Lecture 8: Trade with Heterogenous Firms (Theory II)

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Melitz Extentions

- The Melitz model has been extended in a number of ways and it has been applied to data analysis.
- Large and still growing literature, see review by Melitz and Redding 2014: "Heterogeneous Firms and Trade.'' Handbook of International Economics, 4th ed, 4: 1-54. Elsevier

Today's Plan

- **Revisiting New Trade Theory with firm heterogeneity**
  - Multiple factor of productions: BRS (2007)
  - Variable mark-ups: Melitz and Ottaviano (2008)
- **Looking down: what else do micro-level data say?**
  - Structure of trade costs: Arkolakis (2010), EKK (2011)
  - Multi-product firms: BRS (2009), Arkolakis and Muendler (2011)
- **"Export" is not the only organizational decision of the firm**
  - FDI: HMY (2004)
  - Outsourcing versus vertical integration: Antras and Helpman (2004)

Revisiting New Trade Theory with Firm Heterogeneity

Basic idea

- Melitz (2003) builds on Krugman (1980)
- Krugman (1980) imposes two strong assumptions:
  - **One factor of production** $\Longrightarrow$ no role for factor endowments
  - **CES preferences** $\Longrightarrow$ no changes in mark-ups
- We will first discuss extensions of Melitz (2003) that relax these two assumptions by revisiting other classics from the New Trade Theory:
  - **Multiple factors of production**: BRS (2007)
    [Melitz (2003) meets Helpman and Krugman (1985)]
  - **Linear demand**: Melitz and Ottaviano (2007)
    [Melitz (2003) meets Krugman (1979)]

Multiple Factors: Bernard, Redding and Schott (2007)

Summary

- Introduce a second factor of production into Melitz (2003)
- **Goal**:
  Analyze the interaction between inter-industry reallocations at the core of Heckscher-Ohlin model and intra-industry reallocations at the core of Melitz (2003)
- **Central Idea**:
  Because of differences in export opportunities, intra-industry reallocation differ systematically across comparative advantage and disadvantage sectors

Multiple Factors: Bernard, Redding and Schott (2007)

Model

- BRS (2007) consider a world economy with:
  - 2 countries, Home and Foreign
  - 2 industries, 1 and 2
  - 2 factors, l and s
- Factor endowments across countries are such that

$$\frac{s^H}{l^H} \leq \frac{s^F}{l^F} \tag{1}$$

- Production is like in Melitz (2003), but total costs are given by

$$\Gamma_i = \left[f_i + \frac{q_i}{\varphi} \right] (w_s)^{\beta_i} (w_l)^{1-\beta_i}, \quad with \quad \beta_1 > \beta_2 \tag{2}$$

Multiple Factors: Bernard, Redding and Schott (2007)

Results

- Following the opening up of trade, profits increase more in comparative advantage industries $\Longrightarrow$ productivity cut off and "average" productivity increase more as well

- **Magnification effect** (Proposition 6)

  The opening of (costly) trade magnifies ex ante cross country differences by inducing endogenous Ricardian productivity differences at the industry level that are positively correlated with H-O based comparative advantage:

$$\tilde{\varphi}_1^H / \tilde{\varphi}_2^H \geq \tilde{\varphi}_1^F / \tilde{\varphi}_1^F \tag{3}$$

Variable Mark-ups: Melitz and Ottaviano (2008)

Summary

- Introduce endogenous mark-ups into Melitz (2003)
- **Goal:**
  Explore the pro-competitive effects of trade in environments with firm-level heterogeneity
- **Technical innovation:**
  Use Ottaviano, Tabushi, and Thisse (2002) linear demand system instead of CES

Variable Mark-ups: Melitz and Ottaviano (2008)

Model

- Preferences are now represented by

$$U^c = q_0^c + \alpha \int_\Omega q^c(\omega) d\omega - \frac{1}{2}\gamma \int_\Omega [q^c(\omega)]^2 d\omega - \frac{1}{2}\eta \left[\int_\Omega q^c(\omega) d\omega \right]^2$$

  where:

  - q_0 is consumption of a homogeneous good
  - $\alpha > 0$, $\eta > 0$ reflect substitution between homogeneous and differentiated good
  - γ reflect substitution across differentiated varieties

Variable Mark-ups: Melitz and Ottaviano (2008)

Model (Cont.)

- Quadratic preferences lead to a linear demand system:

$$q(\omega) = Lq^c(\omega) = \frac{\alpha L}{\eta N + \gamma} - \frac{L}{\gamma} p(\omega) + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \bar{p}$$

where:

  - N is the number of varieties
  - $\bar{p} \equiv \frac{1}{N} \int_\Omega p(\omega) d\omega$ is the average price

- **Key property:**

$$\left| \frac{\partial \ln q(\omega)}{\partial \ln p(\omega)} \right| = \frac{\frac{L}{\gamma} p(\omega)}{\frac{\alpha L}{\eta N + \gamma} - \frac{L}{\gamma} p(\omega) + \frac{\eta N}{\eta N + \gamma} \frac{L}{\gamma} \bar{p}}$$

  - Lower $\bar{p} \implies$ higher elasticity $\implies$ lower mark-ups
  - Higher N $\implies$ higher elasticity $\implies$ lower mark-ups

Variable Mark-ups: Melitz and Ottaviano (2008)

Results

- Larger markets are associated with:
  - lower average markups and prices
  - bigger and more profitable firms
  - higher welfare
- Compared to Melitz (2003):
  - opening up to trade has pro-competitive effects (as in Krugman 1979)
  - firms select into exporters and non-exporters even in the absence of fixed costs (finite reservation prices)
- Does that imply that gains from trade liberalization are larger than if markups were constant?
  - Arkolakis, Costinot, Donaldson and Rodriguez-Clare (2012) say no
  - Key issue is larger compared to what?

Looking Down: What Else Do Micro-Level Data Say?

Basic Idea

Quantitative models:

- Melitz (2003) offers a model qualitatively consistent with firm-level data, but model is too stylized to explain these data quantitatively
- Arkolakis (2010), Eaton, Kortum, and Kramarz (2011) propose variations of Melitz (2003) with richer specification of trade costs to match richness of frm-level data

New micro-level data:

- Melitz (2003) focuses on firm-level data, but we now have information about products (even shipments)
- Bernard, Redding and Schott (2011), Arkolakis and Muendler develop variations of Melitz (2003) to explain qualitatively or quantitatively these new product-level facts
- Mayer, Melitz and Ottaviano (2009) propose a similar exercise starting from Melitz and Ottaviano (2008)

Marketing Costs and Exporter Size: Arkolakis (2010)

Summary

- Melitz (2003) introduces fixed exporting costs in order to explain why large firms export whereas small firms don't
- In the data, however, we observe that:
  - Only a small number of firms export, which suggests that fixed exporting costs are large
  - Many exporters only export small amounts, which suggests that exporting costs are small
- Arkolakis (2010) develops avariation of Chaney (2008) with endogenous marketing costs to explain size distribution of exporters

Marketing Costs and Exporter Size: Arkolakis (2010)

Model

Key difference: from Melitz (2003)

- In order to reach consumers with probability x in country j, a firm from country i must now pay a fixed cost equal to

$$f_{ij}(x) = f_{ij} \times \left[\frac{1 - (1 - x)^{1-\mu}}{1 - \mu} \right]$$

- Melitz corresponds to the particular case in which $\mu = 0$, $f_{ij} = f_X$
- If $\mu = 0$, marginal cost of reaching additional consumer is constant and firms find it optimal to reach every potential consumer or none at all.

Marketing Costs and Exporter Size: Arkolakis (2010)

Results

- In equilibrium, smaller exporters spend less on fixed marketing costs
- This explains why a large number of firms export small amounts
- In addition, the model predicts that smaller exporters grow faster after a particular decrease in trade cost

Multi-Product Firms: Bernard, Redding and Schott (2011)

Summary

- In Melitz (2003), reallocations occur within an industry **across firms**
- In the data, reallocations also occur within firms **across products**
- BRS (2011) develop multi-product variation of Melitz (2003):
  - varieties are reinterpreted as products rather than "firms''
  - productivity draws are positively correlated across products within firms
- Model can explain increases in firm-level productivity after trade liberalization (due to selection of most productive products)
  - Even in Melitz (2003), though, *measured* productivity, defined as revenue per worker, increases with firm-level employment
  - Since firm-level employment changes with trade liberalization in Melitz (2003), measured productivity must change as well

Firms' Organizational Decisions

Basic Idea

- In Melitz (2003), heterogeneous firms can self-select into two "organizational forms'': (i) domestic production; or (ii) export
- In practice, firms engaged internationally face a much larger set of choices. For example:
  - They can produce and sell in the Foreign country [**Horizontal FDI**]
  - They can also split their production process in two different countries [**Vertical FDI**]. In this case, they can either own their intermediate suppliers or trade at arm's length.
- Helpman, Melitz, and Yeaple (2004) focus on the first choice, whereas Antras and Helpman (2004) focus on the latter

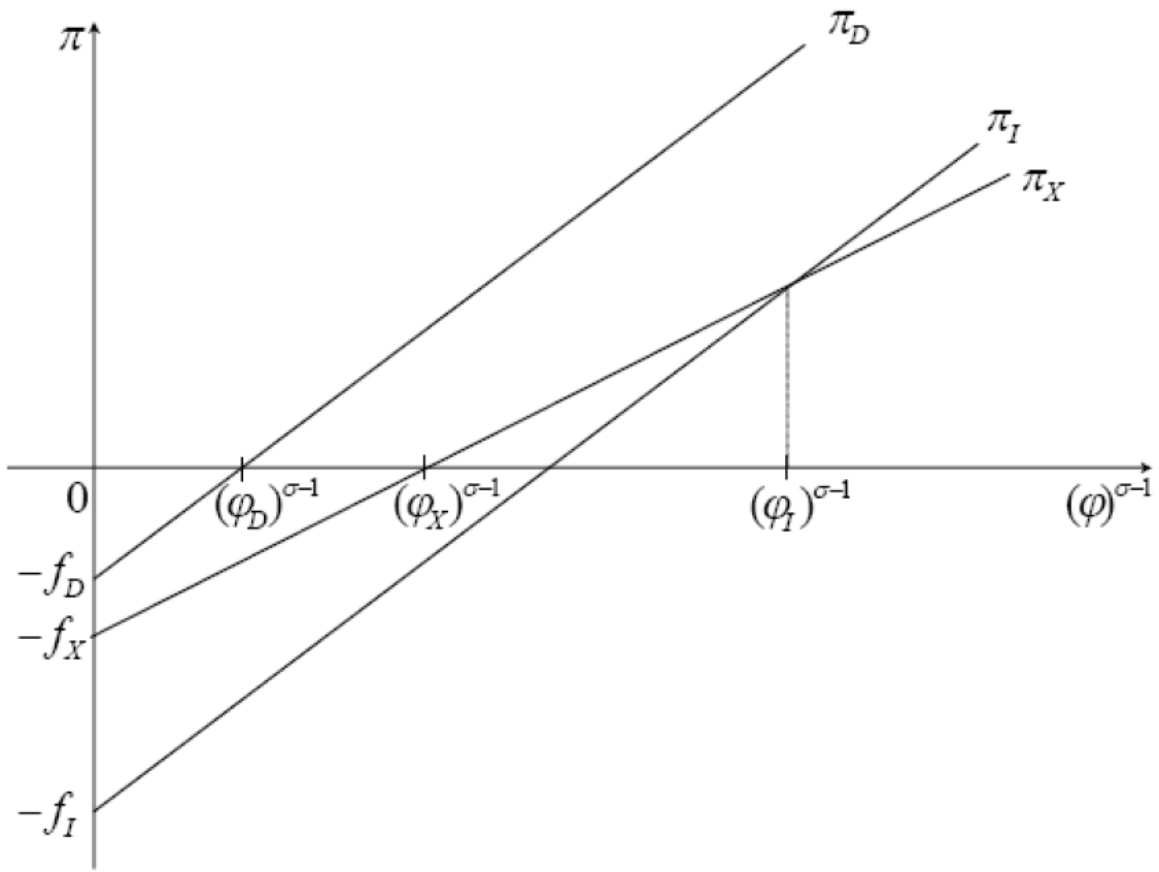
Horizontal FDI: Helpman, Melitz and Yeaple (2004)

Model

- Firm productivity φ is drawn from a Pareto, $G(\varphi) = 1 - (\bar{\varphi}/\varphi)^k$
- 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: $f_I > f_X > f_D$

Horizontal FDI: Helpman, Melitz and Yeaple (2004)

Selection into exports and FDI



Horizontal FDI: Helpman, Melitz and Yeaple (2004)

Main result

- 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 (for which they find support in the data)
- **Intuition**
  - Low-k sectors have relatively more high-φ firms
  - high-φ firms are more likely to select in I than X

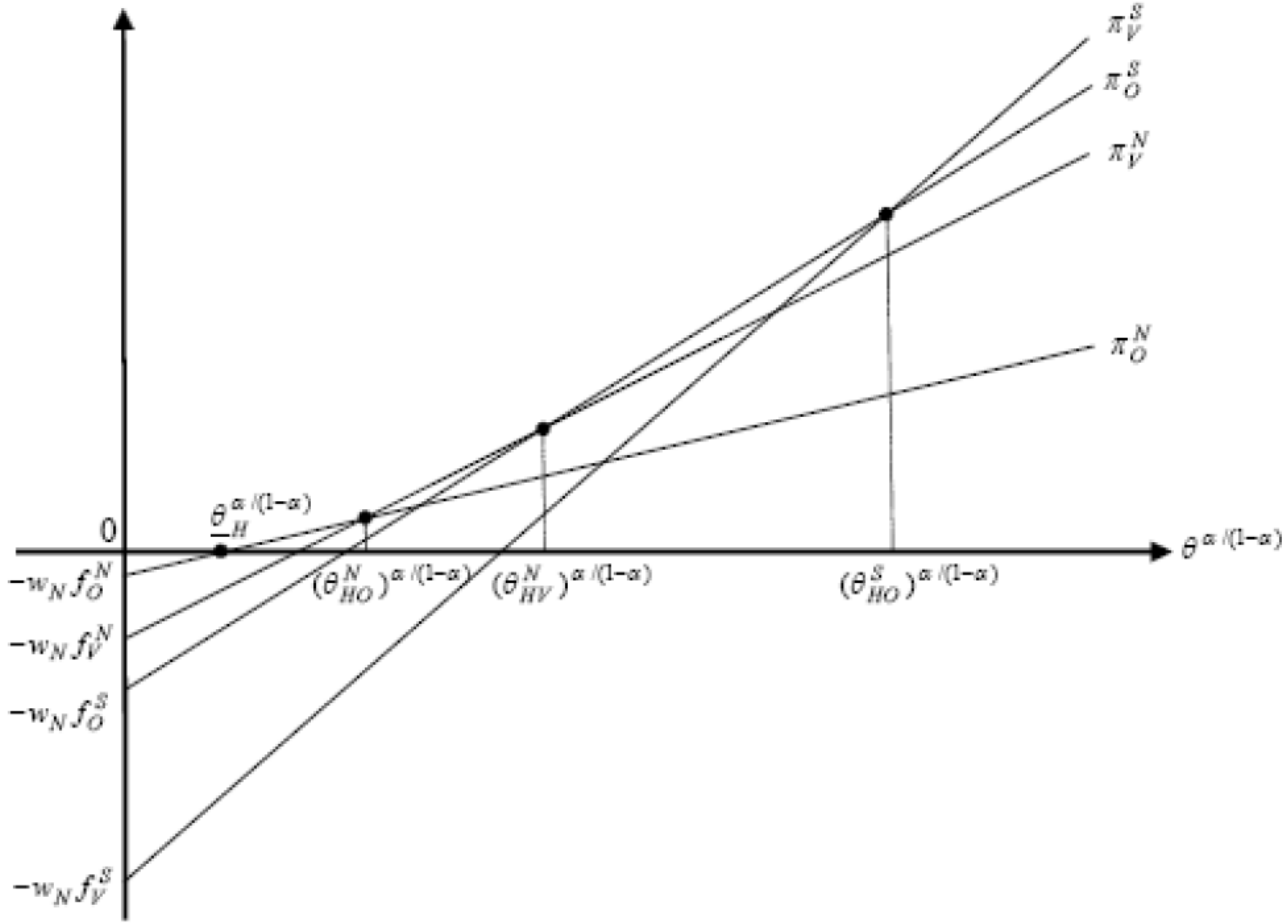
Global Sourcing: Antras and Helpman (2004)

Model

- Firm productivity φ is drawn from a Pareto, $G(\varphi) = 1 - (\bar{\varphi}/\varphi)^k$
- Firm chooses ownership structure, vertical integration (V) or outsourcing (O), and location of production, North (N) or South (S)
- Authors provide micro-foundations s.t:
  - Profits are given by $\pi_k^l = X^{(\mu-\alpha)/(1-\alpha)}\phi^{\alpha/(1-\alpha)}\psi_k^l - w^N f_k^l$, with $(k, l) \in \{V, O\} \times \{N, S\}$
  - Variable organizational costs satisfy: $\psi_V^S > \psi_O^S > \psi_V^N > \psi_O^N$
- Fixed organizational costs satisfy: $f_V^S > f_O^S > f_V^N > f_O^N$

Global Sourcing: Antras and Helpman (2004)

Selection into organizations



Global Sourcing: Antras and Helpman (2004)

Results

Industries with higher dispersion of productivity across firms – i.e. a lower shape parameter k should have:

- a lower fraction of firms that outsource in the North
- a higher fraction of firms that insource in the South
- more offshoring
- more vertical integration

Though micro-foundations are different, intuition is similar to results in Helpman, Melitz, and Yeaple (2004)

Where Do We Go From There?

- Wherever micro-level data lead us (?)
  - More on zeros (e.g. Eaton, Kortum, and Sotelo 2012)
  - Quality versus productivity (e.g. Verhoogen 2008)
  - Matched importer-exporter data (e.g. Eaton et al. 2010)
- Other covariates of firm productivity (?):
  - Financial constraints (see e.g. Manova 2012)
  - Technology adoption (see e.g. Bustos 2011)
- Under-explored issues (?):
  - Growth (see e.g. Baldwin and Robert-Nicoud 2009)
  - Misallocations (see e.g. Hsieh and Klenow 2009)
  - Trade policy

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