Discussion of “Monetary Policy Through Production Networks” by Ali Ozdagli and Michael Weber (2016)

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Main Question

- Can input-output linkages matter for the effect of monetary policy?

- Basu (1995); Nakamura and Steinsson (2010):
- In a menu cost model, input-output linkages make pricing decisions of different firms strategic complements
  - firms may adjust their prices less than they otherwise would at the face of aggregate demand shocks, because the prices of many their inputs have not yet responded.
- This amplifies the degree of monetary non-neutrality

This Paper

- New perspective on the role of input-output linkages: monetary policy shocks are demand shocks that propagate from customers to suppliers.
- Focus on the stock market returns using spatial econometrics methods

- Theory:
  - A model where shocks propagate over IO linkages.
  - Monetary policy shocks manifest themselves as demand shocks that propagate upstream (from customer firms to supplier firms).

- Empirics:
  - Identify monetary policy shocks as changes in futures on FF rates
  - “Indirect effects” account for roughly 80% of the overall impact.

This Discussion

- A slightly modified version of the model
- One comment on the interpretation of the results
- Some thoughts on identification

How Do Shocks Propagate Over IO Linkages?

- n competitive sectors producing different products:

$$\begin{aligned} \max \quad & p_i y_i - w l_i - \sum_{j=1}^{n} p_j x_{ij} - f_i \\ \text{s.t.} \quad & y_i = e^{z_i} l_i^{1-\alpha} \prod_{j=1}^{n} x_{ij}^{\alpha w_{ij}} \end{aligned}$$

  where w_{ij} captures input-output linkages and z_i is the productivity shock to sector i.

- Market clearing:

$$p_i y_i = d_i + \sum_{j=1}^{n} p_i x_{ji}$$

  where d_i is the nominal demand for good i (by HHs, Gov, etc).

Propagation of Shocks

- From firm's first-order conditions:

$$p_i y_i = d_i + \alpha \sum_{j=1}^{n} w_{ji} p_j y_j \tag{1}$$

- On the other hand, from firm's problems:

$$\log p_i = -z_i + \alpha \sum_{j=1}^{n} w_{ij} \log p_j.$$

- As a result,

$$\log y_i = z_i + \alpha \sum_{j=1}^{n} w_{ij} \log y_j + \text{constant}. \tag{2}$$

Propagation of Shocks: Effect on the Output

- Supply-side (productivity) shocks only propagate downstream, from more upstream sectors to their customers.

- Demand-side shocks only propagate upstream, from downstream sectors to their suppliers.

Back to the Paper: Model

- Monetary policy shocks in this model are effectively demand shocks:
  - Goods demanded by customers who are subject to a cash-in-advance constraint.
  - An increase in the supply of money enables them to purchase more goods ($d_i \uparrow$ for all i)
- More specifically:

$$p_i y_i = d_i + \alpha_m \sum_{j=1}^{n} w_{ji} p_j y_j$$

$$RET_i = (1 - \alpha_m - \alpha_l) p_i y_i - f_i.$$

- As a result:

$$RET_i = \text{constant}_i + (1 - \alpha_m - \alpha_l) d_i + \alpha_m \sum_{j=1}^{n} w_{ij} RET_j$$

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Direct & Indirect Effects

- Main reduced-form equation of the model:

$$RET_i = (1 - \alpha_m - \alpha_l) d_i + \alpha_m \sum_{j=1}^{n} w_{ij} RET_j$$

- This means:

$$RET = Ld$$

where

$$L = (1 - \alpha_m - \alpha_l) \left(I - \alpha_m W \right)^{-1}$$

is the Leontief inverse of the economy.

- If W is diagonal, so will be L: only direct effects.
- The off-diagonal elements of L measure the indirect effects.

Interpretation: Network vs. Size Effects?

- Recall:

$$RET_i = (1 - \alpha_l - \alpha_m)p_i y_i - f_i.$$

- This suggests that the main role of input-output linkages is to create heterogeneity in sectoral sizes.

- But firms can have different sizes due to non-network reasons.
- Raises the question of interpretation: is this a network or a size effect?
- In principle, with idiosyncratic shocks, one should be able to tell the two apart by looking at comovement patterns. But not immediately clear how to do so in the presence of aggregate shocks.

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Identification

- Paper's baseline regression:

$$RET_{it} = \alpha + \beta v_t + \rho \sum_{j=1}^{n} w_{ji} RET_{jt} + \epsilon_{it}$$

interpreting ρ as the extent of the "network effect."

- But it is plausible that a firm's returns are correlated with its suppliers & customers, even in short windows with no monetary policy shocks.
  (1) related industries may be subject to similar shocks.
  (2) exactly because of IO linkages, other (non-monetary) shocks can also propagate from one firm to another, creating correlations.

- If so, ρ also picks up these "correlated effects" in addition to the "peer/endogenous effects" (Manski, 1993).

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Identification

- Simple example: suppose error terms are themselves generated by the same network effects:

$$RET_{it} = \alpha + \beta v_t + \rho_1 \sum_{j=1}^{n} w_{ji} RET_{jt} + u_{it}$$

$$u_{it} = \rho_2 \sum_{j=1}^{n} w_{ji} u_{jt} + \epsilon_{it}.$$

- In this case:

$$RET_{it} = \hat{\alpha} + \hat{\beta} v_t + \underbrace{(\rho_1 + \rho_2 - \rho_1 \rho_2)}_{\rho} \sum_{j=1}^{n} w_{ji} RET_{jt} + \epsilon_{it}.$$

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Identification

- Given that sectoral returns would be correlated over non-FOMC windows as well, maybe a diff-in-diff approach would be helpful.

- Focus on the interaction term:

$$RET_{it} = \alpha + \beta v_t \mathbf{1}\{\text{Ann}\} + \rho \sum_{j=1}^{n} w_{ji} RET_{jt} + \widehat{\rho}\ \mathbf{1}\{\text{Ann}\} \sum_{j=1}^{n} w_{ji} RET_{jt} + \epsilon_{it}.$$

- $\widehat{\rho}$ measures spillover effects relative to a window with no announcements.

Summary

- Very interesting question: do inter-firm linkages matter for the degree of monetary non-neutrality?
- A perspective different from Basu and Nakamura-Steinsson.
- Theory:
  - a model in which input-output linkages determine sectoral sizes.
  - Interpretation? Is there a way to tease out network effects from size effects?
- Empirics:
  - "Peer effect" regressions, measuring higher-order impacts
  - Identification? How can we tease out these network effects from correlated effects?