The Transmission of Shocks in Endogenous Financial Networks: A Structural Approach

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Discussed by
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- Recent literature emphasizes the importance of financial linkages for the propagation of shocks (Elliot et al 2014; Acemoglu et al 2015)
- But these linkages are also affected by the shocks
  → let's endogenize them!
- This paper:
  - New propagation channels
  - Structural estimation of the model to highlight their importance
  - Look at the impact of ECB quantitative easing
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Overview of the Model

- Banks: $i \in \{1, \ldots, N\}$
- Traded instruments: $j \in \{1, \ldots, J\}$
  - Some of these instruments are the banks' equity $\{E_i\}_{i \in \{1,\ldots,N\}}$
- Bank i has subjective beliefs r_{ijt} about instrument j's return
- Bank i's *net* holding (demand less supply) of securities is a J-vector Δ_{it}
  - **Network of linkages through equity claims**
- Banks i's problem

$$\max_{\Delta_{it}} \int u_i \left(\Delta'_{it} r\right) dr - \underbrace{\left\| \frac{\gamma_i}{p} \cdot \left(\Delta_{it} - \Delta_{it-1}\right) \right\|^2}_{\text{adjustment costs}}$$

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- Notation:
  - θ is a shock
  - p^p is the vector of prices for non-equity instruments
  - Δ_i^p is the net demand of bank i for non-equity instruments
  - Δ_i^e is the net demand of bank i for equity instruments
- Suppose no propagation through the network for now

$$\frac{dE}{d\theta} = [\cdots] \left[\underbrace{\left\{ 1' \frac{\partial \Delta_i}{\partial \theta} \right\}_i}_{\text{A}} + \underbrace{\left\{ \frac{\partial 1_p' \Delta_i^p}{\partial \log p^p} + \frac{\partial 1_e' \Delta_i^e}{\partial \log p^p} \right\}_i \frac{d \log p^p}{d\theta}}_{\text{B}} \right]$$

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- General linear network model

$$\begin{bmatrix} E_1 \\ \vdots \\ E_n \end{bmatrix} = \begin{bmatrix} A_{11} & \cdots & A_{1n} \\ \vdots & \ddots & \vdots \\ A_{n1} & \ldots & A_{nn} \end{bmatrix} \begin{bmatrix} E_1 \\ \vdots \\ E_n \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \vdots \\ \varepsilon_n \end{bmatrix}$$

- Can be rewritten as

$$E = [\mathbb{1} - \mathcal{A}]^{-1} \varepsilon$$

where $[\mathbb{1} - A]^{-1}$ is the Leontief inverse (from olden input-output analysis)

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- What is in the influence matrix $\mathcal{A}$?

$$\mathcal{A} = \left(\underbrace{H}_{\text{A}} + \underbrace{\frac{\partial H}{\partial \log p^e}}_{\text{B}} + \underbrace{\left\{ \frac{\partial \left(1_p' \Delta_i^p\right)}{\partial \log p^e} \right\}}_{\text{C}} \right) (\text{diag} E)^{-1}$$

where $H_i = 1_e' \text{diag} \Delta_i^e$ is the vector of holdings

- Mechanisms:
  - A: Cross-bank equity holdings
  - Impact of changes in equity prices on:
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Endogenous network $\equiv \mathcal{A}$ is endogenous

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Implications:

- The influence of a bank on another one is endogenous
- After shocks some banks gain in influence, others lose
- No links destructions/creations (all links always exist)
- Contrast with recent literature in macro
  - Oberfield (2018), Taschereau-Dumouchel (2019), Acemoglu and Azar (2019)
- Do we care?
  - Maybe. Do we see a lot of link creations/destructions in the data?
  - Models with links creations/destructions are harder to build/solve $\rightarrow$ harder to estimate.

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Contact with the finance network literature

One popular model of networks in finance (Elliot et al 2014)

- Cascading failure across institutions

$$V_i = \sum_{j \neq i} C_{ij} V_j + \sum_k D_{ik} p_k - \beta_i I_{v_i < \underline{v}_i}$$

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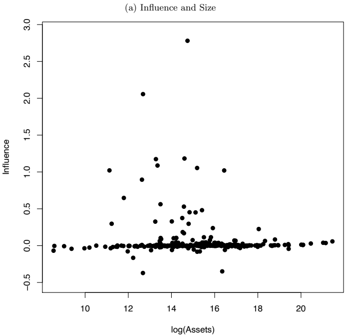
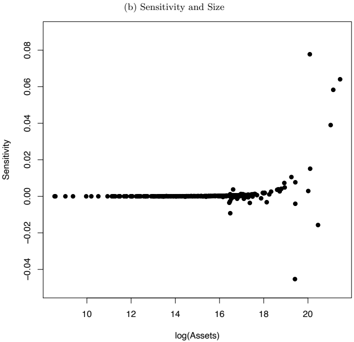
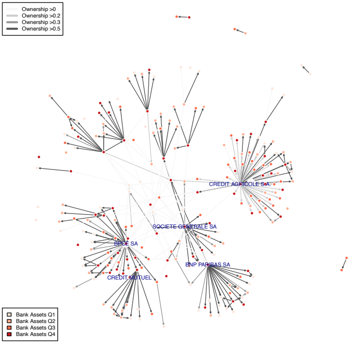
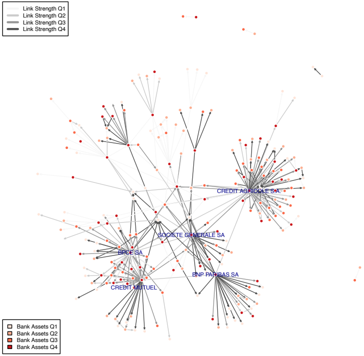
Estimation using details French data.





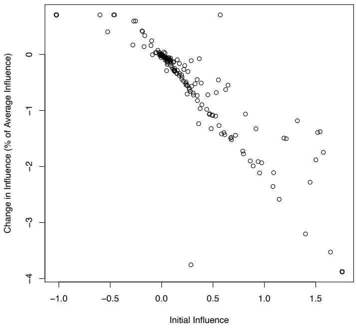
Comparing exogenous part (left) and endogenous part (right) of the network



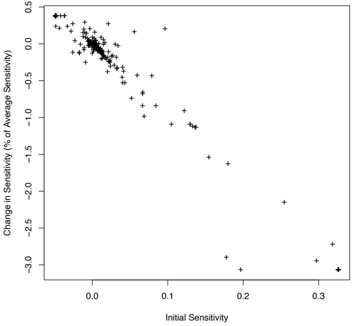


Shock to estimated model: ECB quantitative easing (increased demand for government bonds)

(a) Impact on Firm Influence in General Equilibrium



(b) Impact on Firm Sensitivity in General Equilibrium



Why the endogenous network?

Main comment: Quantify the importance of the mechanism

- How big of a mistake do we make if we simply use holding data as exogenous network

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- Discussion of how the environment changes the network
- What networks are better/worse for shocks?
- Firms do not solve their dynamic problem correctly
  - Do we really need the fixed cost?
- Expected returns for banks are unrelated to their holdings
  - Example:
    - Two banks A and B, and some outside asset C
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Concluding comments

To conclude:

- Very interesting paper
- Great contact with the data
- Nice next step for financial network literature