Discussion of "The Network Origins of Bank Influence" Dewachter, Tielens, and Van Hove (2019)

Alireza Tahbaz-Salehi

Northwestern University

Banco de España-CEMFI Second Conference on Financial Stability
June 2019

Production Networks

- Growing literature on how input-output linkages can
  - (i) function as a mechanism for propagation and amplification of shocks.
  - (ii) translate micro shocks into aggregate fluctuations.

- Most of (theoretical) literature ignores financial shocks/frictions. Focuses on
  - efficient economies
  - models with exogenous distortions (e.g., constant markups)

- Despite the fact that financial shocks/frictions can be first-order
  - Sweden: bankruptcy spillovers due to trade credit (Jacobson & Von Schedvin, 2015)
  - Spain: propagation of bank credit supply shocks to borrowers' downstream customers (Alfaro, García-Santana, & Moral-Benito, 2019)

This Paper

- Main question:
  can the interaction of financial shocks and financial frictions with firm-level input-output linkages matter for macroeconomic outcomes?

- Framework:
  New-Keynesian model with various ingredients:
  - heterogenous firm-level input-output relationships (*production network*)
  - monopolistically competitive banking sector
  - heterogenous bank-firm lending relationships (*credit network*)
  - collateral constraints

- Shocks:
  (1) shocks to banks' lending rates
  (2) shocks to firms' collateral constraints

This Paper

- Main question:
  can the interaction of financial shocks and financial frictions with firm-level input-output linkages matter for macroeconomic outcomes?

- Framework:
  New-Keynesian model with various ingredients:
  - heterogenous firm-level input-output relationships (*production network*)
  - monopolistically competitive banking sector
  - heterogenous bank-firm lending relationships (*credit network*)
  - collateral constraints

- Shocks:
  (1) shocks to banks' lending rates
  (2) shocks to firms' collateral constraints

This Paper

- Theoretical results:
  - shocks to banks and to firms' borrowing constraints can propagate via I-O linkages
  - idiosyncratic bank-level shocks can have macro consequences
  - a mapping from production and credit networks to aggregate volatility
- Calibration exercise:
  - calibrate the production network to Belgian B2B VAT dataset
  - calibrate the credit network to NBB's Corporate Credit Register
- Takeaways:
  - a measure for banks' systemicness measuring their impact on the real economy
  - bank-specific shocks can have large effects on aggregate volatility: 44.7% of what an aggregate shock of the same magnitude would cause

This Paper

- Theoretical results:
  - shocks to banks and to firms' borrowing constraints can propagate via I-O linkages
  - idiosyncratic bank-level shocks can have macro consequences
  - a mapping from production and credit networks to aggregate volatility

- Calibration exercise:
  - calibrate the production network to Belgian B2B VAT dataset
  - calibrate the credit network to NBB's Corporate Credit Register

- Takeaways:
  - a measure for banks' systemicness measuring their impact on the real economy
  - bank-specific shocks can have large effects on aggregate volatility: 44.7% of what an aggregate shock of the same magnitude would cause

This Paper

- Theoretical results:
  - shocks to banks and to firms' borrowing constraints can propagate via I-O linkages
  - idiosyncratic bank-level shocks can have macro consequences
  - a mapping from production and credit networks to aggregate volatility

- Calibration exercise:
  - calibrate the production network to Belgian B2B VAT dataset
  - calibrate the credit network to NBB's Corporate Credit Register

- Takeaways:
  - a measure for banks' systemicness measuring their impact on the real economy
  - bank-specific shocks can have large effects on aggregate volatility: 44.7% of what an aggregate shock of the same magnitude would cause

Model: Firms

- Economy consisting of n firms and m banks
- production functions:

$$y_{it} = k_{it}^{1-\delta_i} l_{it}^{\delta_i \phi_i} \prod_{j=1}^{n} x_{ijt}^{\omega_{ij}}$$

- Marginal costs:

$$\mathrm{mc}_{it} = R_{it}^{1-\delta_i} w_{it}^{\delta_i \phi_i} \prod_{j=1}^{n} p_{jt}^{\omega_{ij}}$$

Model: Entrepreneurs

- Firm-specific capital is produced by a firm-specific entrepreneur, who combines labor with land to produce:

$$k_{it} = n_{it}^{1-\nu_i} h_{it}^{\nu_i}$$

- Entrepreneurs require financing to transform land and labor to capital, but are subject to a collateral constraint:

$$s_{it} \leq \ell_{it} \cdot \text{resale value of land holding}$$

Model: Banks

- Each bank can borrow from households and lend to a subset of firms at constant markups (modeled as monopolistic competition):

$$R_{ibt} = \frac{\mu_{bt}}{\mu_{bt} - 1} R_t$$

- Determines the rental rate of firm-specific capital:

$$R_{it} = \prod_{b=1}^{n} R_{ibt}^{\psi_{ib}}$$

Closed-Form Characterization: Simplified Model

Proposition

Suppose the collateral constraints never bind. Then,

$$\log(\text{GDP}) = -\sum_{b=1}^{m} v_b \log\left(\frac{\mu_{bt}}{\mu_{bt}-1}\right),$$

where

$$v_b = \sum_{i=1}^{n}\sum_{j=1}^{n} \theta_i \ell_{ij} \psi_{jb},$$

where $L = (I-\Omega)^{-1}$ is the Leontief inverse and Ψ is the firm-bank lending network.

- Implication I: v_b measures the "real systemicness" of shocks bank b
- Implication II: network heterogeneity can result in non-trivial macro volatility:

$$\text{var}(\log(\text{GDP})) = \sigma_\epsilon^2 \text{var}(v_1, \ldots, v_m)$$

- Implication III: disentangling the role of the two types of connections

Closed-Form Characterization: Simplified Model

Proposition

Suppose the collateral constraints never bind. Then,

$$\log(\text{GDP}) = -\sum_{b=1}^{m} v_b \log\left(\frac{\mu_{bt}}{\mu_{bt}-1}\right),$$

where

$$v_b = \sum_{i=1}^{n}\sum_{j=1}^{n} \theta_i \ell_{ij} \psi_{jb},$$

where $L = (I-\Omega)^{-1}$ *is the Leontief inverse and* Ψ *is the firm-bank lending network.*

- Implication I: v_b measures the "real systemicness" of shocks bank b
- Implication II: network heterogeneity can result in non-trivial macro volatility:

$$\text{var}(\log(\text{GDP})) = \sigma_\epsilon^2 \text{var}(v_1, \ldots, v_m)$$

- Implication III: disentangling the role of the two types of connections

Comment: Simplified Model

- There are two networks and two shocks.
- The characterization results are for a simplified model with only shocks to borrowing rates:

$$\log R_{it} = \log R_t + \sum_{b=1}^{m} \psi_{ib} \log\left(\frac{\mu_{bt}}{\mu_{bt} - 1}\right)$$

- Equivalent to correlated markup shocks: a shock to bank b increases the marginal cost of all its borrower, and hence can be cast as the special case of the standard result in the literature:

$$\log \text{GDP} = \sum_{i=1}^{n}\sum_{j=1}^{n} \theta_i \ell_{ij} \xi_j \quad \text{versus} \quad \log \text{GDP} = -\sum_{i=1}^{n}\sum_{j=1}^{n} \theta_i \ell_{ij} \psi_{jb} \log\left(\frac{\mu_b}{1-\mu_b}\right).$$

- No meaningful interaction between the two sides in the simplified model.

Comment: Simplified Model

- There are two networks and two shocks.
- The characterization results are for a simplified model with only shocks to borrowing rates:

$$\log R_{it} = \log R_t + \sum_{b=1}^{m} \psi_{ib} \log\left(\frac{\mu_{bt}}{\mu_{bt} - 1}\right)$$

- Equivalent to correlated markup shocks: a shock to bank b increases the marginal cost of all its borrower, and hence can be cast as the special case of the standard result in the literature:

$$\log \text{GDP} = \sum_{i=1}^{n}\sum_{j=1}^{n} \theta_i \ell_{ij} \xi_j \quad \text{versus} \quad \log \text{GDP} = -\sum_{i=1}^{n}\sum_{j=1}^{n} \theta_i \ell_{ij} \psi_{jb} \log\left(\frac{\mu_b}{1-\mu_b}\right).$$

- No meaningful interaction between the two sides in the simplified model.

Comment: Simplified Model

- In contrast, depending on how they are modeled, shocks to collateral constraints,
  - cannot be cast as exogenous movements in productivities or markups
  - may result in non-trivial interactions between financial and real sides

- For example, if firms' pledgeable assets are tied to their specific operations (say, firm-specific capital, future cashflow, etc.), shocks to that firm would have heterogenous effects on its suppliers' and customers'
  - already in the model, but unexplored
  - can say anything about the interaction between and input-output linkages and financial constraints?
  - maybe able to speak to the empirical findings in the literature?

Comment: Firm- vs. Industry-Level Networks?

- Firms in the model are assumed to be either competitive/monopolistically competitive (with constant markups)
  - Standard assumption in the literature

- Reasonable assumption at the industry level, but less so at the firm level:
  - it implies that the pass-through of the shocks are 100%
  - treats the firm-level input-output linkages as exogenous

- Both features lead to an overestimation of the shocks' aggregate effects!

Comment: Policy Implications

- Paper investigates various macro-prudential/financial policy implications:
  (1) firm-level LTV requirements
  (2) bank specialization
  (3) systemically important financial institutions

- The measure used is macroeconomic volatility: $\mathrm{var}(\log(\mathrm{GDP}))$
  however, unclear this is the proper welfare-relevant measure.

- Example: tighter LTV ratios for particular "central" firms would reduce macroeconomic volatility, suggesting, a "borrower-based" measure of systemicness for non-financial corporations.
  - But given these firms' centrality in the economy, tightening their LTV ratios would probably have the most severe adverse effect on welfare.

Comment: Policy Implications

- Paper investigates various macro-prudential/financial policy implications:
  (1) firm-level LTV requirements
  (2) bank specialization
  (3) systemically important financial institutions

- The measure used is macroeconomic volatility: $\mathrm{var}(\log(\mathrm{GDP}))$
  however, unclear this is the proper welfare-relevant measure.

- Example: tighter LTV ratios for particular "central" firms would reduce macroeconomic volatility, suggesting, a "borrower-based" measure of systemicness for non-financial corporations.
  - But given these firms' centrality in the economy, tightening their LTV ratios would probably have the most severe adverse effect on welfare.

Comment: Leveraging Firm-Level Information?

- The paper can probably do a lot more with the unique firm-level dataset.

- Example from a similar context: Alfaro, García-Santana, & Moral-Benito (2019):
  - use administrative data for all firms in Spain to estimate bank-year credit supply shocks and firm-year credit demand shocks.
  - but to study the propagation of the shocks, they have to rely on industry-level I-O data

- Important to know whether one can verify these findings using firm-level data. (probably there are other more interesting possibilities)

Summary

- Nice paper aimed at incorporating financial frictions and bank-firm relationships into a production network setting
- Closed-form results on the impact of credit supply shocks via production networks
- Ambitious calibration using firm-to-firm, bank-to-firm microdata from Belgium

- (Unexplored) theoretically interesting mechanism: financial frictions and production networks
- Proper measure for assessing policy?
- Leveraging firm-level data more?