Outline

Motivation

- Which are the key sectors for economic development?
  - agriculture, manufacturing, or services?
- What is the role of sector-specific distortions that produce cross-sector misallocation?

What I argue (1)

- The productivity of highly *interconnected* sectors is an important determinant for aggregate productivity.
  - Example: Productivity of refined petroleum affects gasoline production, which in turn affects transportation, which affects trade, which affects refined petroleum products, and so on.
- It matters:
  - The productivity gap of a single sector with respect to the leader.
  - The degree of interconnections of this sector with the rest of the economy.

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  - The degree of interconnections of this sector with the rest of the economy.

Definition

A key sector is one with a large productivity gap and a high degree of interconnections.

What I argue (2)

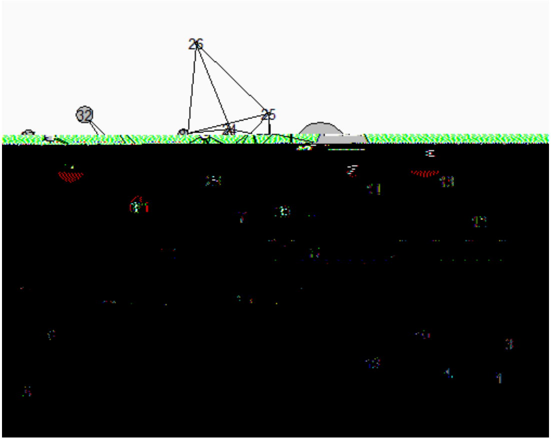
- Sector-specific distortions affect aggregate productivity.
    - Create cross-sector misallocation.
    - Reduce the resources available for consumption.
- The effect of these distortions is also determined by the degree of inter-sectoral linkages.
    -

What I do

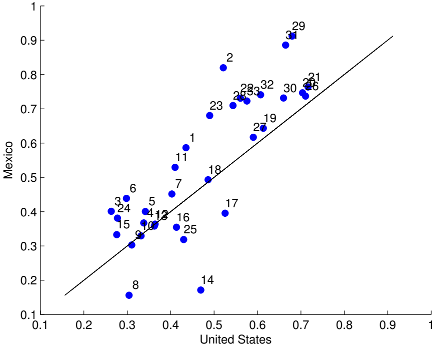
- Set-up a multi-sector model.
  - Output of a given sector can be used as an intermediate input for production in other sectors.
    - Introduces a link between the performance of a single sector, and the performance of the rest.
- Use the model to study three types of distortions per sector:
  - Productivity wedge.
  - Wedge between marginal revenue and marginal cost (a markup).
  -

What I do

Network map



Share of value added in gross output



Labor income share in GDP, by sector.

Figure: Labor income share in value-added

Model

- Multi-sector model with N sectors (Long and Plosser, 1983, Jones, 2011; Acemoglu et al, 2012, and others).
- Supply of labor H is exogenous.
- Each sector uses labor, and commodities from all sectors (including its

Problem of the final good producer

The problem consists on choosing $\{c_i\}$, taking $\{p_i\}$ as given, to solve:

$$\max_{\{c_i\}} \quad c_1^{\beta_1} c_{2\ldots}^{\beta_2} c_N^{\beta_N} - \sum_{i=1}^{N} p_i c_i \quad .$$

The first order conditions are given by:

$$\beta_i (Y/c_i) - p_i = 0 \Leftrightarrow \beta_i Y = p_i c_i, \quad i. \tag{2}$$

$$\beta_i = \frac{p_i c_i}{Y}$$

FOCs

$$\frac{1}{\psi_i}\alpha_i(1-\sigma_i)\frac{p_i Q_i}{H}$$

FOCs

$$\frac{1}{\psi_i}\alpha_i(1-\sigma_i)\frac{p_iQ_i}{H_i} = \varphi_i w, \quad i \tag{5}$$

$$\frac{1}{\psi_i}\sigma_{ij}\frac{p_iQ_i}{x_{ij}} = p_j, \quad i,j \tag{6}$$

Equilibrium aggregate output

- Equilibrium aggregate output is given by:

$$Y = \mathscr{A} H^{\tilde{\alpha}}$$

where $\tilde{\alpha}$ and $\mathscr{A}$ are constants. Additionally,

$$ln(\mathscr{A}) = m\,a + const$$

where:

$$m\,a = [m_1\, m_2\, m_3 \ldots m_N] \begin{bmatrix} lnA_1 \\ lnA_2 \\ lnA_3 \\ \vdots \\ lnA_N \end{bmatrix}$$

Vector of influence (or multipliers)

Vector of influence:

$$m = \beta \, (I - B)^{-1}$$

- Two terms:
  - Weights: β
  - Inter-sectoral linkages: $(I - B)^{-1}$.
    - where typical element of B is σ_{ij}.
- Interpretation: a 1% increase in A_i rises aggregate GDP in m_i%.

$$dln(Y) = m_i da_i$$

Allocation of labor

Economy without distortions:

$$\frac{\hat{H}_i}{H} = \hat{\theta}_i = \frac{\alpha_i(1-\sigma_i)m_i}{\sum_{s=1}^{N}\alpha_s(1-\sigma_s)m_s}$$

- Does not depends on relative productivity (A_i).

Economy with distortions.

$$\frac{H_i}{H} = \theta_i = \frac{\alpha_i(1-\sigma_i)\left(\frac{1}{\psi_i}\right)\left(\frac{1}{\varphi_i}\right)\tilde{m}_i}{\sum_{s=1}^{N}\alpha_s(1-\sigma_s)\left(\frac{1}{\psi_s}\right)\left(\frac{1}{\varphi_s}\right)\tilde{m}_s}$$

- where, $\tilde{m} = \beta\left(I - \tilde{B}\right)^{-1}$, and a typical element of NxN matrix $\tilde{B}$ is σ_{ij}/ψ_i.
- If distortions are homogeneous, the allocation of labor is not affected (dispersion is key).

Allocation of labor

Economy without distortions:

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- Does not depends on relative productivity (A_i).

Economy with distortions.

$$\frac{H_i}{H} = \theta_i = \quad \alpha_i(1-\sigma_i)^{\;\square}\ \frac{1}{}$$

Rents of distortions are lost $T = 0$

- In this case distortions are isomorphic to productivity.

$$\frac{1}{\psi_i} Q_i = \frac{1}{\psi_i} A_i f(H_i, \{x_{ij}\}) = c_j + \sum_{i=1}^{N} x_{ij}, \quad i \tag{7}$$

- E□ect on aggregate output and productivity could be sizable if resources are not given back.

Removal of a single distortion: Total effect

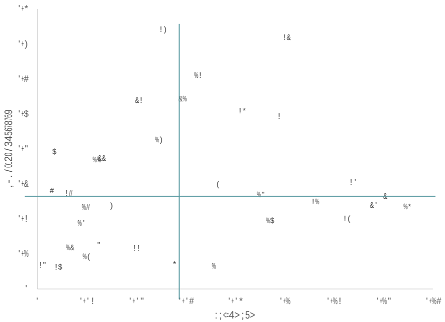
Change in one of the distortions: $\psi_i^1 < \psi_i^0$:

$$ln\left(\frac{Y^1}{Y^0}\right) = \sum_{j=1}^{N} m_j \alpha_i (1-\sigma_i) ln\left(\frac{\theta_j^1}{\theta_j^0}\right) + m_i \sigma_i ln\left(\frac{\psi_i^0}{\psi_i^1}\right) + \sum_{j=1}^{N} m_j (1-\sigma_j) ln\left(\frac{\tilde{m}_i^0}{\tilde{m}_i^1}\right) \quad (8)$$

1. Effect on the allocation of labor.
   - It could be positive or negative depending on whether the change in ψ_i reduces the dispersion of wedges.
   - It depends on the degree of influence of each sector m_i.
2. Effect on aggregate output through the supply of sector i (positive).
3. Effect on the allocation of gross output into final and intermediate uses (negative).

Key sectors

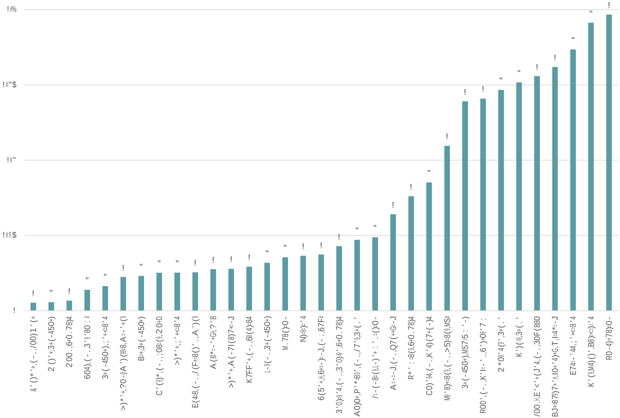
Figure: Productivity vs. degree of influence



- 18 Construction; 30 Business Services; 29 Real Estate; 21 Retail Trade;

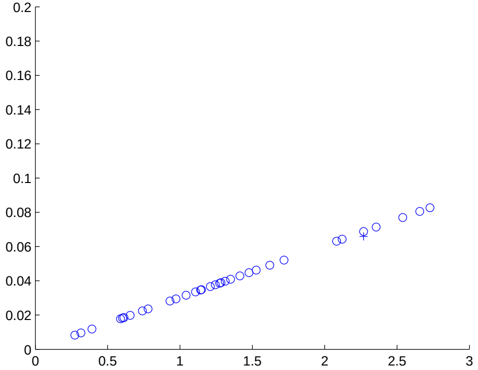
Closing productivity gaps

Figure: Effect in Y of closing the productivity gap



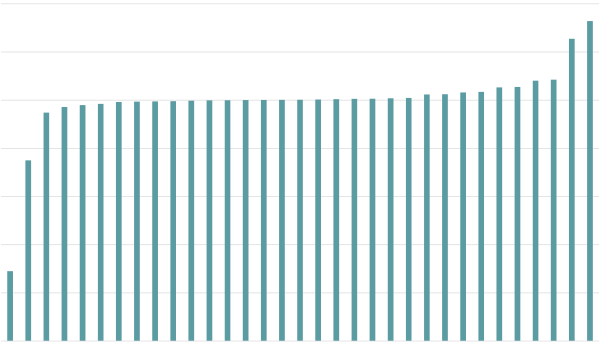
Decomposition

Figure: Decomposing the e□ect in Y of closing the productivity gap



Reducing distortions: $T > 0$

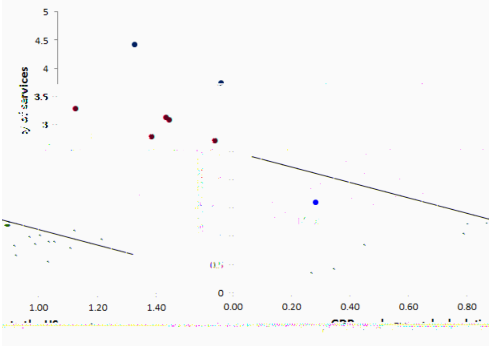
Figure: E□ect in Y of reducing markups in Case 1



Reducing distortions: $T = 0$

Productivity gap is larger in manufacturing

Data from Inklaar and Timmer (2012)



Productivity gap is larger in manufactures

Data from Herrendorf and Valentinyi (2012)

Category	Ratio	Value
Aggregate	TFP^{US}/TFP^{LA}	2.30
Services	TFP_s^{US}/TFP_s^{LA}	1.86
Goods	TFP_g^{US}/TFP_g^{LA}	3.58

Table: Labor share in Mexico

Method	Description	Value
Naive	Compensation of employees / GDP	0.28
Corrected (Gollin, 2001)	Compensation of employees/ (GDP-Net Mixed Income-Net indirect taxes)	0.42

FOCs

$$\frac{1}{\psi_i}\alpha_i(1-\sigma_i-\lambda_i)\frac{p_iQ_i}{H_i}=\varphi_i w, \quad i \tag{9}$$

$$\frac{1}{\psi_i}\sigma_{ij}\frac{p_iQ_i}{x_{ij}}=p_j, \quad i \tag{10}$$

1

FOCs

$$\frac{1}{\psi_i}\alpha_i(1-\sigma_i-\lambda_i)\frac{p_iQ_i}{H_i}=\varphi_i w, \quad i \tag{9}$$

$$\frac{1}{\psi_i}\sigma_{ij}\frac{p_iQ_i}{x_{ij}}=p_j, \quad i \tag{10}$$

$$\frac{1}{\psi}$$

FOCs

$$\frac{1}{\psi_i}\alpha_i(1-\sigma_i-\lambda_i)\frac{p_iQ_i}{H_i} = \varphi_i w, \quad i \tag{12}$$

$$\frac{1}{\psi_i}\sigma_{ij}\frac{p_iQ_i}{x_{ij}} = p_j, \quad i \tag{13}$$

$$\frac{1}{\psi_i}\lambda_i\frac{p_iQ_i}{M}$$

FOCs

$$\frac{1}{\psi_i}\alpha_i(1-\sigma_i-\lambda_i)\frac{p_iQ_i}{H_i}=\varphi$$

Equilibrium Characterization

- Assume: $\tau_i = 0$ and $\psi_i = \varphi_i = 1$. Then:

$$\sigma_{ij} = \frac{p_j x_{ij}}{p_i Q_i}.$$

$$= \quad \sigma_i = \sum_{j=1}^{N} \sigma_{ij} = \sum_{j=1}^{N} \left(\frac{p_j x_{ij}}{p_i Q_i} \right) = \left(\frac{1}{p_i Q_i} \right) \sum_{j=1}^{N} p_j x_{ij}.$$

is the share of domestic intermediate inputs in gross output.

- Similarly:

$$\sigma_i + \lambda_i = \left(\frac{\sum_{j=1}^{N} p_j x_{ij}}{p_i Q_i} \right) + \frac{p_{M,i} M_i}{p_i Q_i}; \qquad (15)$$

is the share of domestic and imported intermediate inputs in gross output.

Equilibrium Characterization

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is the share of domestic intermediate inputs in gross output.

- Similarly, when $\psi_i = 1$:

$$\left(\frac{1}{\psi_i}\right)(\sigma_i + \lambda_i) = \left(\frac{\sum_{j=1}^{N} p_j x_{ij}}{p_i Q_i} \right) + \frac{p_{M,i} M_i}{p_i Q_i}; \tag{16}$$

is the share of domestic and imported intermediate inputs in gross output.

Calibrate productivity gaps, not levels.

- Problem: we don't have import prices, we can not calculate productivity levels.
- It can be shown that in equilibrium:

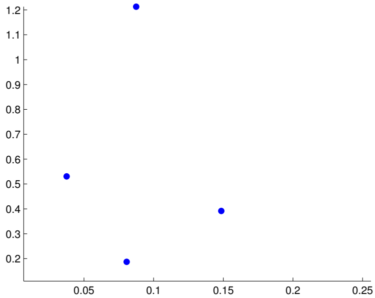
$$ln$$

Calibrated distortions

Figure: Distortions

Key sectors (naive definition)

Figure: Key Sectors



Markups