Discussion of Bigio and La’O

“Financial Frictions in Production Networks”

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July 13, 2013
Overview

- Input-output economics is intriguing!
  - Shocks to one sector affect other sectors — a key theme of macro missing from “standard” model
  - Amplification and propagation possibilities...

- I’ve looked at this in the context of development
  - How can distortions get amplified to explain 50-fold income differences across countries?
  - Much easier by comparison for changing distortions to reduce GDP by 2 or 3 pp in a recession!
Outline

- Simple model and intuition for magnitudes
- The “wedges”: interpretation and economic consequences
- Other comments
First point: the “liquidity multiplier”

(a) depends on the I-O structure and is independent of identifying the “financial frictions”

(b) amplifies other shocks as well, not just financial frictions — distortions in one sector will affect other sectors.
Simple Model: Environment

Production of final good

\[ Y_t = \bar{A} L_t^{1-\sigma} X_t^\sigma \]

Resource constraint

\[ C_t + X_{t+1} = Y_t \]

Utility

\[ U = \sum_t \beta^t U(C_t, L_t), \quad U(C, L) = \log C - L \]

Notice that \( X \) is just like capital with full depreciation.
Simple Model: Equilibrium

- **Financial friction**: Firms can run away with fraction $\phi$ of final good

  $$wL + pX \leq \phi Y$$

  Note: Friction is equivalent to a sales tax: $\phi = 1 - \tau$

- Households “accumulate” and sell intermediate goods to firms
Solution (steady state)

- Intermediate use is proportional to output

\[ X = \phi \beta \sigma Y \]

Amplification: \( \downarrow \phi \Rightarrow \downarrow X \Rightarrow \downarrow Y \Rightarrow \downarrow X \Rightarrow \downarrow Y \) etc.

- Plugging into production function (\( Y = \bar{A} L^{1-\sigma} X^{\sigma} \)):

\[ Y = (\phi \beta \sigma)^{\frac{\sigma}{1-\sigma}} \bar{A}^{\frac{1}{1-\sigma}} L \]

- With exogenous \( L \), effect of distortion depends on \( \frac{1}{1-\sigma} \) because of amplification effect:

\[ 1 + \sigma + \sigma^2 + \ldots = \frac{1}{1 - \sigma} \]

- But only affects \( \sigma \) share of the inputs \( \Rightarrow \frac{\sigma}{1-\sigma} \)
• With endogenous labor supply, $L$ is affected by $\phi$ as well, so you get an even bigger effect.

$$L = (1 - \sigma) \frac{\phi}{1 - \phi \beta \sigma}$$

$$\Rightarrow Y = \frac{\phi^{\frac{1}{1-\sigma}} A^{\frac{1}{1-\sigma}}}{1 - \phi \beta \sigma}$$

Elas wrt $\phi$ is larger than $\frac{1}{1-\sigma}$!

• Evidence (next slide): $\sigma \approx 1/2 \Rightarrow \frac{1}{1-\sigma} \approx 2$
  – Extent of LM $> 2$ depends on labor supply elasticity...
Evidence on the Intermediate Goods Share, $\sigma$

Intermediate goods share, $\sigma$

Per capita GDP, 2000 (US=1)

- Argentina
- Australia
- Belgium
- Brazil
- Canada
- China
- Czech Republic
- Denmark
- Spain
- France
- Greece
- Hungary
- Indonesia
- India
- Israel
- Korea, Republic of
- Slovak Republic
- New Zealand
- United Kingdom
- Portugal
- Poland
- Norway
- Russia
- Turkey
- United States
- Italy
- Japan
- Netherlands
- Australia
- China
- Japan
- Poland
- Russia
- Turkey
- Greece
- Hungary
- Korea, Republic of
- Slovak Republic
- New Zealand
- United Kingdom
- Portugal
- Poland
- Norway
- India
- Israel
- Korea, Republic of
- Slovak Republic
- New Zealand
- United Kingdom
- Portugal
- Poland
- Norway
- India
- Israel
- Korea, Republic of
- Slovak Republic
- New Zealand
- United Kingdom
- Portugal
- Poland
- Norway
- India
- Israel
- Korea, Republic of
- Slovak Republic
- New Zealand
- United Kingdom
- Portugal
- Poland
- Norway
Richer Model

  - Each sector uses all others as an input
  - Let $W \equiv N \times N$ matrix of IG exponents ($\sigma_{ij}$).
  - Cobb-Douglas $\Rightarrow$ log-linear $\Rightarrow$ elegant solution

- Liquidity multiplier $\sim$ the Leontief inverse (Prop 10):

\[(I - W)^{-1}\]

- Matrix version of $1/(1 - \sigma)$! Can be formalized (Jones 2011)
  If all sectors have the same cumulative exponent
  $\sigma_i \equiv \sum_j \sigma_{ij} = \bar{\sigma}$ on intermediates, regardless of composition, then LM with fixed labor is

\[\beta'(I - W)^{-1}1 = \frac{1}{1 - \bar{\sigma}}\]
\( \sigma_{ij} \) for the U.S. in 1997 (480 industries)
## The sectors with the largest multipliers

<table>
<thead>
<tr>
<th>Sector</th>
<th>Multiplier</th>
<th>$\beta_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>General government</td>
<td>0.115</td>
<td>0.112</td>
</tr>
<tr>
<td>Real estate</td>
<td>0.094</td>
<td>0.051</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>0.091</td>
<td>0.057</td>
</tr>
<tr>
<td>Retail trade</td>
<td>0.061</td>
<td>0.052</td>
</tr>
<tr>
<td>Owner-occupied dwellings</td>
<td>0.059</td>
<td>0.058</td>
</tr>
<tr>
<td>Management of companies</td>
<td>0.056</td>
<td>0.027</td>
</tr>
<tr>
<td>Monetary/depository authorities</td>
<td>0.042</td>
<td>0.029</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>0.036</td>
<td>0.018</td>
</tr>
<tr>
<td>Advertising</td>
<td>0.032</td>
<td>0.011</td>
</tr>
<tr>
<td>Power generation</td>
<td>0.030</td>
<td>0.017</td>
</tr>
</tbody>
</table>
The sectors with the largest “excess” multipliers

<table>
<thead>
<tr>
<th>Sector</th>
<th>“Excess” multiplier</th>
<th>Multiplier</th>
<th>βi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real estate</td>
<td>0.043</td>
<td>0.094</td>
<td>0.051</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>0.034</td>
<td>0.091</td>
<td>0.057</td>
</tr>
<tr>
<td>Management of companies</td>
<td>0.029</td>
<td>0.056</td>
<td>0.027</td>
</tr>
<tr>
<td>Advertising and related</td>
<td>0.020</td>
<td>0.032</td>
<td>0.011</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>0.018</td>
<td>0.036</td>
<td>0.018</td>
</tr>
<tr>
<td>Oil and gas extraction</td>
<td>0.014</td>
<td>0.018</td>
<td>0.004</td>
</tr>
<tr>
<td>Power generation</td>
<td>0.013</td>
<td>0.030</td>
<td>0.017</td>
</tr>
<tr>
<td>Monetary/depository</td>
<td>0.013</td>
<td>0.042</td>
<td>0.029</td>
</tr>
<tr>
<td>Truck transportation</td>
<td>0.012</td>
<td>0.022</td>
<td>0.010</td>
</tr>
<tr>
<td>Legal services</td>
<td>0.011</td>
<td>0.024</td>
<td>0.013</td>
</tr>
</tbody>
</table>
The $\phi_i$ wedges: interpretation and magnitudes
Are the “wedges” financial frictions?

- $\phi_i = \text{Labor+Intermediate “wedge” (wedges between the MPs of labor/intermediates and their prices).}$

  $\phi_i = \frac{\text{Share of revenue spent on labor and intermediates}}{\text{Production function elasticity, } \alpha_i}$

  - Not clear that these are financial frictions
  - Multiplier amplification applies regardless of source.

- They tend to focus on “What effect would a common proportional change in $\phi$ in all sectors have on GDP?”

  - Also interesting: “What effect did the actual movements in $\phi_i$ in the data have on GDP?”
Average wedge, $\phi(t)$
Wedges in select sectors

Year

\( \phi(t) \)

1998
2000
2002
2004
2006
2008
2010
2012

Retail
Chem
RealEstate

Discussion of Bigio and La’O – p.17/23
Wedges in select sectors

φ(t)

1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0.84
0.82


Year

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What about static misallocation?

• Maybe the dispersion of the $\phi$ across sectors increased sharply?

• Yes! See figure next slide.

• Magnitude
  ◦ If lognormal frictions, then log output falls like

  $\frac{1}{2} \cdot \frac{1}{1 - \sigma} \cdot \text{Variance}$

  $\Rightarrow$ Approximately the change in variance $\approx 0.4$.
  Implies a 0.4 percentage point decline in output

  ◦ Calculate exactly using linear algebra...

  ◦ Misallocation across firms within a sector as well?
Did (static) misallocation rise? (variance of $\phi$)
Average $\phi$ and Fernald’s TFP index

Discussion of Bigio and La’O – p.21/23
Additional Comments

• Odd to have no capital in a model of financial frictions...

• Dynamics: Intermediate goods are another form of capital — raise the share of produced factors and will increase persistence of shocks as well?

• Standard wedge criticism: these are reduced form impacts of a set of underlying structural shocks that are correlated across sectors. Can you recover the structural shocks?
  ◦ There are other structural shocks besides financial frictions
  ◦ Financial frictions may affect economy in ways beyond labor wedge?

• Can you trace a well-identified ("case study") shock through the input-output matrix?
Promising area of research!