Discussion of
"Information Acquisition and Response in Peer-Effect Networks"
Leister (2015)

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Overview

- A growing literature on the equilibrium vs. efficient use of information.
  - exogenous information structure
    Morris and Shin (2002), Angeletos and Pavan (2007)
  - endogenous information structure
    Hellwig and Veldkamp (2009), Myatt and Wallace (2012)
- The literature focuses on “symmetric” interactions: externalities and strategic complementarities are the same between any two agents i, j.
- A parallel literature focuses on asymmetric (network) interactions, but under complete information.
- This paper:
  network (asymmetric) interactions + endogenous info structure.

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Why Should We Care?

- Growing set of papers that argue informational frictions can be the source of business cycle fluctuations.
- Does welfare improve when firms are better informed about the state of the economy, specially when they need to coordinate with others for production? Angeletos and La'O (2013), Angeletos, et al. (2015)

- At the same time, it is highly plausible to assume that firms care differentially about coordinating with one another (think input-output linkages, credit relations, etc.)
- The framework in this paper is the right first step.

The "Network Game"

- A variant of Ballester, Calvo-Armengol and Zenou (2006)

$$u_i(x_i, x_{-i}) = \theta x_i - \frac{1}{2} x_i^2 + \alpha x_i \sum_{j \neq i} w_{ij} x_j$$

- θ underlying state of the world.
- $W = [w_{ij}]$ captures the extent of interactions between agents.
- For simplicity, suppose actions are strategic complements: $w_{ij} \geq 0$.
- Can be represented by a directed, weighted network

Complete Information Game

- Suppose θ is common knowledge
- Equilibrium actions are given by

$$x_i = \theta \sum_{j=1}^{n} \ell_{ij},$$

where $L = (I - \alpha W)^{-1}$ is the Leontief inverse of the economy.

- ℓ_{ij} captures the extent of (direct and indirect) interactions between j and i.

Incomplete Information Game

- Now suppose agents do not know the underlying state θ,
- Agent i observes a signal s_i about the state: $\mathbb{E}[\theta|s_i] = e_i s_i$.
- The weight agent i assigns to his signal $x_i = \beta_i s_i$ is given by

$$\beta_i = \sum_{j=1}^{n} \widehat{\ell}_{ij} e_j,$$

where $\widehat{L} = (I - \alpha EWE)^{-1}$ is a modified Leontief inverse.

- In the presence of strategic complementarities, the more informed other people are, the more weight I put on my own signal.
- A general statement that is not about networks, but the network determines the extent to which I react to other people's signal precision.

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Information Acquisition Game

- Now endogenize information acquisition
- Suppose agent i can acquire information about θ at $t = 0$ at cost $\kappa(e_i)$
- Main focus of the paper: how do network interactions impact the extent of information acquisition?

Benchmark Setting: Unobservable Acquisition

- Agents at $t = 1$ do not observe others' information acquisition decisions at $t = 0$.
- Equilibrium acquisition decisions and second-stage actions:

$$e_i \kappa'(e_i) = v_0 \beta_i^2$$
$$\beta_i = \sum_{j=1}^{n} \widehat{\ell}_{ij} e_j.$$

- Suggests that acquisition decisions are also dependent on the network.

- But are they really?

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Comment 1: Network Effects vs. Size Effects

- Let's assume that agents are symmetric in all respects, except for the nature of their network interactions.
- Most importantly, let's assume that all agents are of equal "size":

$$\sum_{j=1}^{n} w_{ij} = \sum_{j=1}^{n} w_{ji} = 1.$$

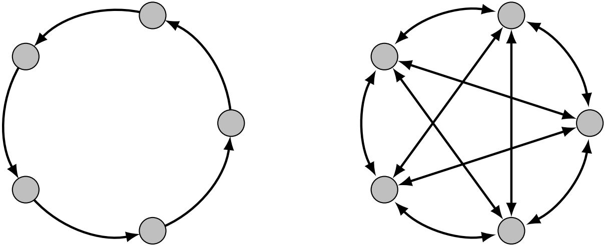
- It turns out:

$$\kappa'(e_i) = \frac{v_0 e_i}{\left(1 - \alpha e_i^2\right)^2}.$$

- All agents acquire informations of the same exact precision!

Comment 1: Network Effects vs. Size Effects

- A mean-preserving spread of network interactions does not impact acquired precisions:



- When acquisition decisions are endogenized, the details of network interactions become irrelevant!
- Are the results driven by “network effects”, “size effects”, or the interaction between the two?

Alternative Setting: Observable Acquisition

- Now suppose that e_i is observable to all agents.
- First-order conditions:

$$v_0 \beta_i \frac{\partial \beta_i}{\partial e_i} = \kappa'(e_i)$$

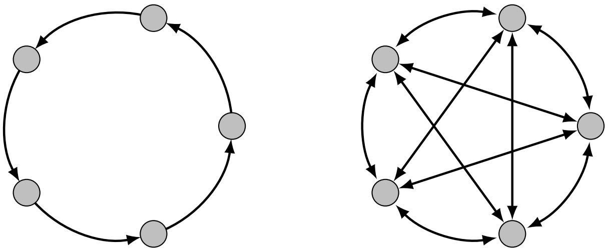
where

$$\frac{\partial \beta_i}{\partial e_i} = \frac{\beta_i}{e_i} \left(2\widehat{\ell}_{ii} - 1 \right).$$

- Now, unlike the case of unobservable actions, the details of the network becomes important, even when all agents are of the same "size".

Observable Acquisition

$$\widehat{\ell}_{ii}(\text{complete}) > \widehat{\ell}_{ii}(\text{ring}).$$



- Agents acquire more information if interactions are more evenly distributed.

Equilibrium and Efficiency

- In the observable action case, agents under-acquire information relative to the welfare maximizing benchmark (when actions are strategic complements).

- They do not internalize the fact that a more precise signal about θ also helps other agents to coordinate better ($\partial \beta_j / \partial e_i > 0$).

Comment 2: Efficiency Benchmark

- Consider the game with unobservable information acquisition decisions.
- The paper compares equilibrium outcomes to the outcome of a benchmark in which
  (a) the social planner chooses $(e_1, \ldots, e_n)$.
  (b) the social planner lets agents choose the second stage actions x_i.
  (c) agents' actions are contingent on $(e_1, \ldots, e_n)$.
- But this seems to be the correct efficiency benchmark for the game with *observable* actions.

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Comment 3: "Small" Peer-Effects

$$u_i(x_i, x_{-i}) = \theta x_i - \frac{1}{2}x_i^2 + \alpha x_i \sum_{j \neq i} w_{ij} x_j$$

- The paper characterizes $\Delta e_i = e_i^{\text{eff}} - e_i^{\text{eq}}$ as $\alpha \to 0$.
- This provides a first-order approximation to network effects.
- It is as if $L = (I - \alpha W)^{-1} \approx I + \alpha W$.
- But this effectively shuts down all interesting network effects.
- Not surprisingly, Δe_i is a function of $(w_{i1}, \ldots, w_{in})$
- To understand the overall network effects, I think it would be important to avoid the small α approximation.

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Summary

- Timely paper that focuses on the interplay between information acquisition and asymmetric interactions.
- Provides a neat characterization of the information acquisition decisions.
- Possible application: firms in a production network learning about shocks, with implications for business cycle fluctuations.
- Think harder about the role of the network interactions: when is it truly a "network effect" as opposed to a "size effect"?
- What is the right efficiency benchmark?
- I'm worried that even though informative, the "small" peer effect approximation is throwing the baby out with the bathwater.