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 endogenous 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, $\phi$ and $\delta$
  - Higher $\phi \implies$ more efficient in using labor input
  - Higher $\delta \implies$ household buys more

- Continuum of firms of each type $\chi \equiv (\phi, \delta)$

- $m(\chi, \chi')$ is a chance that type $\chi$ meets type $\chi'$

- Since there is a continuum of firms $\chi$, $m(\chi, \chi')$ is
  - Fraction of firms $\chi'$ that sell to type $\chi$
  - Fraction of firms $\chi$ that buy from firm $\chi'$

- Identities of connected firms within types $\chi$ and $\chi'$ are not important
  - Probabilistic characterization similar to Eaton-Kortum
My interpretation:

- Every firm $\chi$ is connected with every other firm $\chi'$
- “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 $\phi$ and demand $\delta$ into *network* productivity $\Phi$ and demand $\Delta$

- 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
  - $\xi_t$ has distribution $G_\xi$ and unit mean
  - Now network is parametrized by distribution of $(\chi, \chi', \xi_t)$
- 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 $\chi$ and $\chi'$, $m_t (\chi, \chi')$
  - 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 equilibrium in period $t$
Structural Estimation

- Parametric assumptions:

\[
\begin{bmatrix}
\ln \phi \\
\ln \delta
\end{bmatrix} \sim \mathcal{N} \left( \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 & \nu^2 \\ \nu^2 & 0 \end{bmatrix} \right),
\]

and \( \xi_t \) has Weibul distribution with shape \( s_\xi \) and scale \( \lambda \), i.e.,

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

- Scale \( \lambda \) is such that \( E[\xi_t] = 1 \)

- Focus on estimation of \( \nu, \psi, s_\xi, \) and \( \nu \)
  - 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" $\nu$
▶ Distributions 4-7 "identify" $s_\xi$ and $\nu$
▶ $\psi$ 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 $\phi$ for all firms in decile 1, 2, ..., 10
  - Positive/negative shock to demand $\delta$ 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 particular firm is negligible
  - Goes against the “granularity” macro literature
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 $\chi$, 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)