EFFICIENCY AND STABILITY OF A FINANCIAL ARCHITECTURE WITH TOO-INTERCONNECTED-TO-FAIL INSTITUTIONS

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Macro Financial Modeling Winter 2016 Meeting
NYU Stern School of Business, Kaufman Management Center
January 28, 2016

Motivation

"If the crisis has a single lesson, it is that the too-big-to-fail problem must be solved." Ben Bernanke, 2010.

"[T]he risk of failure of 'large, interconnected firms' must be reduced, whether by reducing their size, curtailing their interconnections, or limiting their activities." Paul Volcker, 2012.

Dodd-Frank Act, Sec. 123 requires to estimate the benefits and costs of explicit or implicit limits on the maximum size of banks; limitations on the activities or structure of large financial institutions.

Research Questions

- How efficient and stable is the current financial architecture?
- What are the welfare and stability implications of limiting the maximum number of trading partners that financial institutions can have?

Summary of the Results

- On one side, there are benefits of large interconnected financial institutions (LIFIs). They make the liquidity allocation process more efficient in the Fed funds market by allowing for short intermediation chains.
- On the other side, failure of the most interconnected bank triggers larger cascades of failures in the estimated architecture than in the counterfactuals.
- The expected number of bank failures is non-monotonic in the degree of regulation.

The Framework

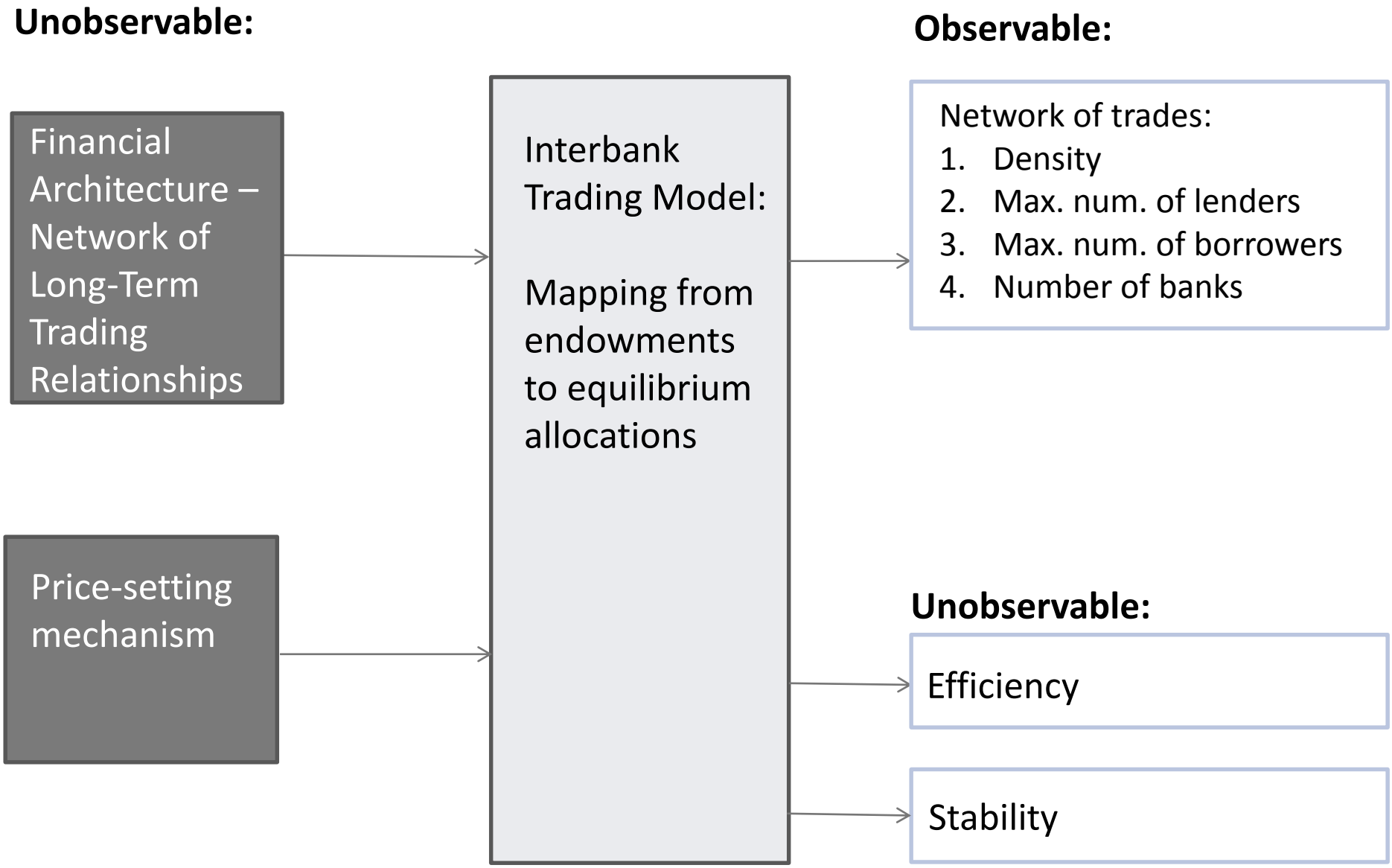
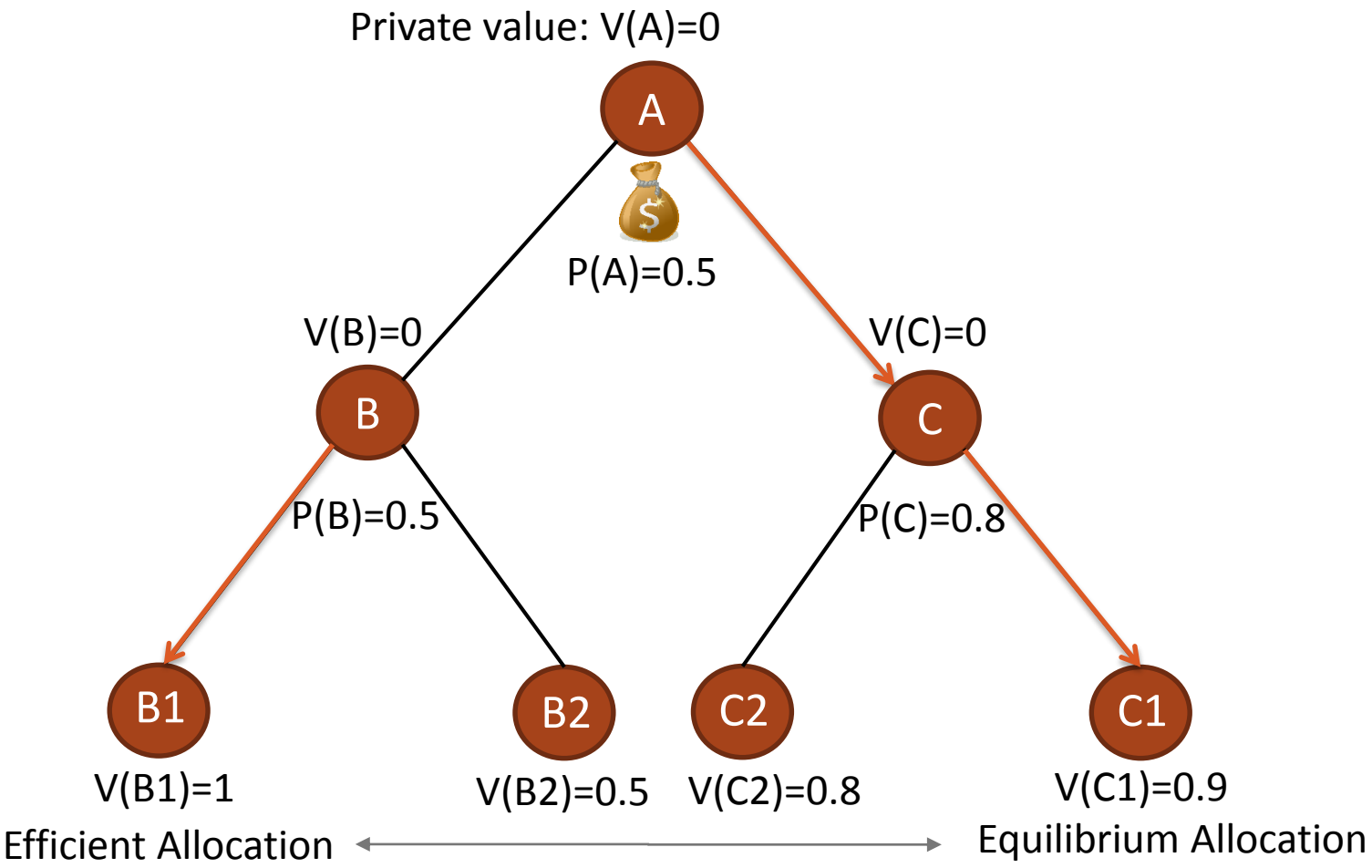


Illustration of the Model



$$\text{Surplus loss} = \frac{V_{B1} - V_{C1}}{V_{B1} - V_A} = \frac{1-0.9}{1-0} = 0.1$$

The Model*

- **n** banks trade Fed funds.
- Financial architecture is a network of trading relationships (**g**).
- One bank at a time receives an endowment of liquidity (deposit).
- Private values for liquidity (**V**) are uniformly distributed between 0 and 1.

Definition (Equilibrium)

i. Bank i's equilibrium valuation is given by:

$$P_i = \max\left\{V_i, \delta \max_2 P_{j \in N(i,g)}\right\}$$

ii. Bank i's equilibrium trading decision is given by:

$$\sigma_i = \underset{\sigma_j \in N(i,g) \cup i}{\operatorname{argmax}} P_j$$

*Gofman (2011), “A Network-based Analysis of Over-the-Counter Markets”.

Model Fit (3 parameters)

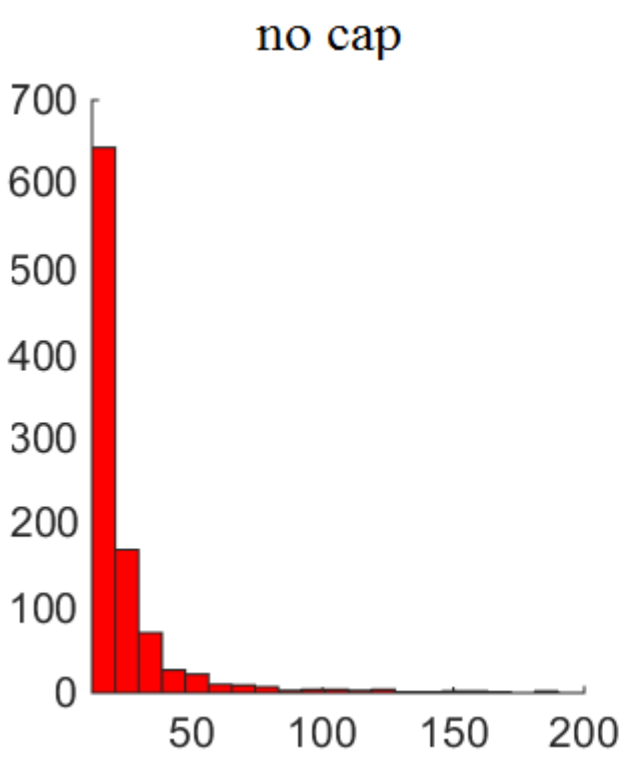
Network Moments Used in the Estimation:	**Model**	**Data***
Average density (%)	0.7	0.7
Maximum number of lenders to a single bank	111.8	127.6
Maximum number of borrowers from a single bank	47.2	48.8
Average number of active banks	473.9	470.2
Network Moments Not Used in the Estimation:		
Number of links	1557	1543
Average number of counterparties	3.3	3.3
Average path length-in	2.8	2.4
Average path length-out	2.8	2.7
Average maximum path length-in	4.6	4.1
Average maximum path length-out	4.6	4.5
Diameter	6.7	7.3
Clustering by lenders	0.1	0.1
Clustering by borrowers	0.28	0.12
Reciprocity	6.5	26
Degree correlation (borrowers, lenders)	-0.28	-0.35
Degree correlation (lenders, lenders)	-0.13	-0.26

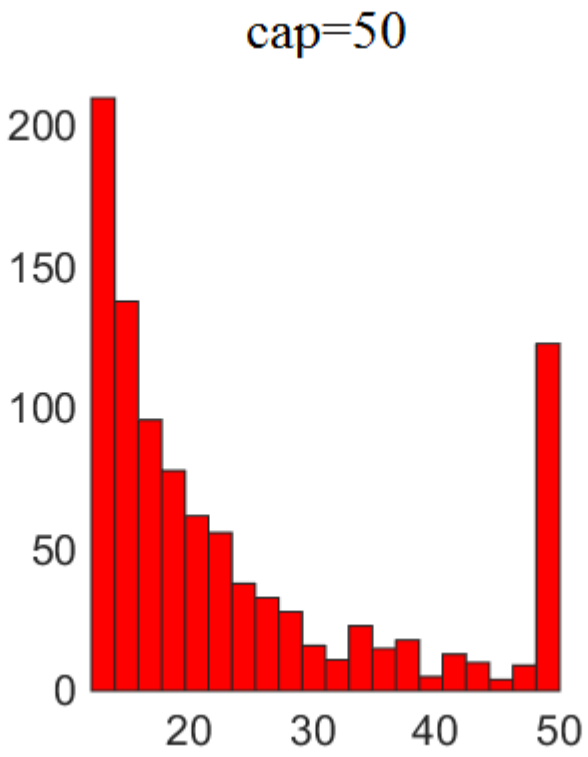
* Data Source: “The Topology of the Federal Funds Market” Bech and Atalay , *Physica A*, 2010

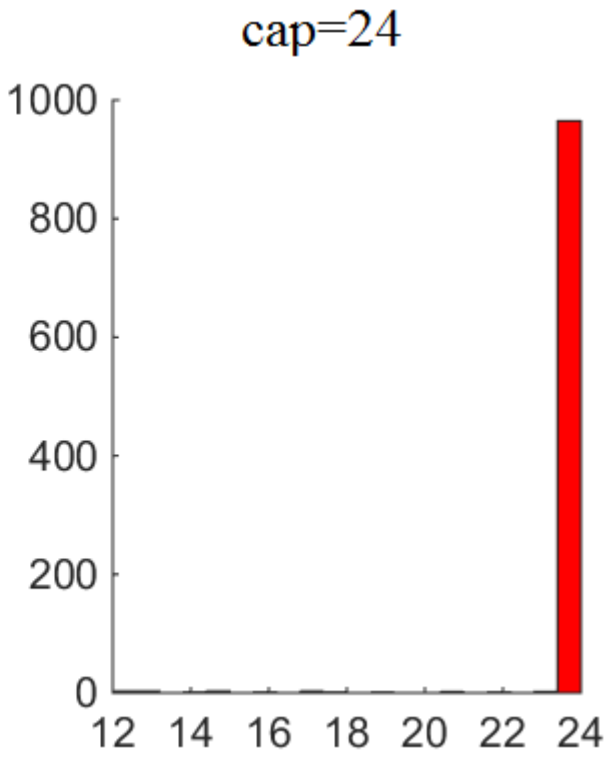
Counterfactual Financial Architectures

Estimated architecture

Homogeneous architecture





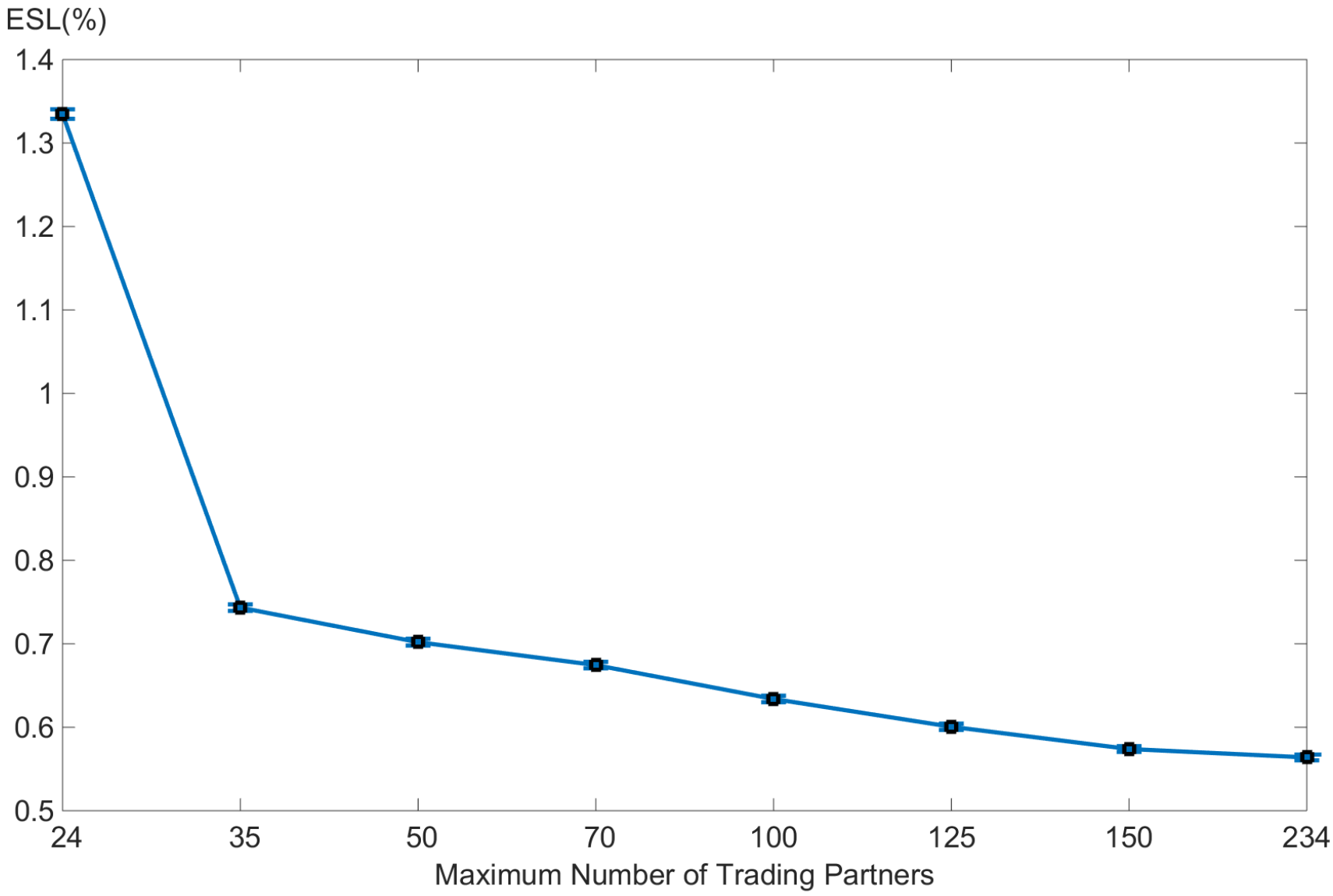


Efficiency and Stability Measures

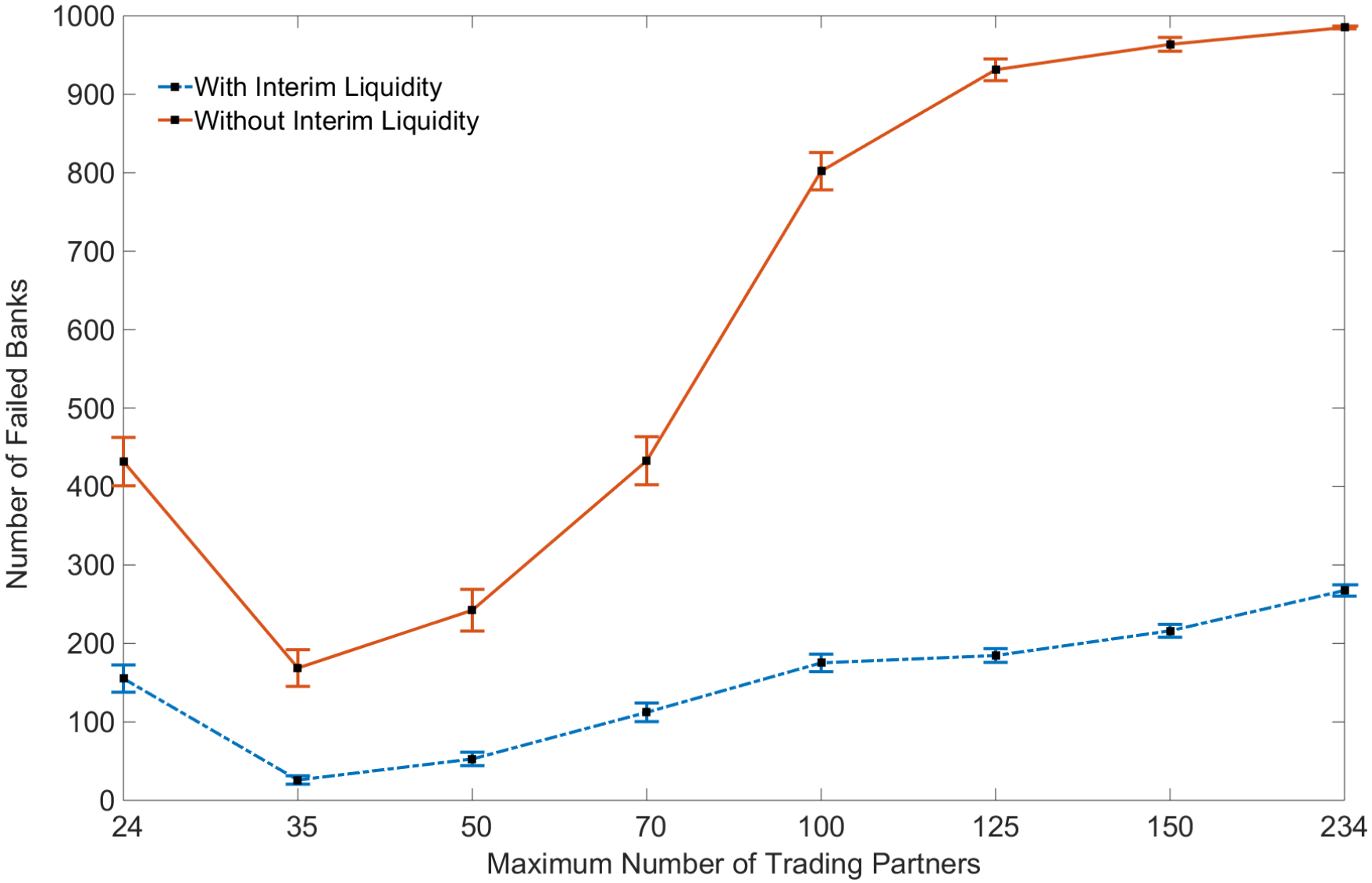
- **Efficiency Measures**
  - Welfare loss = Highest private value – Final borrower's private value
  - Surplus loss = Welfare loss / (maximum possible surplus)
  - Expected Surplus Loss (ESL) = average of surplus losses across different realizations of liquidity shocks.

- **Stability Measures**
  - Use the estimated model to compute exposures (% of loans to each bank relative to total loans).
  - Assume the most interconnected bank fails.
  - Compute the total number of bank failures:
    - [With interim liquidity] A bank fails when its exposure to a failed counterparty is above 15%.
    - [Without interim liquidity] A bank fails when its exposure to all failed counterparties is above 15%.
  - Compute the ESL after contagion.
    - Endogenous rerouting of trades.

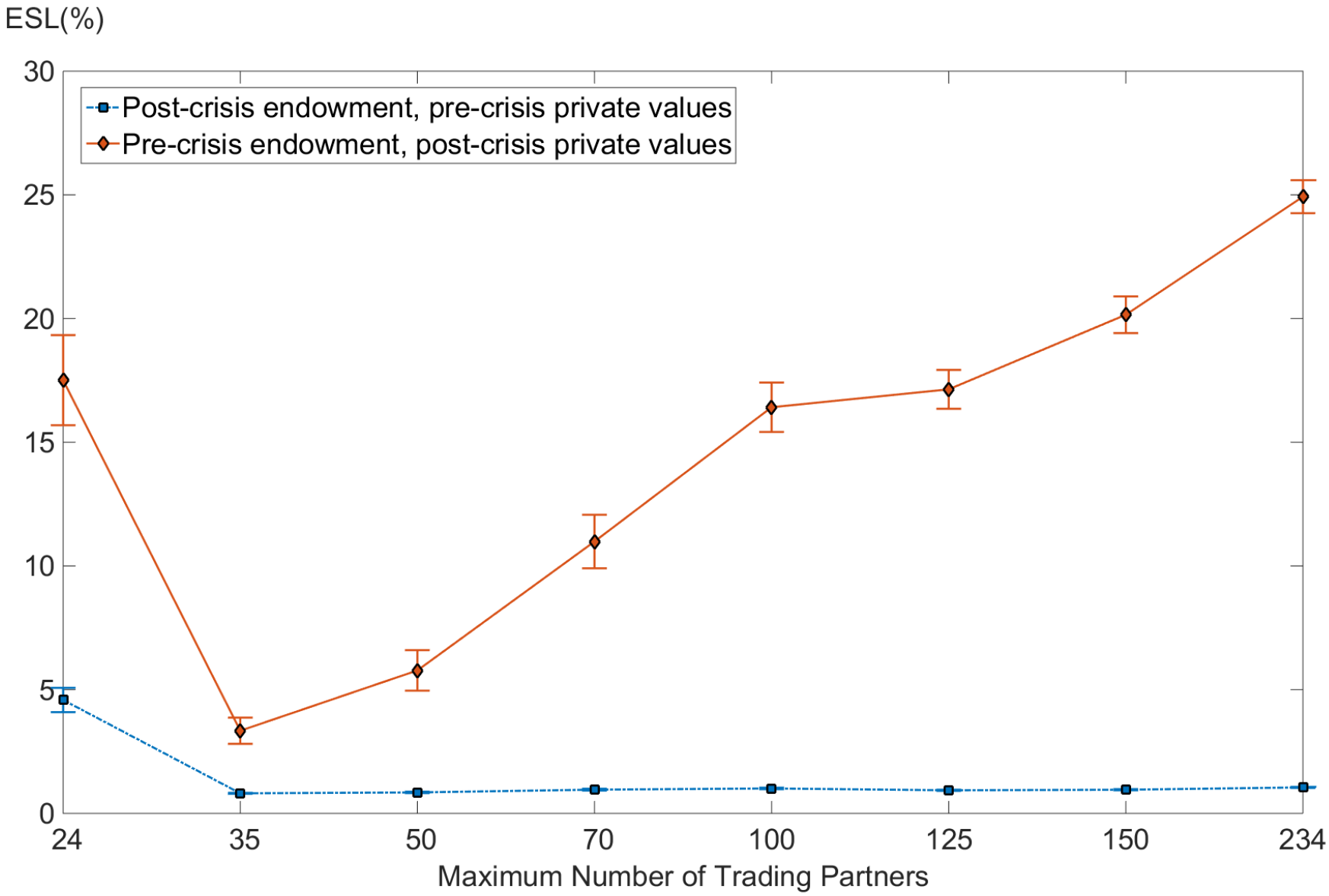
Efficiency Results



Stability Results



Stability Results (Cont.)



Non-monotonicity Example with Six Banks

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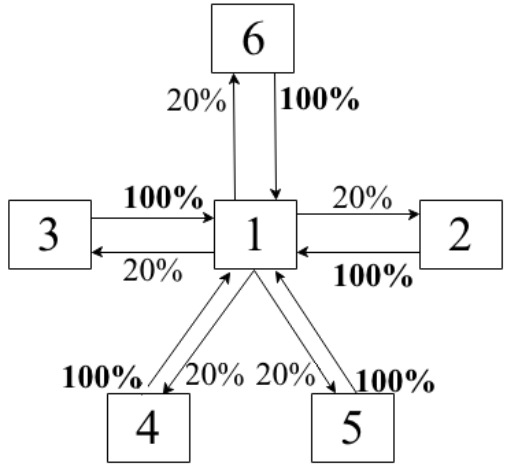

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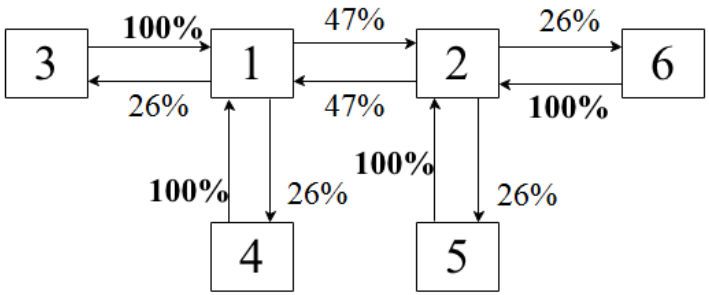

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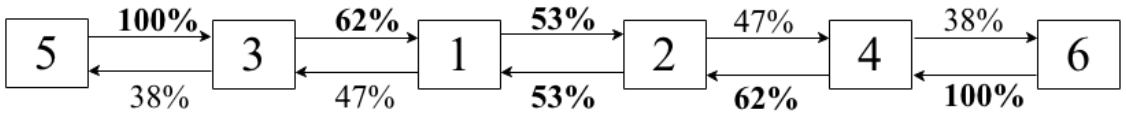

Conclusion

- Limits on interconnectedness reduce trading efficiency.
- While restricting the interconnectedness of banks improves stability, the effect is non-monotonic.
- Stability also improves when:
  - Banks are required to hold more liquid assets to absorb losses on interbank loans.
  - Banks have access to liquidity during the crisis.
  - Failed banks' depositors move money to the surviving banks.