Discussion of "Network Hazard and Bailouts" by Selman Erol

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Reduced-Form Model: Threshold Contagion + Network Formation

- A collection of firms, banks, etc., of various types interacting over a network
- Each entity can either "survive" or "fail"
- Threshold contagion: a la Granovetter (1978), failure occurs if the number of failing neighbors exceeds a certain threshold.
- Network formation: the network of interactions is endogenous in the sense that agents need to be interacting in a "stable" network.
- Key questions:
  (1) What are the stable networks in the presence of threshold contagion?
  (2) How does the set of stable networks change with intervention?

Threshold Contagion

- A subset of agents are exposed to some shock, pushing them into failure
- Entity i fails if

$$\sharp \text{ failing neighbors} \geq R_i(d_i, \gamma_i)$$

- payoffs:
  - survival: $P(f_i, d_i, \gamma_i)$
  - failure due to a bad shock: $P_B(d_i, \gamma_i)$
  - failure due to contagion: $P_G(d_i, \gamma_i)$.
- It matters how i fails, but not the "margin" of failure

Network Stability

- Pairwise linkages are determined endogenously, in the sense that the network of interactions has to be stable.

- Solution concept: Pareto strong stability (Jackson & van den Nouweland, 2005).

- A deviation by $N' \subseteq N$ is feasible if agents in N' can
  - (i) add or delete any link between themselves
  - (ii) delete any link with agents in $N \setminus N'$

- A network is PSS if there are no feasible deviations by any $N' \subseteq N$ such that all agents in N' are weakly better off, with at least one strictly better off.

Reduced-Form Insights and Result

- Conditional on a fixed degree d, agents want to reduce second-order counterparty risk (SOCPR): risk due to contagion from neighbors of neighbors
- Thus, star network is the ideal configuration for any agent i of a given degree.
- But if agents are all symmetric, the star network is as good as the complete network: in any state of the world in which a peripheral's failure leads to another peripheral's failure, the center fails anyways.
- The equilibrium network is a union of cliques of identical agents (no SOCPR).
- Ex post interventions (rescue) break the above argument: agents are no longer worried about SOCPR.
- This can lead to more interconnected structures ← Network Hazard

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From the Reduced-Form to the Structural Model

- Multiple applications, but main focus on interbank networks

$$\begin{aligned} \text{agents} &\longrightarrow \text{banks} \\ \text{agent type} &\longrightarrow \text{bank size/deposit level} \\ \text{linkages} &\longrightarrow \text{credit lines for future lending/borrowing} \\ \text{shock} &\longrightarrow \text{shock to operating costs} \\ \text{failure} &\longrightarrow \text{if operating cost} > \text{continuation value} \end{aligned}$$

- Forming and maintaining credit lines are costly.
- Surviving banks use the credit lines to channel their excess deposits to banks with investment opportunities. But funds can only travel over one link.
- This means banks draw benefits from establishing direct credit lines to others.

Comment: Failure Mechanism

- Each bank can only survive if it can cover its operational costs.
- Banks obtain higher profits by lending their excess cash to banks with investment opportunities.
- Value of credit lines: the more direct linkages I have, the more money I can lend (at a profit) to my counterparties.

- Failure mechanism:

- In other words, i defaults because it has too much idle cash that it cannot invest!
- Not sure if this maps to reality: at least when it comes to large banks, defaults happen because they cannot raise sufficient cash

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$$\begin{array}{ccc} i\text{'s counterparties go under} & \longrightarrow & i \text{ cannot lend its excess cash} \\ & & \downarrow \\ \text{default} & \longleftarrow & \text{not enough profits to cover operational costs} \end{array}$$

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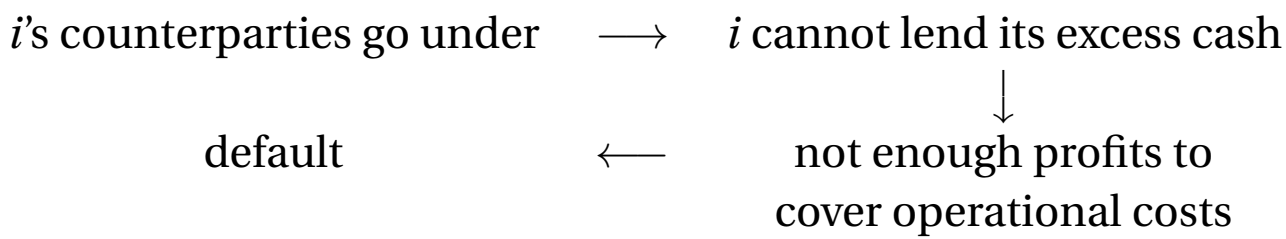

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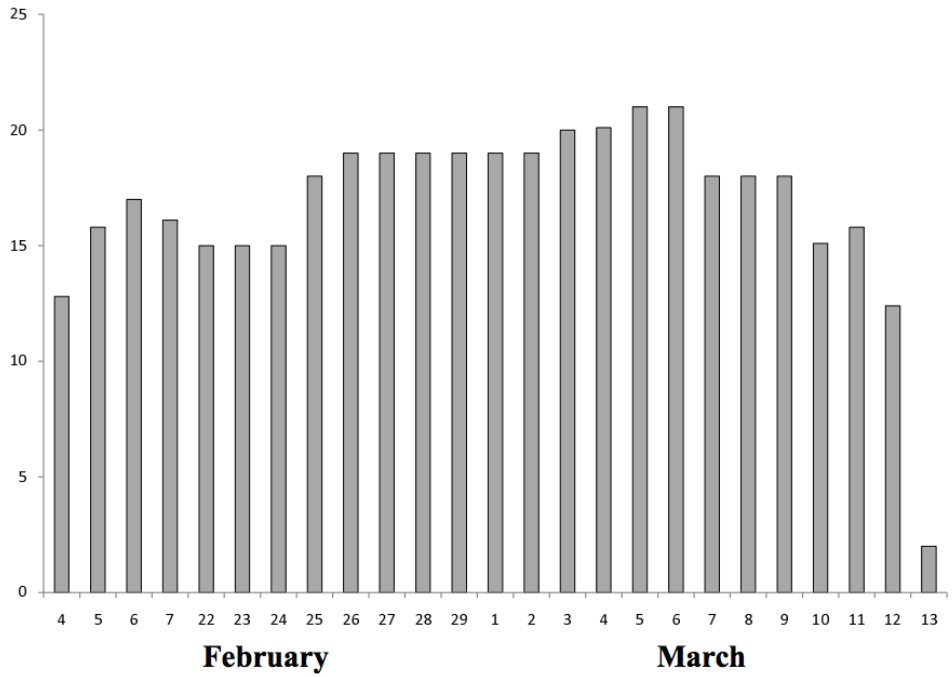
Comment: Failure Mechanism

- Bear Stearns' liquidity pool (in $ billions) in the days before it was acquired by J.P. Morgan in 2008



Source: Testimony by SEC Chairman Chris Cox (Duffie, 2010)

- The distinction may not matter for the mechanics of threshold contagion, but may matter for network formation incentives.
- Do I form links to raise funds or to lend?

Comment: Spillover Mechanism

- The model implies that the shock "passthrough" is either 0 or 100%.
- An artifact of (i) interactions on the extensive margin and (ii) threshold contagion.

- In financial markets, lenders/borrows can also adjust the intensive margin (both quantities and prices)
- These can lead to intermediate passthrough of the shocks, with qualitatively important effects for SOCPR and hence the equilibrium network.

- E.g., the equivalence between complete and star networks may break down.
  - In the threshold contagion/extensive margin model, those shocks propagate to the center via multiple channels if and only if the center would have failed without them $\rightarrow$ cliques obtain minimal SOCPR.
  - With intermediate passthrough, shocks to peripherals can propagate to the center via multiple channels $\rightarrow$ interaction between peripherals matter for the center.

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Summary

- Useful (reduced-form) framework to allow for endogenous networks in the presence of threshold contagion
- Breaks new ground by allowing for endogenous response of the network architecture to intervention policies

- Key insights:
  (1) entities endogenously eliminate SOCPR by forming cliques
  (2) interventions that remove SOCPR would induce more interconnected networks (core-periphery)

- Comment: bringing the model closer to that of financial crises
  - failure mechanism
  - how far can one push the insights on SOCPR to a world with intermediate passthrough?