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

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April 4th, 2014
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.
Questions

• How efficient and stable is the current financial architecture with large interconnected banks?

• What are the welfare and stability implications of limiting the maximum number of trading partners that financial institutions can have?
Contribution

- Calibrate the unobservable financial architecture using a network-based model of the federal funds market.

- Quantify efficiency of liquidity allocation in the current architecture and nine regulated financial architectures with different limits on the maximum number of counterparties.

- Quantify endogenous exposures between banks, and endogenous contagion risk: the number of banks that fail in a cascade and the drop in efficiency after their failure.

- Study which banks are systemically important in the ten architectures: most interconnected? most central? largest borrower? most critical for direct counterparties?
Summary of the Results

• The current financial architecture is relatively efficient. In case of contagion many banks will fail, but mostly small, periphery banks whose failure does not have a large impact on market efficiency.

• Putting a cap on the number of counterparties will make the financial architecture less efficient, more fragile and harder to monitor.

• The number of bank failures is non-monotonic in the cap. A financial architecture with a cap of 80 can be less stable than when it is 50 or 120.

• It is difficult to identify systemically important banks ex-ante.
Illustration of the Model

Initial allocation: E(1)=1

Private valuation: V(5)=0.6

P(5)=0.6

Welfare loss = 1-0.6=0.4
Surplus loss = welfare loss/first-best surplus = 0.4/(1-0.3)=0.57

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

\[ P_i = \max \{ V_i, \max_{j \in N(i,g)} V_j + B_i(P_j - V_j) \} \]
\[ B_i = 1 - \frac{0.5}{N(i,g)} \]

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

\[ \sigma_i = \arg \max_{j \in N(i,g) \cup i} P_j \]
Regulation Example with Six Banks

cap=5

\[
\begin{align*}
&\text{3} \\
&\text{1} \\
&\text{2} \\
&\text{4} \\
&\text{5} \\
\end{align*}
\]

\[
\begin{align*}
&\text{6} \\
&\text{cap=3} \\
&\text{3} \\
&\text{1} \\
&\text{2} \\
&\text{6} \\
&\text{4} \\
&\text{5} \\
\end{align*}
\]

\[
\begin{align*}
&\text{cap=2} \\
&\text{4} \\
&\text{3} \\
&\text{1} \\
&\text{2} \\
&\text{5} \\
&\text{6} \\
\end{align*}
\]
Equilibrium daily network of trades in the model. Only one third of all trading relationships are equilibrium trades.

Network of trades in the Fed funds market on September 29, 2006
Source: Bech and Atalay (2010)
• Between 30% to 55% of banks fail due to endogenous contagion.
• The number of bank failures is non-monotonic.
• Regulation can increase the number of failures.
The largest cascade size:

- The maximum number of failures triggered by a failure of a single bank (called systemically important) is higher for regulated architectures.
- The number of bank failures is non-monotonic.
Number of Waves of Defaults

- **Average number of waves of defaults**
- **Maximum number of waves of defaults**

**Graph:**
- X-axis: Maximum Number of Trading Partners
- Y-axis: Number of Waves of Defaults

- The graph illustrates the relationship between the maximum number of trading partners and the number of waves of defaults.
- There are two lines: one showing the average number of waves of defaults, and another showing the maximum number of waves of defaults.

**Data Points:**
- The lines show a decreasing trend as the maximum number of trading partners increases.

Regulated Architectures are More Fragile

Average number of banks failures

- Compute the size of the cascade triggered by failure of every bank
- Average across banks

Size of the largest contagion cluster

- If any bank in the cluster fails, it triggers failure of all other banks in the cluster (and maybe more)
What Bank is Systemically Important is Hard to Predict

Fraction of banks in each category that trigger the largest cascade

- Most Critical Bank for the First Wave of Failures
- Maximum Volume Borrower
- Most Central Bank
- Most Interconnected Bank

Maximum Number of Trading Partners
A methodology to calibrate a financial architecture based on the network of realized trades.

Quantify trading efficiency of a financial architecture with large interconnected banks.

Quantify welfare effects of *endogenous* financial contagion.

Can be used for assessment of financial regulation of systemically important financial institutions (e.g. Dodd-Frank, Sec. 123)