Externalities and Contagion in Banking Networks

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Contagion in Banking Networks

- Important policy topic, with a large academic literature in recent years.

  Two big challenges:
  - Complexity of network measures
  - Endogeneity of banking networks (Lucas critique)

  Two contributions:
  - Measure based on aggregate statistics only
  - Network formation game
Connectivity and defaults, two forces:
  - Risk-sharing
  - Contagion

**Critical connectivity** $k^*$ such that:
  - $k < k^*$: defaults propagate over the network.
  - $k \geq k^*$: no second-round defaults.

With a symmetric network:

$$k^* = \frac{rf\Lambda}{(R - 1)\Lambda + (2 - R)}$$

with $f$ interbank loans/assets, $\Lambda$ assets/equity, $r$ interbank rate, $R$ return of external investment.
Pros and cons:

- closed-form measure, easily computed from aggregate data on the banking system.
- based on a symmetric network (all banks lend 1 unit to \( k \) other banks at the same rate \( r \)).

What should we do with this measure?

- Should we encourage banks to be even more connected, increase \( k \) above \( k^* \)? Probably rather differently connected.
- Does not identify key players.
- Can be useful to monitor the market as a whole over time.
Robustness

- Comparison with random networks:
  - Similar average of expected failures for Erdos-Renyi networks.
  - Much less so for Barabasi-Albert networks (e.g. 4 vs. 6.6 for $k = 5$).
  - Important dispersion in random networks.

- What about actual networks?
  - Some random networks may look like actual networks.
  - Actual networks may not be close to the “average” random network.
  - How would the measure perform compared to an actual network? Lower bound on contagion?
Strategic network formation

- Build a Cournot lending game played by the banks.
- Show that it satisfies the assumptions of Goyal and Joshi (2006): each player’s payoffs depend on his own links and the aggregate number of links only.
- Use Goyal and Joshi to solve for the equilibrium bank network.
- To be done: is contagion higher/lower than in typical random networks?
The Cournot game

\[ \pi_i = pq_i - c_i(g)q_i \]

\[ p = \theta - \sum q_j \]

\[ c_i(g) = c_0 - \theta \sum g_{ij}q_j \]

Remarks:

- Unrelated to Part 1 ⇒ different paper?
- Microfoundation of the cost function? \( g_{ij} \) may reflect diversification, but why \( g_{ij}q_j \)?
Robustness

- Solve the Nash Equilibrium of the Cournot game for a given network $g$.
- One obtains $\pi^*_i(g)$ for all $i$.
- To apply Goyal and Joshi, one needs $\pi^*_i(g)$ to depend only on $i$’s links and the aggregate number of links in the network.
- Is that true? $\pi^*_i$ depends on $g_{ij}q_j$ but $q_j$ depends on all the $g_{jk}$...
- Seems unlikely, or at least it’s not direct!
Conclusion

- Two papers in one, a bit too ambitious.
- Contributions seem a bit technical at the moment.
- Need to better identify the knowledge gap in the literature and the economic contributions of the paper.
- Preliminary version, promising work.
Thank you!