14.581 International Trade

Class notes on 4/22/2013[1]

1 Neoclassical Theories of Fragmentation

1.1 Fragmentation of production: Overview

- In recent years, a lot of attention has been given to "fragmentation of production" a.k.a. the "slicing of the value chains" or "trade in tasks"
  - Baldwin (2006) has referred to this period as "the great unbundling"
- Fragmentation is related to activities of MNEs, though less than perfectly
  - Intuitively, if US firm outsources services in India, we would like to say that there is "fragmentation"
  - but this may not show up in the data (in U.S. statistics, a U.S. company needs to hold 10% or more of the stock of a foreign company in order to be considered a MNE)
- **Question:**

  Is "fragmentation" just a fancy name for "trade in intermediate goods"?
- **Answer(s):**
  1. It is about trade in intermediate goods, but new models emphasize differences in trade costs across goods (e.g. how routine a particular "task" may be), which previous models abstract from
  2. It is *not just* about trade in intermediate goods, since "fragmentation" also usually includes a transfer of technology from one country to another

1.2 Grossman and Rossi-Hansberg (2008)

1.2.1 Assumptions

- As in Heckscher-Ohlin model:
  - There are two countries, Home and Foreign
  - There are 2 tradeable goods, $i = 1, 2$
  - There are two factors of production, L and H
- In contrast with Heckscher-Ohlin model:

[1] The notes are based on lecture slides with inclusion of important insights emphasized during the class.

- Production process involves a large number of *tasks* $j \in [0, 1]$

- Tasks are of two types:
  - L-tasks which require 1 units of low-skilled labor
  - H-tasks which require 1 units high-skilled labor

1.2.2 Offshoring Costs

- Tasks vary in their offshoring costs
  - because some tasks are easier to codify
  - because some services must be delivered personally, while others can be performed at a distance with little loss in quality

- To capture this idea, GRH assume that:
  - H-tasks cannot be offshored
  - L-tasks can be offshored, but amount of low-skilled labor necessary to perform task j abroad is given by $\beta t(j) > 1$

- Under this assumption,
  - β reflects overall feasibility of offshoring at a point in time (e.g. communication technology)
  - $t(j)$ is an increasing function which captures differences in offshoring costs across tasks (e.g. cleaning room vs. call center)

1.2.3 The Offshoring Decision

- Suppose that wages for low-skilled labor are higher at Home

$$w_L > w_L^*$$

- Benefit of offshoring$\equiv$ lower wages abroad
- Cost of offshoring$\equiv$ loss in productivity captured by $\beta t(j)$
- In a competitive equilibrium, firm will offshore tasks if and only if:

$$\beta t(j) w_L^* < w_L$$

- Let $J \in [0, 1]$ denote the marginal task that is being offshored

$$\beta t(J) w_L^* = w_L \tag{1}$$

1.2.4 Offshoring as Factor Augmenting Technological Change

- The cost of producing one unit of some good is given by

$$c_i = a_{Li}\left[w_L(1-J) + w_L^*\beta T(J)\right] + a_{Hi}w_H \tag{2}$$

with $T(J) \equiv \int_0^J t(j)dj$, $w_H \equiv$ wage of high-skilled workers at Home

- Substituting (1) into (2), we obtain

$$c_i = a_{Li}w_L\Omega + a_{Hi}w_H$$

where $\Omega = (1-J) + \frac{T(J)}{t(J)} < 1$

- This looks just like the cost equation of a firm that employs low-skilled workers whose productivity is (inversely) measured by Ω
  - Hence, offshoring is economically equivalent to labor-augmenting technological progress

1.2.5 Productivity effect

- **Proposition** *If Home is a small open economy that produces both goods, a decrease in β increases w_L*
- **Proof:**
  1. Zero profit requires:

$$p_i = a_{Li}w_L\Omega + a_{Hi}w_H,\ i = 1, 2$$

  2. Since Home a small open economy, p_i does not depend on β
  3. This implies that $w_L\Omega$ (and w_H) do not depend on β either
  4. Since Ω is decreasing in β, we get w_L increasing in β

1.2.6 Other effects

- **Productivity effect** implies that workers whose jobs are being offshored benefit from decrease in offshoring costs
- In general, a decrease in offshoring costs would also have:
  1. **Relative-price effect**. If country is not small compared to the rest of the world, changes in β will also affect p_2/p_1

2. **Labor-supply effect**. If there are more factors than produced goods, changes in β will also affect $w_L\Omega$ and w_H at constant prices

- Simplest way to illustrate labor-supply effect is to consider case where Home is completely specialized in one good
  - this is the effect that has received the most attention in popular discussions

1.3 Costinot, Vogel, and Wang (2013)

An elementary theory of global supply chains

- A simple trade model with sequential production:
  - Multiple countries, one factor of production (labor), and one final good
  - Production of final good requires a continuum of intermediate stages
  - Each stage uses labor and intermediate good from previous stage
  - Production is subject to mistakes (Sobel 1992, Kremer 1993)
- Key simplifications:
  - Intermediate goods only differ in the order in which they are performed
  - Countries only differ in terms of failure rate
  - All goods are freely traded

1.3.1 Basic Environment

- Consider a world economy with multiple countries $c \in \mathcal{C} \equiv \{1, ..., C\}$
- There is one factor of production, labor:
  - Labor is inelastically supplied and immobile across countries
  - L_c and w_c denote the endowment of labor and wage in country c
- There is one final good:
  - To produce the final good, a continuum of stages $s \in \mathcal{S} \equiv (0, S]$ must be performed (more on that on the next slide)
- All markets are perfectly competitive and all goods are freely traded

  - We use the final good as our numeraire

- At each stage, producing 1 unit of intermediate good requires a fixed amount of previous intermediate good and a fixed amount of labor
  - "Intermediate good 0" is in infinite supply and has zero price
  - "Intermediate good S" corresponds to final good mentioned before
- Mistakes occur at a constant Poisson rate, $\lambda_c > 0$
  - λ_c measures total factor productivity (TFP) at each stage
  - Countries are ordered such that λ_c is strictly decreasing in c
- When a mistake occurs, intermediate good is entirely lost
- Formally, if a firm combines $q(s)$ units of intermediate good s with $q(s)ds$ units of labor, the output of intermediate good $s + ds$ is

$$q\left(s + ds\right) = \left(1 - \lambda_c ds\right) q\left(s\right)$$

1.3.2 Free trade equilibrium

- In spite of arbitrary number of countries, unique free trade equilibrium is characterized by simple system of first-order difference equations
- This system can be solved recursively by:
  1. Determining assignment of countries to stages of production
  2. Computing prices sustaining that allocation as an equilibrium outcome
- Free trade equilibrium always exhibits vertical specialization:
  1. More productive countries, which are less likely to make mistakes, specialize in later stages of production, where mistakes are more costly
  2. Because of sequential production, *absolute productivity differences* are a source of *comparative advantage* between nations
- Cross-sectional predictions are consistent with:
  1. "Linder" stylized facts
  2. Variations in value added to gross exports ratio (Johnson Noguera 10)

1.3.3 Comparative statics

- Comprehensive exploration of how technological change, either *global* or *local*, affects different participants of a global supply chain
- Among other things, we show that:
  1. Standardization—uniform decrease in failure rates around the world—can cause welfare loss in rich countries: a strong form of immiserizing growth
  2. Spillover effects are different at the bottom and the top of the chain: monotonic effects at the bottom, but not at the top
- **Broad message:** *Important to model sequential nature of production to understand consequences of technological change in developing and developed countries on trading partners worldwide*

1.4 Ramondo and Rodriguez-Clare (2012)

1.4.1 Basic Model

- Extension of Eaton and Kortum (2002) with both trade and multinational production (MP)
- For each good $v \in (0,1)$:
  - Ideas gets originated in country $i = 1, ..., I$
  - Production takes place in country $l = 1, ..., I$
  - Consumption takes place in country $n = 1, ..., I$
- Trade versus MP:
  - If $l \neq n$, then good v is traded
  - If $i \neq l$, then MP occurs (in EK, $i = l$)
- Model is Ricardian:
  - Labor is the only factor of production
  - Constant returns to scale
  - (Like EK, full model also includes tradable intermediate goods)
- Constant unit cost of production *and* delivery for a good v given by

$$\frac{d_{nl} h_{li} w_i}{z_{li}(v)}$$

where:

- $d_{nl} \equiv$ iceberg trade costs from country l to country n
- $h_{li} \equiv$ iceberg costs from using technology from i in l
- $c_{li} \equiv$ average unit cost of production for firms from i in country l
- $z_{li}(v) \equiv$ productivity of firms from i producing good v in country l

- $\mathbf{z}_i(v) \equiv (z_{1i}(v), ..., z_{Ii}(v))$ is drawn from multivariate Fréchet

1.4.2 Results

- **Main result:**
  - Gains from trade are larger in the presence of MP because trade facilitates MP
  - Gains from openness are larger than gains from trade because of MP and complementarity between trade and MP
- A model of MP without a model of MNEs?:
  - in any given country and sector, technology is assumed to be freely available to a large number of price-taking firms
  - discipline only comes from aggregate predictions of the model

2 Multinational Firms

2.1 What Are Multinational Enterprises (MNEs)?

- **MNE** $\equiv$ *"An enterprise that controls and manages production establishments (plants) located in at least two countries. It is simply one subspecies of multiplant firms"*; Caves (1996)
- The trade literature distinguishes between two broad types of MNEs:
  1. **Horizontal MNE** $\equiv$ Because of trade costs, firms duplicate production facilities and sell locally in two or more markets (Toyota, Nestle)
  2. **Vertical MNE** $\equiv$ Because of factor price differences, firm locates its headquarter in one country but does production in another (Nike, Intel)
- Other useful definitions:

- **FDI** ≡ Investment made by multinational in the Foreign country
- **Parent** ≡ Company making the investment abroad
- **Affiliate** ≡ Company receiving the investment abroad

2.2 Horizontal MNEs

The proximity-concentration trade-off

- **Basic Idea:**
  - Under free trade, you would never want to have production facilities in multiple countries (why replicate fixed costs?)
  - But in the presence of transport costs, firms may be willing to set up a new plant in order to avoid these costs
- **Proximity-concentration trade-off:**
  - *Domestic firm*: low fixed cost, but high variable costs
  - *Horizontal multinational*: high fixed cost, but low variable costs
- **Main insight [Markusen and Venables 2000]:** Multinationals will be more likely if
  1. Transport costs are higher
  2. Plant-specific costs are lower
  3. GDPs are higher or more similar across countries

2.2.1 Helpman, Melitz and Yeaple (2004)

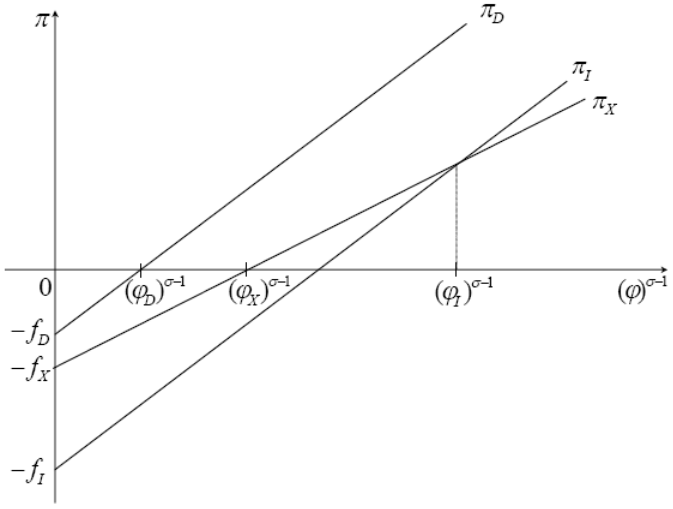
Overview

- Helpman, Melitz and Yeaple (2004) revisit the proximity-concentration trade-off in the presence of firm-level heterogeneity à la Melitz (2003)
- **Basic Idea:**
  - Low-variable costs matter relatively more for more productive firms
  - So high productivity firms will become multinationals, whereas less productive firms will become exporters
- **Main insight:**
  - Differences in the distribution of firm productivity across sectors has implication for export vs. FDI

Model

- Firm productivity φ is drawn from a Pareto, $G(\varphi) = 1 - \left(\underline{\varphi}/\varphi\right)^k$
- Firm in country i chooses whether to become domestic producers (D) or to serve country j via exports (X) or FDI (I).
- Foreign revenues are given by $r_O(\varphi) = (\varphi/\tau_O)^{\sigma-1} B$, with $O \in \{D, X, I\}$
- Variable transport costs satisfy: $\tau_I^{1-\sigma} = 1 > \tau_X^{1-\sigma} > \tau_D^{1-\sigma} = 0$
- Fixed transport costs satisfy: $f_I > f_X > f_D$

Selection into exports and FDI



2.2.2 Prediction

- Industries with higher dispersion of productivity across firms—i.e. a lower shape parameter k—should have a higher ratio of FDI versus export sales
- **Intuition:**
  - Low-k sectors have relatively more high-φ firms
  - high-φ firms are more likely to select in I than X
- **Formally:**

  g is log-supermodular in φ and $-k$; r is supermodular in φ and $\tau^{1-\sigma}$; and log-supermodularity is preserved by integration (Costinot 2009)

2.3 Vertical MNEs

- In models of horizontal MNEs, trade and FDI are substitutes
  - But MNEs account for a very significant fraction of world trade flows and FDI is rising with trade!
  - There is substantial trade of intermediate inputs within MNEs
- **Basic Idea:**

  Factor price differences may provide incentives to operate (skill intensive) headquarter services in North and do (labor intensive) production in South
- **Key insight [Helpman 1984]:**

  Ability of MNEs to spread their facilities across several countries enlarges the region of factor price equalization

2.4 Why Do Multinational Firms Exist?

- Answer so far: "Technological" theories of the multinational firm
  - According to these theories, MNEs will emerge whenever concentrating production in a unique location is *not* profit-maximizing
  - Horizontal vs. Vertical FDI
- In developing global sourcing strategies, firms not only decide on where to **locate** different stages of value chain, but also on extent of **control**:
  - Why is fragmentation occurring within or across firm boundaries?
  - This is nothing more than the classical **"make-or-buy"** decision in IO.

2.5 What Determines (Multinational) Firms' Boundaries?

- Over the last 10 years, trade economists have incorporated various theories of the firm into general equilibrium models:
  1. Williamson's transaction-cost approach [Grossman Helpman 2002]
  2. Grossman-Hart-Moore's property-rights approach [Antras 2003, Antras Helpman 2004]
  3. Aghion-Tirole's approach [Marin Verdier 2008, Puga Trefler 2007]
- We will focus on **property-rights approach**:

– Integration means acquisition of assets; when contracts are incomplete, the parties encounter contingencies that were not foreseen in the initial contract, and the owner of the asset has the residual rights of control; the residual rights of control affect the outside options and therefore how the surplus from the relationship is divided ex-post (ownership = power)

– In the presence of relationship-specific investments, these considerations lead to a theory of the boundaries of the firm in which both the benefits and the costs of integration are endogenous

2.5.1 Antràs (2003)

Overview

- **Fact 1:** *In cross-section of industries, share of intra-firm imports in total US imports increases with capital intensity*
- **Fact 2:** *In cross-section of countries, share of intra-firm imports in total US import increases with capital labor ratio of exporting country*
- In order to explain facts 1 and 2, Antras (2003) proposes to combine Grossman-Hart and Helpman-Krugman:

  1. If final good producers always need an intermediate producer for labor decision, these producers should keep property rights when their decision matters more, i.e. in the labor-intensive sectors
  2. Since capital abundant countries produce capital intensive goods, and these goods are produced within the boundary of the firm, their share of intra-firm trade will be higher

A Simple Property-Rights Model

- Consumer preferences are such that F faces a demand given by

$$y = Ap^{-1/(1-\alpha)}, \qquad 0 < \alpha < 1. \tag{3}$$

- Production of good y requires the development of **two** specialized intermediate inputs h and m. Output is Cobb-Douglas:

$$y = \left(\frac{h}{\eta}\right)^{\eta} \left(\frac{m}{1-\eta}\right)^{1-\eta}, \quad 0 < \eta < 1, \tag{4}$$

  where a higher η is associated with a more intensive use of h in production.

- There are two agents engaged in production:
  - a final-good producer (denoted by F) who supplies the input h and produces the final good y,
  - an operator of a manufacturing plant (denoted by S) who supplies the input m.
- F can produce h at a constant marginal cost c_h; S can produce m at $MC = c_m$. In addition, production requires fixed cost $f \cdot g(c_h, c_m)$.
- Inputs are tailored specifically to other party and useless to anybody else.
- **Contractual structure:** before investments h and m are made, the only contractibles are the allocation of residual rights (i.e., the ownership structure) and a lump-sum transfer between the two parties.
- Ex-post determination of price follows from generalized Nash bargaining.
- *Ex-ante*, F faces a perfectly elastic supply of potential S agents so that, in equilibrium, the initial transfer will be such that it secures the participation of S in the relationship at minimum cost to F.
- Key features:
  1. ex-post bargaining takes place both under outsourcing and under integration;
  2. the distribution of surplus, however, is sensitive to the mode of organization because the outside option of F is naturally higher when it owns S than when it does not.
- Outside options are as follows:
  - under outsourcing, contractual breach gives 0 to both agents;
  - under integration, F can selectively fire S and seize input m (at a productivity cost δ) – because of property rights over input.

Formulation of the Problem

- In light of equations (3) and (4), the potential revenue from the sale of y is
$$R(h, m) = \lambda^{1-\alpha} \left(\frac{h}{\eta}\right)^{\alpha\eta} \left(\frac{m}{1-\eta}\right)^{\alpha(1-\eta)}. \tag{5}$$
- Given the specification of the ex-post bargaining, F obtains share $\beta_O = \beta$ of sale revenue under outsourcing and share $\beta_V = \delta^\alpha + \beta(1 - \delta^\alpha) > \beta_O$ under integration.

- Optimal ownership structure k^* is thus the solution to:

$$\begin{aligned} \max_{k\in\{V,O\}} \quad & \pi_k = R\left(h_k, m_k\right) - c_h \cdot h_k - c_m \cdot m_k - f \cdot g\left(c_h, c_m\right) - \overline{U} \\ s.t. \quad & h_k = \arg\max_h \left\{\beta_k R\left(h, m_k\right) - c_h \cdot h\right\} \\ & m_k = \arg\max_m \left\{\left(1-\beta_k\right) R\left(h_k, m\right) - c_m \cdot m\right\} \end{aligned} \tag{P1}$$

  where $R(\cdot)$ is given in (5) and $\overline{U}$ is the outside option of the operator S

- First-best level of investments would simply maximize π_k

A Useful Result

- The solution to the constrained program (P1) delivers the following result (see Antràs, 2003 for details):

  Proposition 1 *There exists a unique threshold $\widehat{\eta} \in (0,1)$ such that for all $\eta > \widehat{\eta}$, integration dominates outsourcing ($k^* = V$), while for all $\eta < \widehat{\eta}$, outsourcing dominates integration ($k^* = O$).*

- As in Grossman and Hart (1986), in a world of incomplete contracts, ex-ante efficiency dictates that residual rights should be controlled by the party undertaking a relatively more important investment:
  - if production is very intensive in the m input, then choose **outsourcing** to alleviate the underinvestment in the provision of the m input,
  - when production is intensive in the h input, F will optimally choose to tilt the bargaining power in its favor by obtaining these residual rights, thus giving rise to **vertical integration**.

- Convenient Feature: threshold k^* is independent of factor prices (Cobb-Douglas assumption important).

General Equilibrium Model

- Antràs (2003) embeds this structure in a Helpman-Krugman model of trade
- J countries produce differentiated varieties in two sectors (Y, Z) using two factors (K, L)
- K and L are inelastically supplied and freely mobile across sectors

- Preferences of the representative consumer in each country are of the form:

$$U = \left(\int_0^{n_Y} y(i)^\alpha di \right)^{\frac{\mu}{\alpha}} \left(\int_0^{n_Z} z(i)^\alpha di \right)^{\frac{1-\mu}{\alpha}}, \quad \mu, \alpha \in (0,1).$$

- Demands are then $y(i) = A_Y p_Y(i)^{-1/(1-\alpha)}$ and $z(i) = A_Z p_Z(i)^{-1/(1-\alpha)}$
- Free entry $\Rightarrow$ zero expected profits for a potential entrant
- Production is as described before with the following new features:
- h and m are *nontradable*, but combined yield a tradable composite input
- h is capital-intensive relative to m (cost-sharing in capital expenditures). Extreme factor intensity: $c_h^\ell = r^\ell$ and $c_m^\ell = w^\ell$
  - see Table 1 in paper for a supportive evidence
- tradable composite input can be produced in any country according to Cobb-Douglas technology as in (4) with $\eta_Y > \eta_Z$
- homothetic cost functions: $g_j^\ell\left(r^\ell, w^\ell\right) = \left(r^\ell\right)^{\eta_j}\left(w^\ell\right)^{1-\eta_j}$ and $f_k^\ell = f$
- final goods are nontradable, but can be produced one-to-one with inputs (helps pin down world trade flows)
- the same β and δ apply to both sectors and $\overline{U} = 0$.

Firms, Contracts and Trade Structure

- Under these assumptions the ownership structure and locational decisions in (P2) can be analyzed separately.
  - Optimal ownership structure in sector $j \in \{Y, Z\}$ solves (P1) – Proposition 1 applies;
  - Optimal location decision solves $\min_\ell \left\{ \left(r^\ell\right)^{\eta_j}\left(w^\ell\right)^{1-\eta_j} \right\}$.
- Pattern of specialization of intermediate inputs responds to Heckscher-Ohlin forces as well as Helpman-Krugman forces:
  - because of IRS and product differentiation, countries specialize in certain intermediate input varieties and export them worldwide,
  - but capital-abundant countries tend to produce a larger share of capital-intensive varieties than labor-abundant countries.

- Intermediate inputs can be traded at zero cost, while final goods are nontradable so that each F (costlessly) sets J plants to service the J markets.
- It can then be shown that, with FPE, for any country $j \in J$:
  - "probability" of imports being intrafirm is increasing in capital-intensity of the industry.
  - the share of capital-intensive (and *thus* intrafirm) imports in total imports is an increasing function of the capital-labor ratio of the exporting country.

2.5.2 Antràs and Helpman (2004)

Global Sourcing with Heterogenous Firms

- The technological theories of MNEs emphasizes the location decision
- Antras (2003) emphasizes the boundary decision
- Antras and Helpman (2004) offer a model in which final good producers will simultaneously decide:
  1. Where to source their inputs, North or South
  2. Whether to make or buy these inputs
- As in Melitz (2003) and HMY (2004), they introduce firm-level heterogeneity
  - Global sourcing decisions will depend both on firm- and industry-characteristics

The Model

- **Environment and Preferences:** Consider a world with two countries, the North and the South, and a unique factor of production, labor. There is a representative consumer in each country with quasi-linear preferences:

$$U = x_0 + \frac{1}{\mu}\sum_{j=1}^{J} X_j^{\mu},\ 0 < \mu < 1.$$

where x_0 is consumption of a homogeneous good, X_j is an index of aggregate consumption in sector j, and μ is a parameter.

- Aggregate consumption in sector j is a CES function

$$X_j = \left[\int x_j(i)^\alpha di\right]^{1/\alpha}, \ 0 < \alpha < 1,$$

of the consumption of different varieties $x_j(i)$, where the range of i will be endogenously determined.

- This specification leads to the following inverse demand function for each variety i in sector j:

$$p_j(i) = X_j^{\mu-\alpha} x_j(i)^{\alpha-1}.$$

- **Technology:** Producers of differentiated goods face a perfectly elastic supply of labor. Let the wage in the North be strictly higher than that in the South ($w^N > w^S$). The market structure is one of monopolistic competition.
  - As in Melitz (2003), producers needs to incur sunk entry costs $w^N f_E$, after which they learn their productivity $\theta \sim G(\theta)$.
  - As in Antràs (2003), final-good production combines two specialized inputs according to the technology:

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

  - h is controlled by a final-good producer (agent F), m is controlled by an operator of the production facility (agent S).
  - Sectors vary in their intensity of headquarter services η_j. Furthermore, within sectors, firms differ in productivity θ.
  - Intermediates are produced using labor with a fixed coefficient.
  - $h_j(i)$ is produced only in the North, which implies that the headquarters H are always located in the North.
  - Productivity in the production of $m_j(i)$ is assumed identical in both countries.

- After observing θ, H decides whether to exit the market or start producing.

- In the latter case additional fixed cost of organizing production need to be incurred.
  - It is assumed that these additional fixed cost are a function of the structure of ownership and the location of production.
  - In particular, if an *organizational form* is $k \in \{V, O\}$ and $\ell \in \{N, S\}$, these fixed costs are $w^N f_k^\ell$ and satisfy

$$f_V^S > f_O^S > f_V^N > f_O^N. \tag{6}$$

- Contracting is as in the previous models, but we let $\delta^N \geq \delta^S$.
- Following Antràs (2003), the ex-post division of surplus is as follows:

	North	South
Non-Integration	$\beta_O^N = \beta$	$\beta_O^S = \beta$
Integration	$\beta_V^N = \left(\delta^N\right)^\alpha + \beta\left[1 - \left(\delta^N\right)^\alpha\right]$	$\beta_V^S = \left(\delta^S\right)^\alpha + \beta\left[1 - \left(\delta^S\right)^\alpha\right]$

- Notice that

$$\beta_V^N \geq \beta_V^S > \beta_O^N = \beta_O^S = \beta.$$

Equilibrium

- We show that after solving for investment levels (in the constraints), the general program in (P2) reduces to

$$\max_{\beta_k^\ell \in \left\{\beta_V^N, \beta_V^S, \beta_O^N, \beta_O^S\right\}} \pi_k^\ell(\theta, X, \eta) = X^{(\mu-\alpha)/(1-\alpha)} \theta^{\alpha/(1-\alpha)} \psi_k^\ell(\eta) - w^N f_k^\ell \quad (7)$$

where

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

- By choosing k and ℓ, H is effectively choosing a triplet $\left(\beta_k^\ell, w^\ell, f_k^\ell\right)$. And:
  - π_k^ℓ is decreasing in w^ℓ and f_k^ℓ.
  - π_k^ℓ is largest when $\beta_k^\ell = \beta^*(\eta)$, with $\beta^{*\prime}(\eta) > 0$, $\beta^*(0) = 0$ and $\beta^*(1) = 1$ (remember Figure 1). Intuitively, H wants to allocate relatively more power to the party undertaking a relatively more important investment in production.
- One can solve for industry equilibrium as in Melitz (2003) or HMY (2004).

Relevant Trade-offs

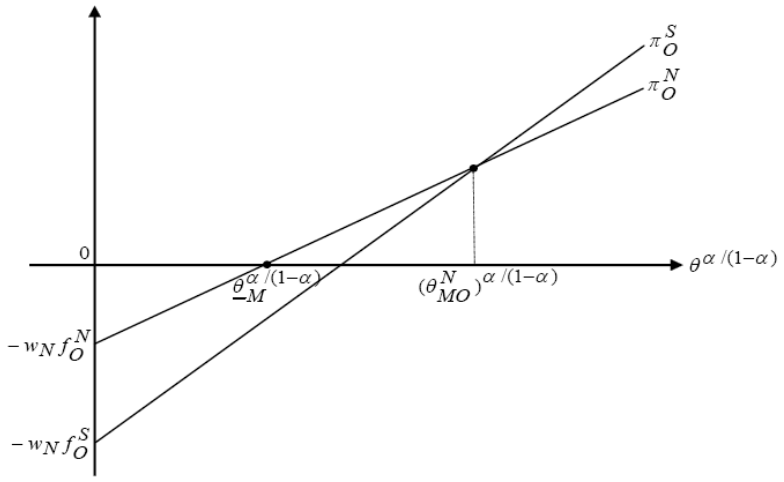
- The choice of an organizational form faces two types of tensions:
  - Location decision: variable costs are lower in the South, but fixed costs are higher there – a firm's productivity θ will turn out to affect crucially the participation in international trade;
  - Integration decision: integration improves efficiency of variable production when the η is high, but involves higher fixed costs. This decision will thus crucially depend on η but also on θ.
- To simplify the discussion, we focus on two types of sectors:

1. A **Component-intensive sector** ($\eta < \beta^{*-1}(\beta)$ and $w^N/w^S < \left(f_O^S/f_O^N\right)^{(1-\alpha)/\alpha(1-\eta)}$):
   - This implies $\psi_O^\ell(\eta) > \psi_V^\ell(\eta)$ for $\ell = N, S$, which together with (6), implies that any form of integration is dominated in equilibrium (see Figure).
2. A **Heaquarter-intensive sector** with $\eta > \beta^{*-1}\left(\beta_V^N\right)$, and $\left(w^N/w^S\right)^{1-\eta}$ "high enough"
   - This implies the ranking of slopes

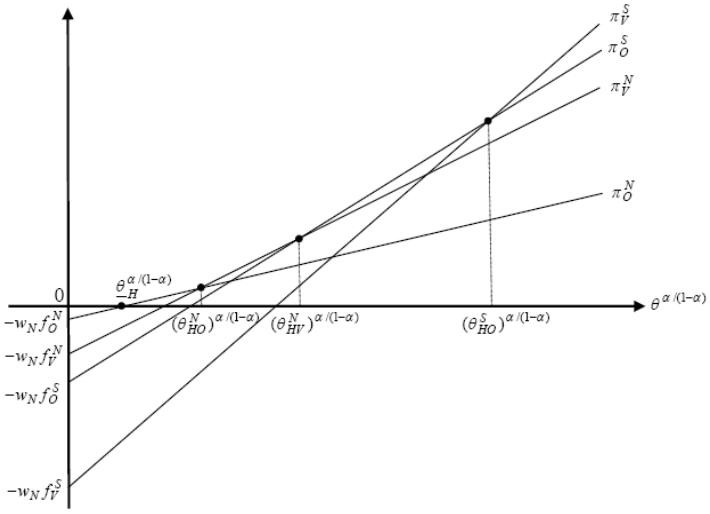
$$\psi_V^S(\eta) > \psi_O^S(\eta) > \psi_V^N(\eta) > \psi_O^N(\eta). \tag{8}$$

   which together with (6) leads to the Figure below.

Equilibrium in the component-intensive sector



Equilibrium in the headquarter-intensive sector



Prevalence of various organizations

- Last part of the paper quantifies the relative prevalence of different organizational forms
- This requires parameterizing the distribution of θ. Following HMY (2004), we choose $G(\theta)$ to be a Pareto distribution with shape z, i.e.,

$$G(\theta) = 1 - \left(\frac{b}{\theta}\right)^z \quad \text{for } \theta \geq b > 0. \tag{9}$$

  - Remember that z is inversely related to the variance of the distribution.

- In the component-intensive sector, foreign outsourcing is more prevalent:
  - the higher is w^N/w^S (or the lower are transport costs τ),
  - the lower are z and η.
- In the headquarter-intensive sector:
  - the share of intrafirm imports in total imports should be higher in industries with higher η, but also in industries with higher productivity dispersion (lower z) and higher transport costs (τ).
  - a higher w^N/w^S (or lower τ) increase the amount of international sourcing, but also increase the share of foreign outsourcing in total foreign sourcing.

Comments

- Antràs and Helpman (2004) offer a rich set of *positive* predictions:
  1. Share of intra-firm trade
  2. Prevalence of offshoring
- We now much less about the *normative* and *policy* implications of contractual theories of MNEs

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