Financial Networks
Contagion, Commitment, and Private Sector Bailouts

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Motivation

- **Previous Literature**: negative aspects of contagion.
  - Allen and Gale (2000)
  - Lagunoff and Schreft (2001), etc.

- **Problem**: Should we worry about the linkages among agents in financial markets? Is there optimal network design?
Main Result

- **Positive Role of Contagion**: linkages may be optimal ex ante because linkages not only spread contagion, but also induce private sector bailouts.

- **Optimal Networks**: whether and how agents should be linked to one another.
Sequence of Events

**Sequence of Events:**
- \( t = 0 \): A financial network is chosen.
- \( t = 1 \):
  1. Endowments \( e \) are realized.
  2. Transfers are made with allocation \( x \).
  3. Investments \( I \) are made.
- \( t = 2 \): Project cash flows are realized.

**Key Assumptions:** Agents cannot commit to
- 1. pay out of their initial endowments.
- 2. pay out of their projects' cash flows.
- 3. invest in their projects.
risk-neutral agents: $N = 1, \ldots, n$, identical ex ante
- expected utility $E(c_1 + c_2)$
- i.i.d. endowment $\tilde{e}_i$
- financial network: $K_i$ - agents linked to agent $i$
- project requires $1$ investment and yields $R > 1(0)$ if succeeds, $p_i(I) = 1$ (fails, $p_i(I) = 0$).
- complementarity: project succeeds iff all agents linked to agent $i$ also invest
Implementation

- agent $i$'s utility $U_i(x, I) = x_i - I_i + p_i(I)R$.

- **optimal investment rule:**
  - $I_i(x)$: invest iff everyone connected also invests.
  - $V_i(x) = x_i - (R - 1)I_i(x)$

- **optimal allocation rule:**
  - budget constraint
  - interim participation constraint: prefer allocation to autarky

**Implementation:**
1. central planner proposes allocation and investments rule
2. agents decide agree or not sequentially
3. allocation achieved if agreed by all, and autarky otherwise
Unlinked versus Fully Linked

- **Unlinked**: autarky allocation and invest iff endowment is higher than 1

- **Fully Linked**: all agents are connected
  - amount of cash agent $i$ willing to give is $\min(e_i, R)$
  - aggregate investment is $n$ if $\sum_{i=1}^{n} \min(e_i, R) \geq n$, and 0 otherwise

**Comparison**:
- If $\Pr(\sum_{i=1}^{n} \min(\tilde{e}_i, R) \geq n) \geq \Pr(\tilde{e}_i \geq 1)$, a fully linked network ex ante Pareto dominates an unlinked network.
- *vice versa.*
**Optimal Network**

- **network**: partition $N_1, N_2, \ldots, N_k$, agents only connected inside group $N_j$

- **expected per capita investment** in a group of $\nu$ agents:

  $$f(\nu) = \Pr(\sum_{i=1}^{\nu} \min(\tilde{e}_i, R) \geq \nu)$$

- **optimal size** of group: $n^* = \arg \max_{\nu \in N} f(\nu)$
  1. $n^* = 1$: unlinked
  2. $n^* = n$: fully linked
  3. otherwise, may be partially linked
**whether to add an agent**: tradeoff b.w. better risk sharing & "weakest link"
- risk sharing: \( n \) agents fail, but adding an agent succeeds
- "weakest link": \( n \) agents succeed, but adding an agent fails

**large economies**:
- LLN: \( \lim_{n \to \infty} f(n) = 1 \), if \( E[\min(\tilde{e}_i, R)] > 1 \), and 0 otherwise.
- If \( E[\min(\tilde{e}_i, R)] > 1 \), fully linked Pareto dominates unlinked, and *vice versa*. 
Discussion and Summary

- **Main Point**: linkages may be optimal because contagion can motivate agents to help others, even without commitment.

- **Applications**: Payment Systems, Joint Liability Arrangements

- **Assumptions**: limited commitment, central planner

- **Comments**: complementarity, network formation