Discussion of "Firm-to-Firm Trade in Sticky Production Networks" by Kevin Lim

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Summary of the Paper

- Theory of endogenous network formation between firms
- Combination of random chance and strategic choice
- Main contribution of the theory:
  - Tractability
  - Produces the key fact from the data that larger firms are connected to more buyers and suppliers than smaller firms
- Takeaways from the empirical/quantitative part:
  - Both relationship heterogeneity and endogeneous network structure are quantitatively important

Key Features of the Static Environment

Overview

- Fixed number of firms: no entry and exit
- Production technology: CES combination of labor and varieties of other firms
- Every firm sells to and buys from every other firm
  - My interpretation (maybe, not correct)
- All firms sell their good to the household
- Market structure: monopolistic competition both on the firm-to-firm and firm-to-household markets

Key Features of the Static Environment

Firms and Network

- Firms characterized by fundamental productivity and demand, ϕ and δ
  - Higher $\phi \Longrightarrow$ more efficient in using labor input
  - Higher $\delta \Longrightarrow$ household buys more
- **Continuum** of firms of each type $\chi \equiv (\phi, \delta)$
- $m(\chi, \chi')$ is a chance that type χ meets type χ'
- Since there is a continuum of firms χ, $m(\chi, \chi')$ is
  - Fraction of firms χ' that sell to type χ
  - Fraction of firms χ that buy from firm χ'
- Identities of connected firms within types χ and χ' are not important
  - Probablistic characterization similar to Eaton-Kortum

Key Features of the Static Environment

Firms and Network

My interpretation:

- Every firm χ is connected with every other firm χ'
- "Intensity" of connection is given by $m(\chi, \chi')$
- Without this, need to solve a large discrete choice problem

Static Equilibrium

- Network structure translates *fundamental* productivity ϕ and demand δ into *network* productivity Φ and demand Δ
- Given function $m(\chi, \chi')$, functions $\Phi(\chi)$ and $\Delta(\chi)$ completely characterize static equilibrium

Key Features of the Dynamic Environment

- Cost $f_t = \psi\xi_t$ of maintaining a link between any two firms
  - Payed by seller in terms of labor
  - ξ_t has distribution G_ξ and unit mean
  - Now network is parametrized by distribution of (χ, χ', ξ_t)
- Seller is given opportunity to alter link with a buyer with probability $(1 - \nu)$
  - Establish link if are not connected
  - Remove link if connected
- Given opportunity to alter link, seller makes an optimal forward-looking decision
  - The only intertemporal decision in the model
- Combination of chance $(1 - \nu)$ and optimal choice determine evolution of links between firms of types χ and χ', $m_t(\chi, \chi')$
  - Function $m_t(\chi, \chi')$ is the state of the network
- Given $m_t(\chi, \chi')$, $\Phi_t(\chi)$ and $\Delta_t(\chi)$ completely characterize equilbrium in period t

Structural Estimation

- Parametric assumptions:

$$\begin{bmatrix} \ln \phi \\ \ln \delta \end{bmatrix} \sim \mathcal{N}\left(\begin{array}{c} 0 \\ 0 \end{array}, \begin{bmatrix} 0 & v^2 \\ v^2 & 0 \end{bmatrix} \right),$$

  and ξ_t has Weibul distribution with shape s_ξ and scale λ, i.e.,

$$G_\xi(x) = 1 - e^{-\left(\frac{x}{\lambda}\right)^{s_\xi}}$$

  - Scale λ is such that $E[\xi_t] = 1$

- Focus on estimation of v, ψ, s_ξ, and ν
  - Other parameters are assigned plausible values

Structural Estimation

Targeted Moments

- 7 targeted distributions:
  1. Revenues
  2. Number of suppliers
  3. Number of customers
  4. Supplier retention rates
  5. Customer retention rates
  6. Supplier creation rates
  7. Customer creation rates
- Distributions 1-3 "identify" v
- Distributions 4-7 "identify" s_ξ and ν
- ψ is estimated by matching the labor share devoted to production of varieties equal to 0.7
  - Motivated by the fact that degree count is continuous in the model but discrete in the data
  - Needs a better explanation
- Overall, reasonable fit

Counterfactual Exercises

- Firms are divided into 10 groups by their revenue
- Four sets of counterfactual exercises:
  - Positive/negative shock to productivity ϕ for all firms in decile 1, 2, ..., 10
  - Positive/negative shock to demand δ for all firms in decile 1, 2, ..., 10
- Baseline result:
  - The bigger is the size of affected firms, the bigger is the positive/negative effect on welfare

Counterfactual Exercises

Importance of Structure and Dynamics of Network

- Relationship heterogeneity is quantitatively important
  - Without heterogeneity, welfare effects of small firms are overpredicted and those of large firms are underpredicted
- Propagation of shocks with a fixed network
  - First-order effect approximates well the total welfare effect
- The role of endogeneity of network
  - Quantitatively important

Discussion

- Firm entry and exit is important feature of data
  - Probably, not difficult to incorporate
- Continuum of firms, so shock to any paritcular firm is negligible
  - Goes against the "granularity" macro literature

Discussion

The exercise with shocks to a fixed network:

- The paper calls this exercise "Supply chain heterogeneity"
- Arguably, the model is not fit to speak to supply chain heterogeneity
  - For each firm type χ, there is a continuum of firms with the full distribution of supply chain lengths
- The small predicted higher-order effects of the shock are counterfactual to what is found in the data by Carvalho, Nirei, Saito, and Tahbaz-Salehi (2016)