Discussion of
"Asset Pricing Implications of Systemic Risk in Network Economies"
Buraschi and Tebaldi (2019)

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Economic and Financial Networks

- Growing literature on how network linkages between firms, banks, industries can
  (i) function as a mechanism for propagation and amplification of shocks.
  (ii) translate micro shocks into aggregate fluctuations.

- Applications:
  - potential explanation for the source of macroeconomic fluctuations
  - a theory of systemic risk in the banking system

- This paper: asset pricing implications of network interactions

This Paper

- Framework: endowment economy of n firms with interlinked dividend streams
  - network Δ capturing the likelihood of distress spillovers (reduction in dividends)
  - study whether the distress can persist for a long time due to spillovers
  - subcritical regime: idiosyncratic shocks die out very rapidly
  - supercritical regime: the distress can persist in the long run in a large economy

- Main Takeaways:
  - the threshold between the two phases depends on the network Δ
  - higher Δ_{ij} results in more spillovers and faster transition to the supercritical regime
  - all this has to be priced ex ante: a model of endogenous long-run risk

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Model

- Economy consisting of n firms with dividend streams

$$d_{it} = (a_i - \epsilon_i H_{it}) Y_t$$

  - Y_t: common systematic shock (following $dY_t / Y_t = \mu dt + \sigma dW_t$)
  - a_i: payout in the normal state
  - ϵ_i: reduction in the distress state
  - $H_{it} \in \{0, 1\}$: binary variable indicating the distress state

- H_{it} transitions between 0 and 1 following independent jump processes:
  - λ_i: transition rate to distress ($0 \to 1$)
  - η_i: transition rate out of distress ($1 \to 0$)

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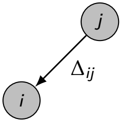
Model: Network Interdependence

- While transitions occur independently, transition rates are intertwined. Distress at some firm j increases the likelihood of distress at other firms:

$$\lambda_i(\mathbf{H}) = \lambda_i + \lambda \sum_{j=1}^{n} \Delta_{ij} H_j$$

- Network of distress spillovers: Δ



- Recovery rates not subject to spillovers: $\eta_i(\mathbf{H}) = \eta$
  - extreme asymmetry in how negative and positive shocks propagate!

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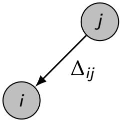

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Markovian Model

- A Markovian model of transitions in and out of distress:

$$d_{it} = (a_i - \epsilon_i H_{it})\, Y_t$$

$$\lambda_i = \lambda \sum_{j=1}^{n} \Delta_{ij} H_j$$

$$\eta_i = \eta.$$

- Key question: suppose we start from a no distress state ($\mathbf{H} = 0$) and push one firm to distress ($H_i = 0 \to H_i = 1$). How long does it take for the system to get back to the full no distress state?
- Solution: use standard results for Markov chain convergence times to quantify this time as a function of Δ.

Cascades

Definition

A sequence of economies experiences a cascade if expected time to mixing of the Markov chain grows exponentially in n.

$$\lim_{n\to\infty} \frac{1}{n} \log \mathbb{E}[T_{\mathrm{mix}}] > 0.$$

- Cascade: distress can persist for a very long time.

Theorem

There exists a critical threshold $\kappa(\Delta)$ such that a cascade can occur with positive probability if and only if $\lambda/\eta > \kappa(\Delta)$.

- Two very different regimes:
  - subcritical: the effect of shocks die out in a large economy in the long run
  - supercritical: the effect of shocks last for a long time even in a large economy

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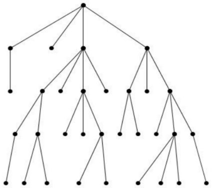
Intuition

- A network where each agent has m neighbors:

$$\begin{cases} \text{subcritical:} & m\lambda < \eta \\ \text{supercritical:} & m\lambda > \eta \end{cases}$$



- If m is large relative to the recovery rate, one distressed firm can infect many many others. But if m is small, the infection dies out.

Asset Pricing Implications

- If initial shocks do not dissipate away in the long run, then they should be priced.
- A model of generating long-run risks endogenously.
- Long term risk premium:

$$\mu^i_\infty = \gamma\sigma^2 + (h_{i\infty}\epsilon/a) * (\text{network-dependent terms})$$

- In the supercritical regime ($h_{i\infty} > 0$), we no longer have a single-factor model.
- Therefore, CAPM β no longer captures priced risk exposure.

Comment

- Modeling assumptions indispensable to the creating long-lasting effects:
  (i) asymmetric propagation between positive and negative shocks
  (ii) epidemic-like propagation mechanism ("neighborhood independence")

- No reason to think the assumptions are unreasonable in principle
- Question: what environment the model is approximating?
  - in general, macro predictions of network models are highly sensitive to the assumptions made on micro interactions (Acemoglu et al., 2016)

Comment

$$\lambda_i(\mathbf{H}) = \lambda \sum_{j=1}^{n} \Delta_{ij} H_j$$

- The model has two key features:

(1) out-neighborhood independence:
likelihood that j infects i is independent of how many others j can infect

(2) in-neighborhood independence:
likelihood that j infects i is independent of how many others can infect i.

- Both forces imply more connections can only intensify the likelihood of cascades.
- Reasonable assumptions for epidemics and pandemics
  - You cannot diversify the risk of getting sick by hanging out with more people!

Comment

- More questionable for spillovers via economic interactions or financial markets: holding the exposure of i to j constant, changing i or j's other connections can still change the propagation intensity.
  - production networks:
    unless inputs are perfect complements, having more suppliers reduces the likelihood of spillover from a given supplier (in-neighborhood dependence)
  - interbank networks:
    the likelihood of spillover of losses from debtor j to creditor i depends not only on i's exposure to j, but also on how much j owes others (out-neighborhood dependence)
- How important is this very strong propagation mechanism for the existence of a supercritical regime?

Summary

- Nice and innovative paper aimed at studying the asset pricing implications of network economies
- Analytical results on how firm-level shocks can persist for a very long time
  - phase transition and sub- vs. supercritical regimes
  - risk premia
  - characterization in terms of network centralities (see the paper)

- Comments/Wishlist: like any other model, results are sensitive to the specific propagation mechanism assumed in the model
  - holding interaction levels constant, shocks to neighbors cannot be diversified away
  - key in generating long-lasting effects
  - important to argue for contexts/applications where such assumptions are good approximations