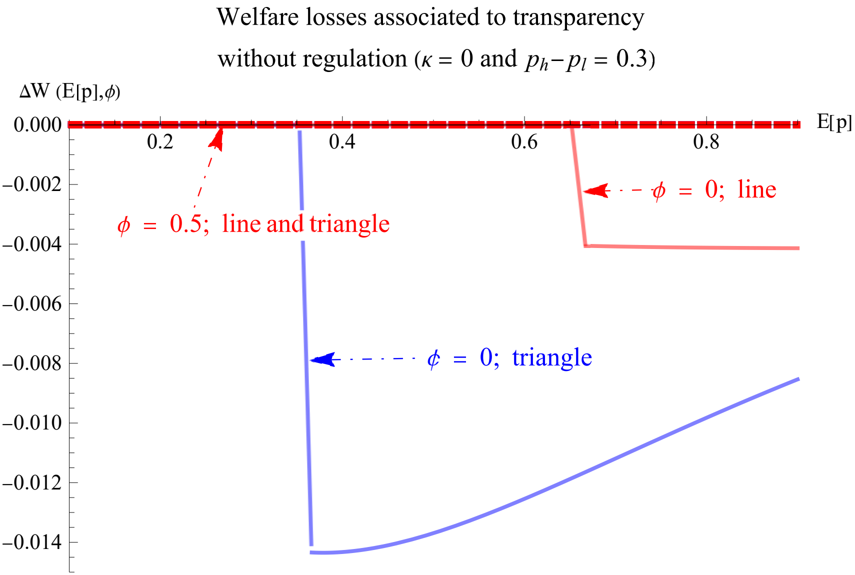


Uncertainty alters banks' behavior and can compound inefficiencies

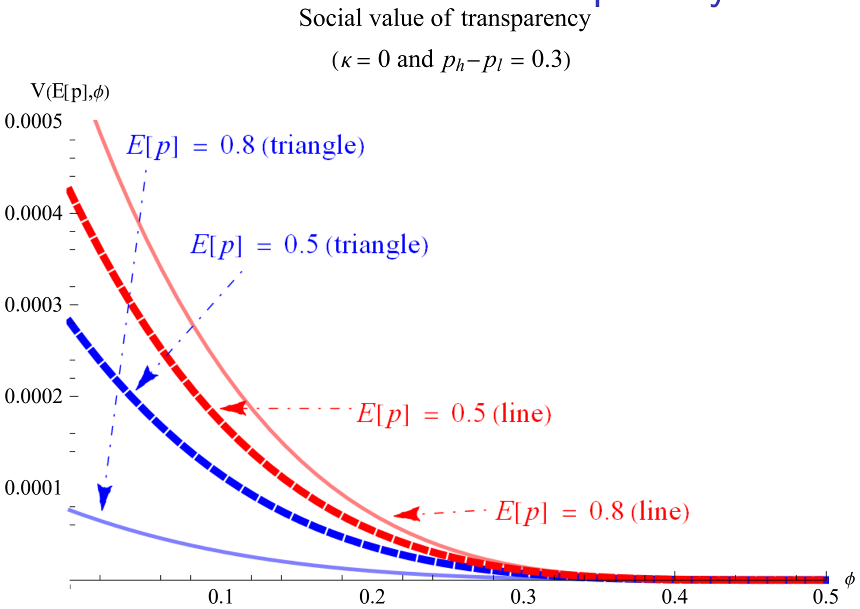




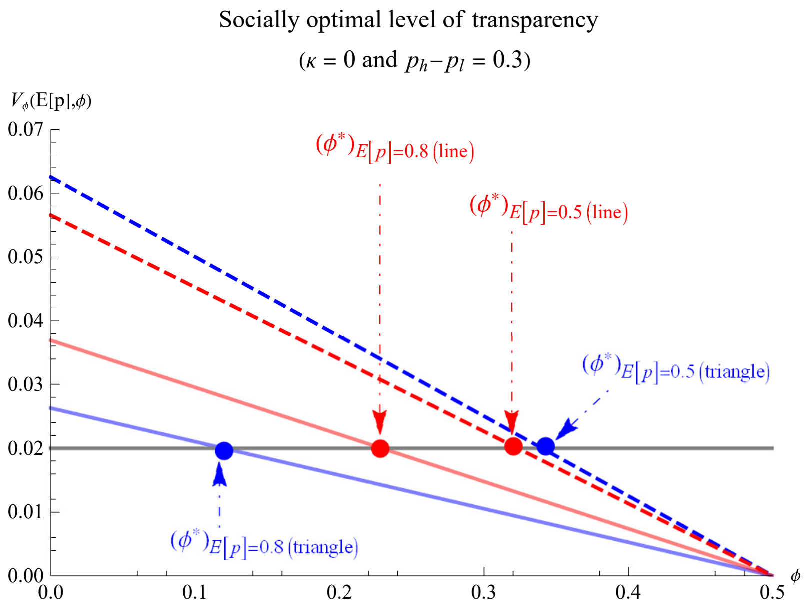
Increasing transparency is not always welfare improving



Network architecture alters value of transparency



Network architecture reshapes optimal level of transparency

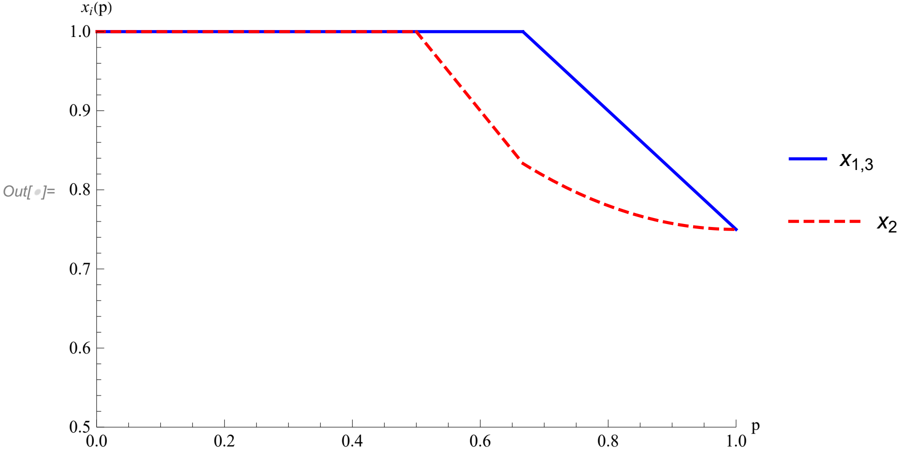


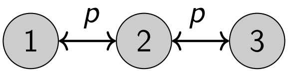
Concluding Remarks

- Uncertainty alters banks' behavior and can compound market equilibrium inefficiencies.
- Increasing network transparency is not always welfare improving.
- Optimal regulation forces banks to internalize their expected systemic footprint.
- The socially optimal level of transparency strikes the right balance between the social costs associated with reducing uncertainty and the expected benefits associated with implementing more effective bank regulation.

Appendix

Banks' location alters their strategic behavior





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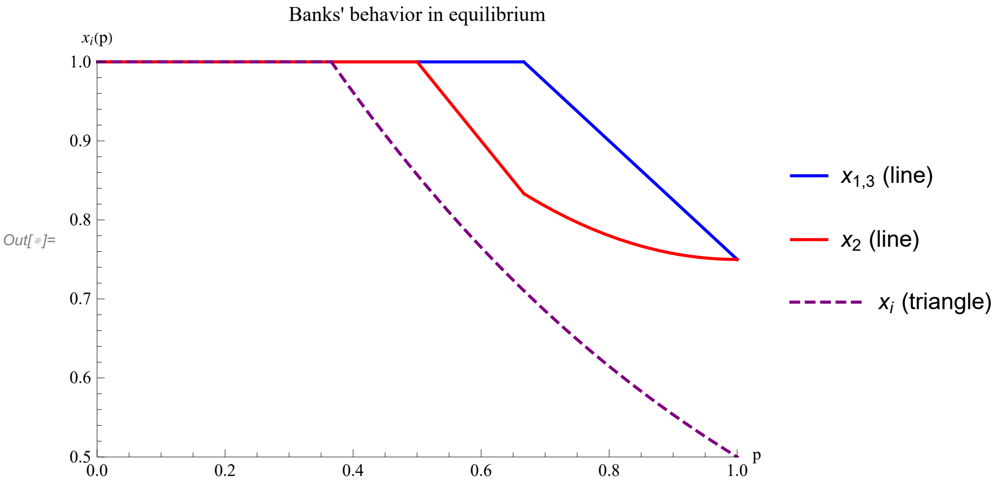
Network architecture alters equilibrium outcomes



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