Global Sourcing

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Background

Old trade theory: cross-country differences drive trade (technology, endowments); emphasis on intersectoral trade flows (intersectoral specialization); factor content.

New trade theory: adds intra-industry specialization (intra-industry trade, intra-firm trade):

- helps explain large volumes of trade between similar countries
- helps explain variations in the share of intra-industry trade and intra-firm trade.

Background (Cont.)

The theory was developed for trade in final goods and intermediate inputs. Nevertheless, within sectors, firms are symmetrically structured (for the most part). Occasional heterogeneity emerges from indifference.

- In the data a lot of within industry heterogeneity.
- Participation in trade is related to firm characteristics.

The modelling of intra-firm trade is unsatisfactory – common failure to model internalization – cf. Tirole (1988), Hart (1995),

Main Questions

How do firms choose to organize production? What are their global sourcing strategies?

- Choice between domestic vs. foreign production of intermediate inputs.
- Choice between intrafirm vs. arm's length purchase of intermediate inputs.
- Are these decisions interrelated?
- How do they depend on industry characteristics? And on firm characteristics? And on country characteristics?

Answers to these questions should help to explain recent trends:

- growing international specialization – see quotes in paper
- FDI and trade growing faster than GDP
- bias towards arm's length relations in the composition of trade (and also in the composition of U.S. manufacturing).

Backbones of the Model

Recent developments have emphasized within sectoral heterogeneity and the organization of production.

- Melitz (2003) and Helpman et al. (2003) study the effects of within sectoral heterogeneity – only more productive firms engage in high fixed-cost strategies – e.g., exporting, FDI.
- Grossman and Helpman (2002) and Antràs (2003) study the choice of organizational structure under incomplete contracts and its effects on the form of international trade (variations across industries) – e.g., higher share of intrafirm trade in capital-intensive sectors.

Preview of Some Results

- We describe industry equilibria in which only high-productivity firms engage in international trade in components.
- We predict a predominance of arm's length relationships in sectors where headquarter services are relatively unimportant.
- We describe equilibria in headquarter-intensive sectors, with domestic and foreign integration, as well as domestic and foreign outsourcing.

Preview of Some Results (Cont.)

- Relative prevalence of different organizational forms is related to:
  - firm characteristics (productivity level)
  - industry characteristics (R&D intensity, productivity dispersion, bargaining power)
  - country characteristics (relative wages, contractual environment).

The Model

Two countries: the North and the South.

Preferences are quasi-linear: $U = x_0 + \frac{1}{\mu}\sum_{j=1}^{J} X_j^{\mu},\ 0 < \mu < 1.$

- Subutility in sector j is $X_j = \left[\int x_j(i)^{\alpha} di\right]^{1/\alpha},\ 0 < \mu < \alpha < 1.$
- Inverse demand function is $p_j(i) = X_j^{\mu-\alpha} x_j(i)^{\alpha-1}.$

Producers of differentiated goods face a perfectly elastic supply of labor ($w^N > w^S$).

Monopolistic competition in final-good markets.

The Model (Cont.)

Entry costs: $w^N f_E$. Productivity θ revealed after entry.

Production function (specialized inputs):

$$x_j(i) = \theta \left(\frac{h_j(i)}{\eta_j} \right)^{\eta_j} \left(\frac{m_j(i)}{1-\eta_j} \right)^{1-\eta_j}, \quad 0 < \eta_j < 1.$$

h controlled by final-good producer (agent H), m by operator of production facility (agent M); both in-house and at arm's length.

Sectors vary in intensity of headquarter services η_j; within sectors, firms differ in productivity θ.

Intermediates are produced using labor with a fixed coefficient; $h_j(i)$ produced only in the North $\rightarrow$ H is always in the North.

The Model (Cont.)

An *organizational form* is $k \in \{V, O\}$ and $\ell \in \{N, S\}$.

Fixed organizational costs: $w^N f_k^\ell$.

- Assumption: $f_V^S > f_O^S > f_V^N > f_O^N$.

Setting of incomplete contracts - parties cannot sign ex-ante enforceable contracts specifying the purchase of specialized intermediate inputs for a certain price; also, no contracts contingent on amount of labor hired or on sale revenues.

The surplus is divided ex-post. Bargaining weights: β of ex-post gains for H, $1 - \beta$ for M.

The Model (Cont.)

Ex-post bargaining takes place both under outsourcing and under insourcing, but firm boundaries affect outside options (G-H, 86).

Outsourcing: 0 outside options.

Integration in country ℓ: M has 0 outside option, but H retains a fraction $\delta^{\ell} > 0$ of final-good production. $\delta^{N} \geq \delta^{S}$.

Implied distribution of revenue: $\beta_V^N = \left(\delta^N\right)^{\alpha} + \beta\left[1 - \left(\delta^N\right)^{\alpha}\right] \geq \beta_V^S = \left(\delta^S\right)^{\alpha} + \beta\left[1 - \left(\delta^S\right)^{\alpha}\right] > \beta_O^N = \beta_O^S = \beta$.

Infinitely elastic supply of operators; H gets all the surplus through ex-ante transfer and chooses mode of organization that maximizes its profits.

Equilibrium

Let R be potential sales revenues. Final-good producer solves:

$$\max_{\beta_k^\ell \in \left\{\beta_V^N, \beta_V^S, \beta_O^N, \beta_O^S\right\}} \pi_k^\ell = \pi\left(h\left(\beta_k^\ell\right), m\left(\beta_k^\ell\right)\right)$$

$$s.t. \quad h\left(\beta_k^\ell\right) = \arg\max_h \beta_k^\ell R\left(h, m\left(\beta_k^\ell\right)\right) - w^N h$$

$$m\left(\beta_k^\ell\right) = \arg\max_m \left(1 - \beta_k^\ell\right) R\left(h\left(\beta_k^\ell\right), m\right) - w^\ell m$$

Equilibrium (Cont.)

Profits:

$$\pi_k^\ell(\theta, X, \eta) = X^{(\mu-\alpha)/(1-\alpha)}\theta^{\alpha/(1-\alpha)}\psi_k^\ell(\eta) - w^N f_k^\ell \ ,$$

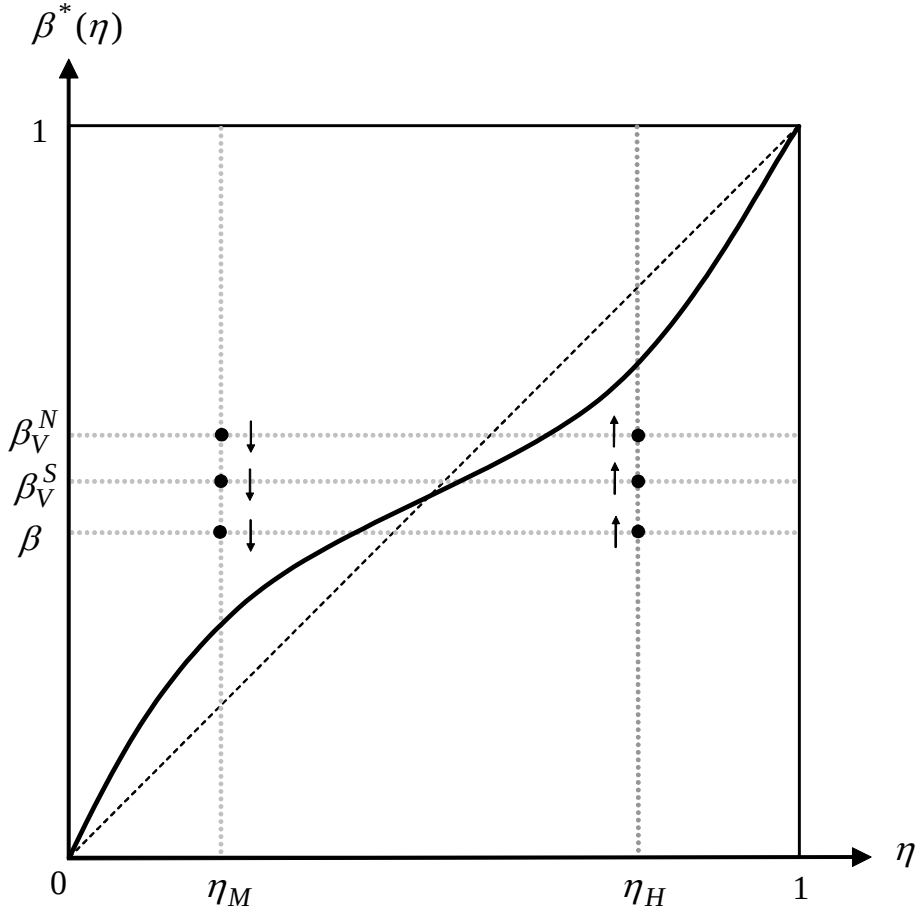
where

$$\psi_k^\ell(\eta) = \frac{1-\alpha\left[\beta_k^\ell\eta + \left(1-\beta_k^\ell\right)(1-\eta)\right]}{\left[\frac{1}{\alpha}\left(\frac{w^N}{\beta_k^\ell}\right)^\eta\left(\frac{w^\ell}{1-\beta_k^\ell}\right)^{1-\eta}\right]^{\alpha/(1-\alpha)}}.$$

Final-good producer is choosing a triplet $\left(\beta_k^\ell, w^\ell, f_k^\ell\right)$. π_k^ℓ is decreasing in w^ℓ and f_k^ℓ.

Equilibrium (Cont.)

Profits are largest when $\beta_k^{\ell} = \beta^*(\eta)$.



Industry Equilibrium

Highest profits are: $\pi(\theta, X, \eta) = \max_{k \in \{V,O\}, \ell \in \{N,S\}} \pi_k^{\ell}(\theta, X, \eta)$.

Lowest cutoff: $\pi(\underline{\theta}, X, \eta) = 0$.

Free entry condition, solves X (demand level):

$$\int_{\underline{\theta}(X)}^{\infty} \pi(\theta, X, \eta)\, dG(\theta) = w^N f_E.$$

Some Relevant Trade-Offs

Importing intermediate from the South saves on variable costs, but involves higher fixed costs – effect of θ.

Integration improves efficiency of variable production when η is high, but involves higher fixed costs.

We focus on two generic sectors:

- **Component-intensive sector** with $\eta < {\beta^*}^{-1}(\beta)$ and w^N/w^S low relative to f_O^S/f_O^N.
- **Heaquarter-intensive sector** with $\eta > {\beta^*}^{-1}\left(\beta_V^N\right)$, w^N/w^S high relative to δ^N.

Key Equations

$$\pi_k^{\ell}(\theta, X, \eta) = X^{(\mu-\alpha)/(1-\alpha)}\theta^{\alpha/(1-\alpha)}\psi_k^{\ell}(\eta) - w^N f_k^{\ell}$$

$$f_V^S > f_O^S > f_V^N > f_O^N$$

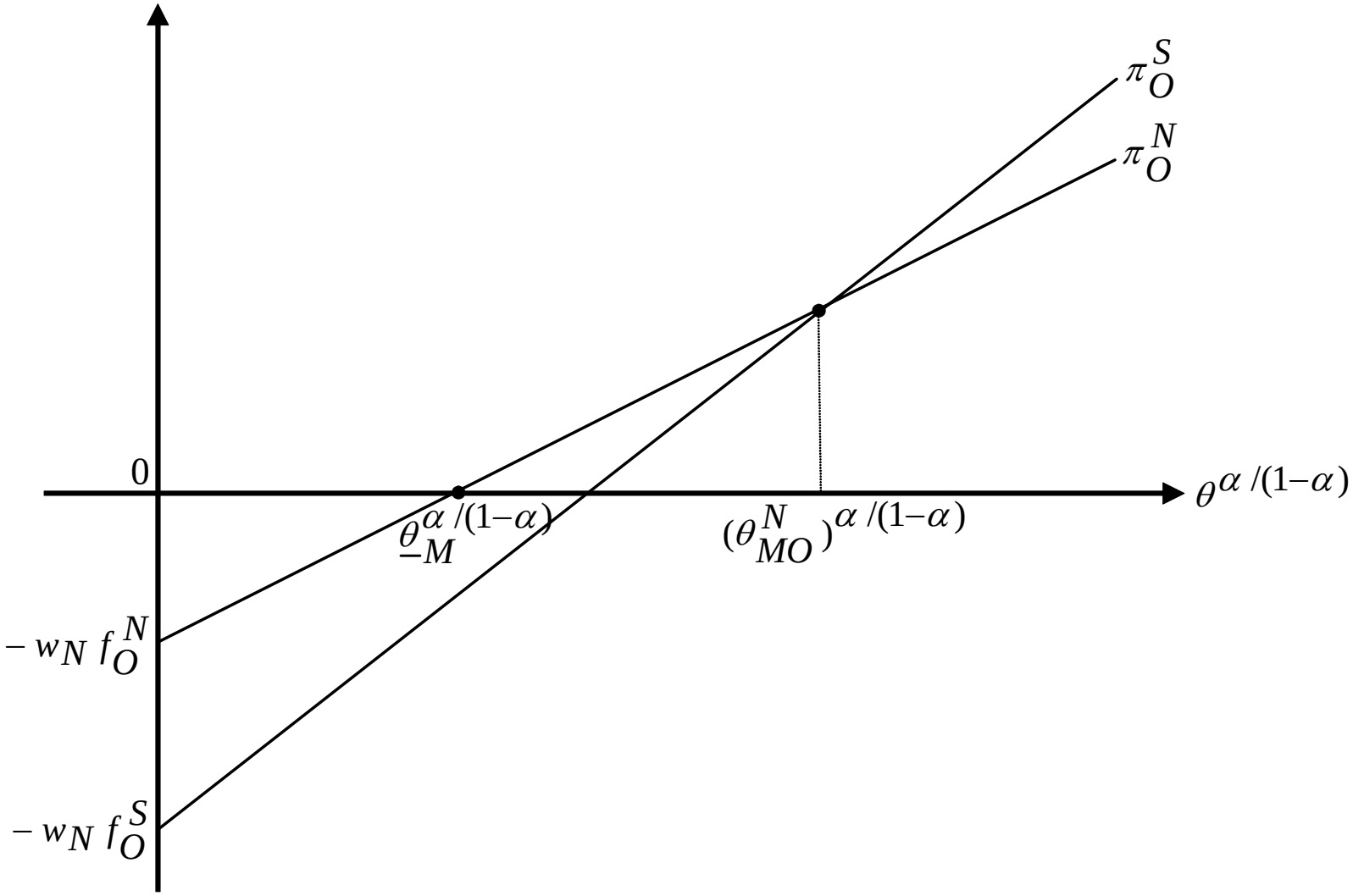
$$w^N > w^S$$

In component-intensive sector: $\psi_O^{\ell}(\eta) > \psi_V^{\ell}(\eta)$

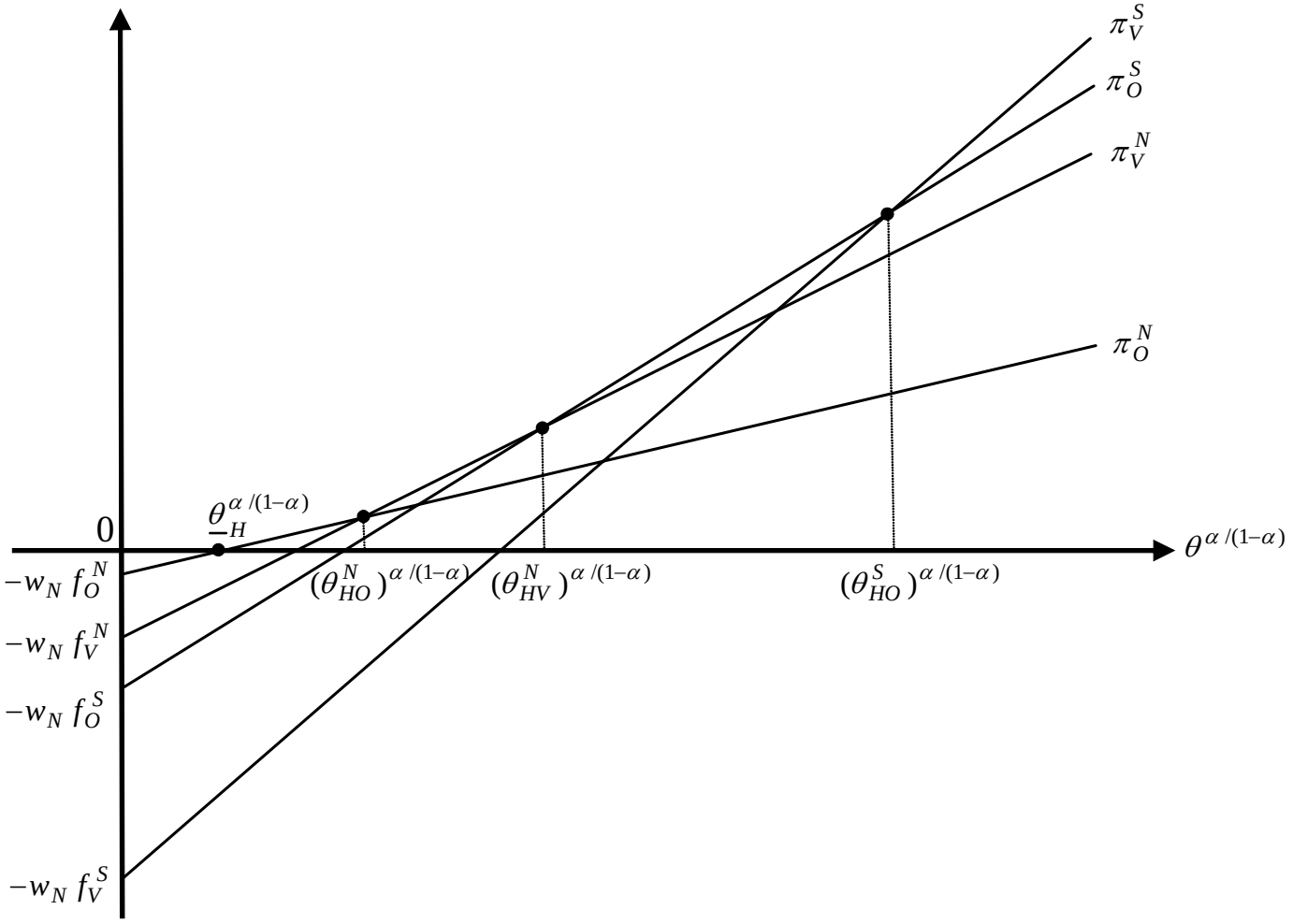
In headquarter-intensive sector: $\psi_V^{\ell}(\eta) > \psi_O^{\ell}(\eta)$, and if w^N/w^S high relative to δ^N,

$$\psi_V^S(\eta) > \psi_O^S(\eta) > \psi_V^N(\eta) > \psi_O^N(\eta)$$

Component-Intensive Sector

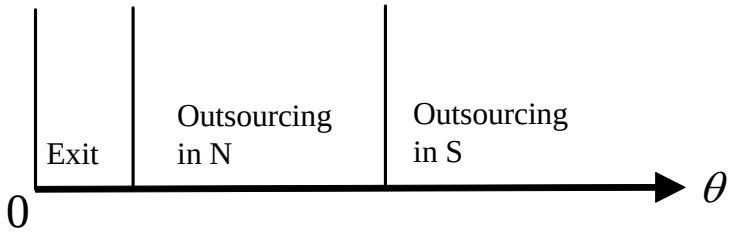


Headquarter-Intensive Sector

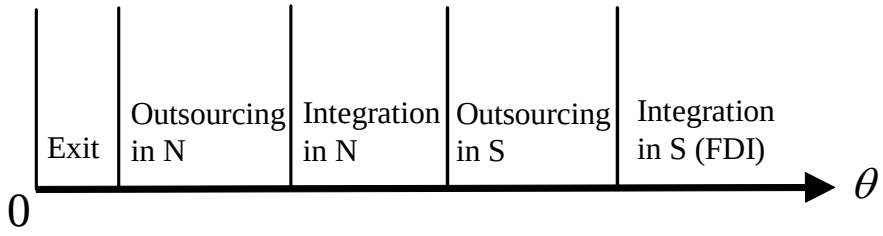


Integration and Outsourcing with Heterogeneity

Comparison of low- and high-tech sectors:



Component-Intensive Sector



Headquarter-Intensive Sector

Relative Prevalence

Relative prevalence: measured by the share of products produced in various organizational forms (V or O, in N or S).

Distribution of θ: Pareto, $G(\theta) = 1 - \left(\frac{b}{\theta}\right)^k$ for $\theta \geq b > 0$. Lower k $\Rightarrow$ more dispersion.

Calculate the shares of final goods produced in each one of the organizational forms

- Appendix: calculate relative prevalence using market shares and output.

Relative Prevalence (Cont.)

In sectors with more productivity dispersion (lower k)

- *the share of imported inputs is* ***higher****;*
- *in headquarter-intensive sectors V is* ***higher*** *relative to O in every country.*

Relative Prevalence (Cont.)

In sectors with higher headquarter intensity (higher η)

- *the share of imported inputs is* ***lower****;*
- *in headquarter-intensive sectors V is* ***higher*** *relative to O in every country.*

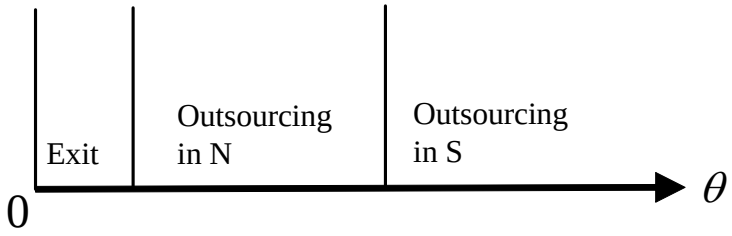
Relative Prevalence (Cont.)

A fall in the relative wage in the South or in trading costs

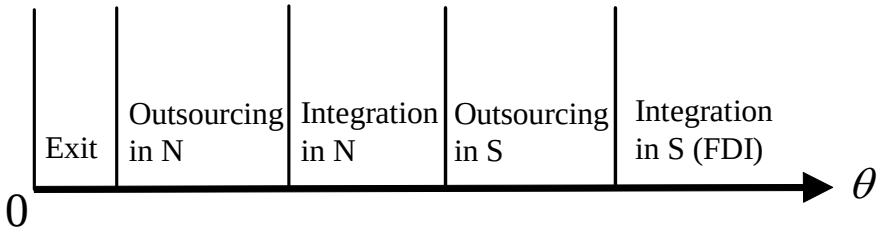
- ***raise*** *the share of imported inputs in all sectors;*
- ***raise*** *O relative to V in headquarter-intensive sectors in every country.*

Integration and Outsourcing with Heterogeneity

Comparison of low- and high-tech sectors:



Component-Intensive Sector



Headquarter-Intensive Sector

Relative Prevalence (Cont.)

An increase in the bargaining power of final-good producers engaging in FDI (higher δ^S)

- ***raises*** *V relative to O in headquarter-intensive sectors in the South;*
- *has* ***no effect*** *on the share of imported inputs in all sectors.*

Relative Prevalence (Cont.)

An increase in the bargaining power of final-good producers engaging in domestic integration (higher δ^N)

- ***raises*** *V relative to O in headquarter-intensive sectors in both countries;*
- ***decreases*** *the share of imported inputs in headquarter-intensive sectors .*

Relative Prevalence (Cont.)

An increase in the primitive bargaining power (higher β)

- ***raises*** *O relative to V in headquarter-intensive sectors in both countries;*
- ***raises*** *the share of imported inputs in headquarter-intensive sectors.*

Future Directions

General Equilibrium – effect of global sourcing strategies on relative wages – Antràs (2003b).

Study more complex strategies involving:

- Vertical as well as horizontal FDI and outsourcing – Grossman, Helpman and Szeidl (2003)
- Multilateral Bargaining with several suppliers.