International Trade I

Monopolistic Competition

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Outline of the Lecture

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Motivation

- **Problem 1:** previous models explain why *different* countries trade, but a large proportion of world trade is between *similar* countries
- So far, all models have assumed:
  - Perfect competition
  - Constant returns to scale
- In reality, many industries exhibit some degree of *imperfect* competition and *increasing* returns to scale
- This introduces many new features:
  - New reasons and gains from trade:
    - Trade increases market size and so allows the exploitation of economies of scale
    - Trade increases the variety of products available
    - Trade increases competition
  - The pattern of trade may not be efficient

Motivation

- **Problem 2:** Nineties have seen a boom in the availability of micro-level data. Previous theories are at odds with (or cannot account for) many micro-level facts:
  1. Within a given industry, there is *firm-level heterogeneity*
  2. *Fixed costs matter in export* related decisions
  3. Within a given industry, more productive firms are more likely to export
  4. Trade liberalization leads to intra-industry reallocation across firms
  5. These reallocations are correlated with productivity and export status
- Melitz (2003) will develop a model featuring facts 1 and 2 that can explain facts 3, 4, and 5
  - This is the most influential trade paper in the last 20 years

Today's plan

- Monopolistic competition
  - Krugman (1979)
  - An important special case: CES utility
- Heterogenous firms: Melitz (2003)
  - Krugman (1980) meets Hopenhayn (1992)
  - Selection into exports and the impact of trade
- Monopolistic competition with heterogeneous firms and variable elasticity demands
  - Demand Manifold: Mrázová and Neary (2017)

Reading

- *F pp. 137-141 and 163-169
- *Krugman, P. (1979), “Increasing Returns Monopolistic Competition, and International Trade,” *Journal of International Economics*, 9, 469-479.
- *Melitz, M. (2003), “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity”, *Econometrica*, 71:6, 1695-1725.

- Krugman, P. (1980), “Scale economies,product differentiation,and the pattern of trade,” *American Economic Review*, 70, 950-959
- Melitz, M. J., and S. J. Redding (2015), “Heterogeneous Firms and Trade.” *Handbook of International Economics*, 4th ed, 4: 1-54. Elsevier, 4, 1-54.
- *Introductory level:* KOM chs. 7 and 8, and FT ch. 6
- Paul Krugman, Nobel Prize Lecture (2008): The Increasing Returns Revolution in Trade and Geography, available at: `http://www.nobelprize.org/nobel_prizes/`

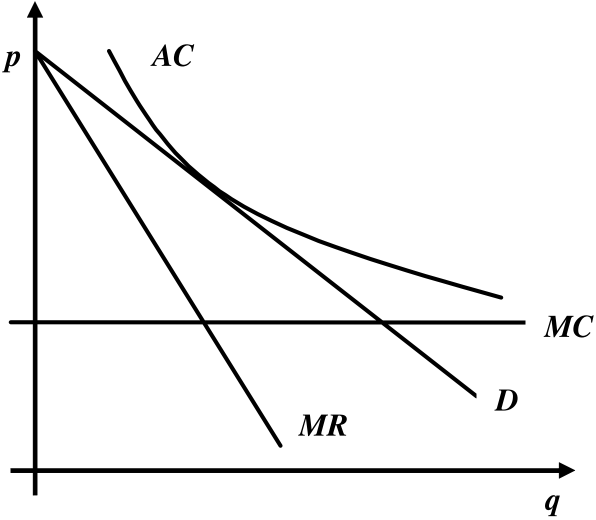
Outline of the Lecture

1. Introduction
2. **Monopolistic competition**
   - Monopolistic pricing: recap
   - Krugman (1979)
   - An important special case: CES utility
3. Monopolistic competition with heterogeneous firms: Melitz (2003)
4. Monopolistic competition with variable elasticity demands

Basic idea

- **Monopoly pricing:** Each firm faces a downward-sloping demand curve
  - Profit maximization $\Rightarrow MR = MC$
- **No strategic interaction:**
  - Each demand curve depends on the prices charged by other firms
  - But since the number of firms is large, each firm ignores its impact on the demand faced by other firms
- **Free entry:** Firms enter the industry until profits are driven to zero for all firms
  - Free entry $\Rightarrow p = AR = AC$

Graphical analysis



Endowments, preferences and technology

- **Endowments:** All agents are endowed with 1 unit of labor
- **Preferences:** All agents have the same utility function given by

$$U = \int_0^n u(c_i)di$$

  where
  - $u(0) = 0$, $u' > 0$, and $u'' < 0$ (love of variety)
  - Elasticity of demand: $\sigma(c) \equiv -\frac{u'}{cu''} > 0$ is such that $\sigma' \leq 0$ (why?)

- **IRS Technology:** Labor used in the production of each "variety" is

$$l_i = f + q_i/\varphi$$

  where $\varphi \equiv$ *common* productivity parameter

Equilibrium conditions

- **Consumer maximization:**

$$p_i = \lambda^{-1} u'(c_i)$$

- **Profit maximization ($MR = MC$):**

$$p_i = \left[\frac{\sigma(c_i)}{\sigma(c_i) - 1}\right] \cdot \left(\frac{w}{\varphi}\right)$$

- **Free entry ($P = AC$):**

$$\left(p_i - \frac{w}{\varphi}\right) q_i = wf$$

- **Good and labor market clearing:**

$$q_i = Lc_i$$

$$L = nf + \int_0^n \frac{q_i}{\varphi} di$$

Equilibrium conditions rearraged

- Symmetry $\Rightarrow p_i = p$, $q_i = q$, and $c_i = c$ for all $i \in [0, n]$
- c and p/w are simultaneously characterized by

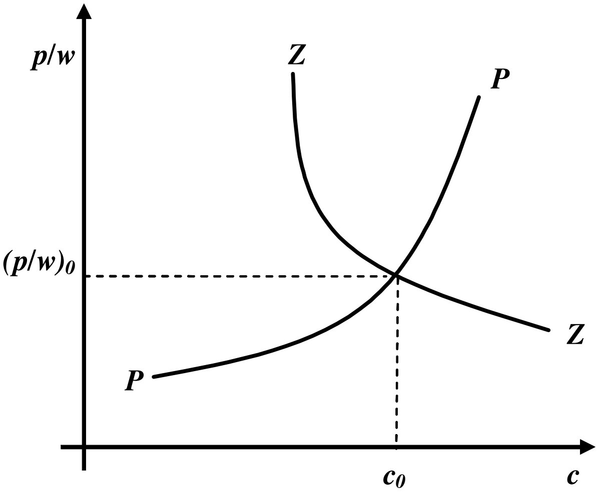
$$(PP): \quad \frac{p}{w} = \left[\frac{\sigma(c)}{\sigma(c)-1}\right]\frac{1}{\varphi}$$

$$(ZZ): \quad \frac{p}{w} = \frac{f}{q} + \frac{1}{\varphi} = \frac{f}{Lc} + \frac{1}{\varphi}$$

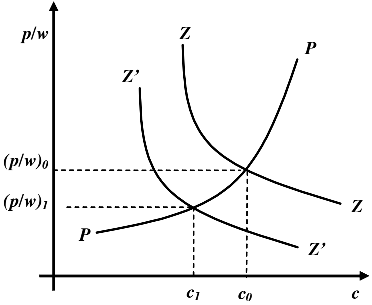
- n can then be computed using market clearing conditions

$$n = \frac{1}{f/L + c/\varphi}$$

Graphical analysis



Gains from trade revisited



- Suppose that two identical countries open up to trade
  - This is equivalent to a doubling of country size (which would have no effect in a neoclassical trade model)
- Because of IRS, opening up to trade now leads to:
  - **Increased product variety:** $c_1 < c_0 \Rightarrow \frac{1}{f/2L + c_1/\varphi} > \frac{1}{f/L + c_0/\varphi}$
  - **Pro-competitive/efficiency effects:** $(p/w)_1 < (p/w)_0 \Rightarrow q_1 > q_0$

Trade economists' most preferred demand system

- Constant Elasticity of Substitution (CES) utility corresponds to the case where:

$$U = \int_0^n (c_i)^{\frac{\sigma-1}{\sigma}} di$$

  where $\sigma > 1$ is the elasticity of substitution between pair of varieties
- This is the case considered in Krugman (1980)
- What is there to like about CES utility?
  - Homotheticity ($u(c) \equiv (c)^{\frac{\sigma-1}{\sigma}}$ is actually the *only* functional form such that U is homothetic)
  - Can be derived from discrete choice model with i.i.d extreme value shocks (see Feenstra Appendix B)
- Is it empirically reasonable?

Special properties of the equilibrium

- Because of monopoly pricing, CES $\Rightarrow$ constant markups:

$$\frac{p}{w} = \left[\frac{\sigma}{\sigma - 1}\right] \frac{1}{\varphi}$$

- Because of zero profit, constant markups $\Rightarrow$ constant output per firm:

$$\frac{p}{w} = \frac{f}{q} + \frac{1}{\varphi}$$

- Because of market clearing, constant output per firm $\Rightarrow$ constant number of varieties per country:

$$n = \frac{L}{f + q/\varphi}$$

- So gains from trade **only** come from access to Foreign varieties
  - IRS provide an intuitive reason why Foreign varieties are different
  - But consequences of trade would now be the same if we had maintained CRS with different countries producing different goods

Special properties of the equilibrium

- Decentralized equilibrium is efficient
- Decentralized equilibrium solves:

$$\max_{q_i, n} \int_0^n p_i(q_i) q_i di \quad \text{s.t.} \quad nf + \int_0^n \frac{q_i}{\varphi} di \leq L$$

- A central planner would solve:

$$\max_{q_i, n} \int_0^n (q_i)^{\frac{\sigma-1}{\sigma}} di \quad \text{s.t.} \quad nf + \int_0^n \frac{q_i}{\varphi} di \leq L$$

- Under CES, $p_i(q_i) q_i \propto (q_i)^{\frac{\sigma-1}{\sigma}} \Rightarrow$ two solutions coincide
  - This is unique to CES (in general, entry is distorted)
  - This implies that many properties of perfectly competitive models carry over to this environment

Outline of the Lecture

Introduction

- **Two building blocs:**
  1. Krugman (1980): CES, IRS technology, monopolistic competition
  2. Hopenhayn (1992): equilibrium model of entry and exit
- CES preferences allow a clever comparison with Krugman (1980): existence of a representative firm
- We study here a simplified (static) version of Melitz (2003) with Pareto distribution of productivities

Demand

- Like in Krugman (1980), representative agent has CES preferences:
$$U = \left(\int_{\omega \in \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}$$
where $\sigma > 1$ is the elasticity of substitution
- Consumption and expenditures for each variety are given by
$$q(\omega) = Q \left[\frac{p(\omega)}{P} \right]^{-\sigma} \equiv A p(\omega)^{-\sigma} \tag{1}$$
$$r(\omega) = R \left[\frac{p(\omega)}{P} \right]^{1-\sigma} \tag{2}$$
where $P \equiv \left[\int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$, $R \equiv \int_{\omega \in \Omega} r(\omega) d\omega$, and $Q \equiv R/P$

Production: assumptions

- Like in Krugman (1980), labor is the only factor of production
  - $L \equiv$ total endowment, $w = 1 \equiv$ wage
- Firms differ in their productivity φ
- Like in Krugman (1980), there are IRS in production

$$l(\varphi) = f + q/\varphi \tag{3}$$

Production: implications

- Like in Krugman (1980), monopolistic competition implies that prices are a constant mark-up over marginal cost

$$\frac{p(\varphi)}{w} = \left[\frac{\sigma}{\sigma - 1}\right] \frac{1}{\varphi} \tag{4}$$

- CES preferences with monopoly pricing, (2) and (4), imply

$$r(\varphi) = R\left[P\frac{\sigma - 1}{\sigma}\varphi\right]^{\sigma-1} \tag{5}$$

- The two assumptions, (3) and (4), further imply that profits are a constant fraction of revenue minus the fixed production cost

$$\pi(\varphi) \equiv r(\varphi) - l(\varphi) = \frac{r(\varphi)}{\sigma} - wf$$

where $r(\varphi) = p(\varphi)q\left(\varphi\right)$

Production: comments

- Higher productivity φ in the model implies higher *measured* productivity
$$\frac{r(\varphi)}{l(\varphi)} = w\frac{\sigma}{\sigma-1}\left[1-\frac{f}{l(\varphi)}\right]$$
- More productive firms produce more and earn higher revenues
$$\frac{q(\varphi_1)}{q(\varphi_2)} = \left(\frac{\varphi_1}{\varphi_2}\right)^{\sigma} \quad \text{amd} \quad \frac{r(\varphi_1)}{r(\varphi_2)} = \left(\frac{\varphi_1}{\varphi_2}\right)^{\sigma-1}$$
- φ can also be interpreted in terms of quality. This is isomorphic to a change in units of account, which would affect prices, but nothing else

Aggregation

- By definition, the CES price index is given by

$$P = \left[\int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}$$

- Since all firms with productivity φ charge the same price $p(\varphi)$, we can rearrange CES price index as

$$P = \left[\int_{0}^{+\infty} p(\varphi)^{1-\sigma} M \mu(\varphi) d\varphi \right]^{\frac{1}{1-\sigma}}$$

  where
  - $M \equiv$ mass of (surviving) firms in equilibrium
  - $\mu(\varphi) \equiv$ (conditional) pdf of firm-productivity levels in equilibrium

Aggregation

- Combining the previous expression with monopoly pricing (4), we get

$$P = M^{\frac{1}{1-\sigma}} w \left[\frac{\sigma}{\sigma - 1}\right] \frac{1}{\tilde{\varphi}} = M^{\frac{1}{1-\sigma}} p(\tilde{\varphi})$$

  where

$$\tilde{\varphi} \equiv \left[\int_0^{+\infty} \varphi^{\sigma-1} \mu(\varphi) d\varphi\right]^{\frac{1}{\sigma-1}}$$

- One can do the same for all aggregate variables

$$R = Mr(\tilde{\varphi}), \quad \Pi = M\pi(\tilde{\varphi}), \quad Q = M^{\frac{\sigma}{\sigma-1}} q(\tilde{\varphi})$$

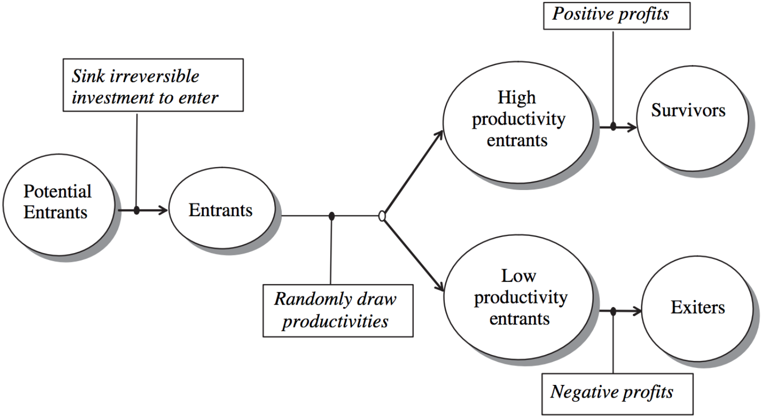
- **Comments:**
  - These are the same aggregate variables we would get in a Krugman (1980) model with a mass M of identical firms with productivity $\tilde{\varphi}$
  - But productivity $\tilde{\varphi}$ now is an endogenous variable which may respond to changes in trade cost, leading to aggregate productivity changes

Entry and exit

- In order to determine how $\mu(\varphi)$ and $\tilde{\varphi}$ get determined in equilibrium, one needs to specify the entry and exit of firms

- Timing is similar to Hopenhayn (1992):
  1. There is a large pool of identical potential entrants deciding whether to become active or not
  2. Firms deciding to become active pay a (sunk) fixed cost of entry $f_E > 0$ and get a productivity draw φ from a cdf G (with density $g(\varphi)$)
     - ★ To decide, they compute their expected profits $\mathbb{E}[\pi]$
  3. After observing their productivity draws, firms decide whether to remain active or not
     - ★ Firms are deciding whether to pay or not a fixed cost f in order to start producing
     - ★ To do this, they check whether $\pi(\varphi) \lesseqgtr 0$

Timing and entry



Source: Greenaway Kneller (2007)

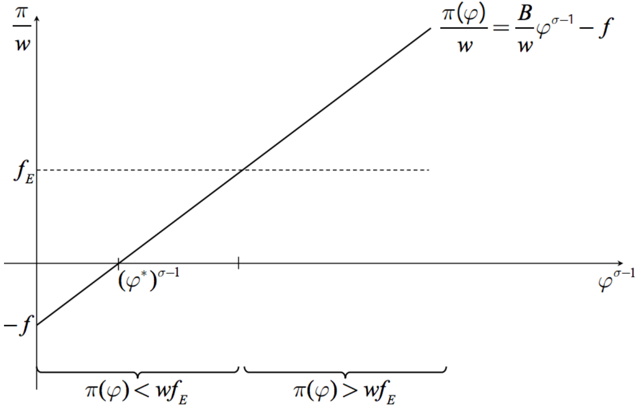
Closed economy

- Solve backwards
- A firm φ produces if it is productive enough i.e.

$$\pi(\varphi) \geq 0$$

- There is a cutoff firm φ^* such that $\pi(\varphi^*) = 0$
- Among firms who have paid the sunk cost, those with a productivity lower than φ^* choose not to produce (and therefore do not pay f)

Closed economy: sorting



Source: Melitz & Redding (2012). $B = \frac{(\sigma-1)^{\sigma-1}}{\sigma^\sigma} A$

Aggregate productivity

- Once we know φ^*, we can compute the pdf of firm-productivity levels

$$\mu(\varphi) = \begin{cases} \frac{g(\varphi)}{1-G(\varphi^*)} & \text{if} \quad \varphi \geq \varphi^* \\ 0 & \text{if} \quad \varphi < \varphi^* \end{cases}$$

- Accordingly, the measure of aggregate productivity is given by

$$\tilde{\varphi}(\varphi^*) = \left[\frac{1}{1-G(\varphi^*)} \int_{\varphi^*}^{+\infty} \varphi^{\sigma-1} g(\varphi) d\varphi \right]^{\frac{1}{\sigma-1}}$$

Free entry condition

- Let $\bar{\pi} \equiv \Pi / M$ denote average profits per period for surviving firms
- Free entry requires the total expected value of profits to be equal to the fixed cost of entry

$$\begin{aligned}\mathbb{E}[\pi] &= \int_0^\infty \pi(\varphi)\, g(\varphi) d\varphi \\ &= 0 \times G(\varphi^*) + \bar{\pi} \times [1 - G(\varphi^*)] = f_E w\end{aligned}$$

- **Free Entry Condition (FE):**

$$\bar{\pi} = \frac{f_E w}{1 - G(\varphi^*)} \tag{6}$$

- Holding constant the fixed costs of entry, if firms are less likely to survive, they need to be compensated by higher average profits

Zero cutoff profit condition

- Definition of φ^* can be rearranged to obtain a second relationship between φ^* and $\bar{\pi}$
- By definition of $\bar{\pi}$, we know that

$$\bar{\pi} = \Pi/M = \pi[\tilde{\varphi}(\varphi^*)] \Leftrightarrow \bar{\pi} = fw\left[\frac{r[\tilde{\varphi}(\varphi^*)]}{\sigma fw} - 1\right]$$

- By definition of φ^*, we know that

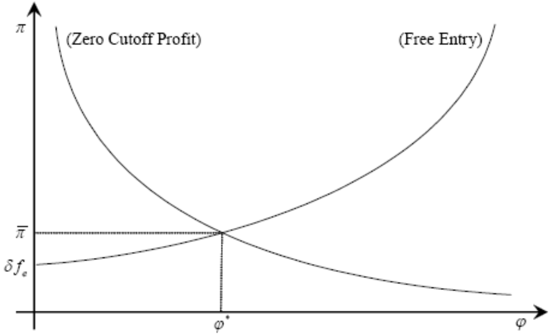
$$\pi(\varphi^*) = 0 \Leftrightarrow r(\varphi^*) = \sigma fw$$

- Two previous expressions imply **ZCP condition:**

$$\bar{\pi} = fw\left[\frac{r[\tilde{\varphi}(\varphi^*)]}{r(\varphi^*)} - 1\right] = fw\left[\left(\frac{\tilde{\varphi}(\varphi^*)}{\varphi^*}\right)^{\sigma-1} - 1\right] \tag{7}$$

Closed economy equilibrium

- FE and ZCP, (6) and (7), determine a unique $(\bar{\pi}, \varphi^*)$, and therefore $\tilde{\varphi}$, independently of country size L
  - the only variable left to compute is M, which can be done using free entry and labor market clearing as in Krugman (1980)



Source: Melitz (2003)

Closed-form using a Pareto

- Why Pareto?
  - Pareto distribution of productivities + CES preferences = Pareto size distribution of firms
  - Found (more or less) in the data (Axtell, 2011) but left tail looks more log-normal...
  - Pareto has good properties: a truncated Pareto is Pareto
- Two-parameter distribution $(\varphi_{\min}, k)$: $G(\varphi) = 1 - \left(\frac{\varphi_{\min}}{\varphi}\right)^k$
- Then the cutoff is simply

$$(\varphi^*)^k = \frac{\sigma - 1}{k - (\sigma - 1)} \varphi_{\min}^k \frac{f}{f_E}$$

Remark

$$\varphi^* = \varphi_{\min} \left(\frac{\sigma - 1}{k - (\sigma - 1)} \frac{f}{f_E} \right)^{\frac{1}{k}}$$

- φ^* does not depend on market size L
- An increase in market size does not change the cutoff
  - Will be restored when moving away from CES preferences.
- Growth in country size and costless trade will therefore have the same impact as in Krugman (1980):
  - welfare $\uparrow$ because of $\uparrow$ in total number of varieties in each country

Open-economy model

- In the absence of trade costs, we have seen trade integration does not lead to any intra-industry reallocation
- In order to move away from such (counterfactual) predictions, Melitz (2003) introduces two types of trade costs:
    1. **Iceberg trade costs:** in order to sell 1 unit abroad, firms need to ship $\tau \geq 1$ units
    2. **Fixed exporting costs:** in order to export abroad, firms must incur an additional fixed cost f_X (information, distribution, or regulation costs) after learning their productivity φ
- In addition, Melitz (2003) assumes that $c = 1, \ldots, n$ countries are symmetric so that $w_c = 1$ in all countries

Production

- Monopoly pricing now implies

$$p_D(\varphi) = \frac{1}{\rho\varphi} \quad \text{and} \quad p_X(\varphi) = \frac{\tau}{\rho\varphi}$$

where $\rho = (\sigma - 1)/\sigma$

- Revenues in the domestic and export markets are

$$r_D(\varphi) = R_D[P_D\rho\varphi]^{\sigma-1} \quad \text{and} \quad r_X(\varphi) = \tau^{1-\sigma}R_X[P_X\rho\varphi]^{\sigma-1}$$

- Note that by symmetry, we must have $P_D = P_X = P$ and $R_D = R_X = R$
- Profits in the domestic and export markets are

$$\pi_D(\varphi) = \frac{r_d(\varphi)}{\sigma} - fw \quad \text{and} \quad \pi_X(\varphi) = \frac{r_X(\varphi)}{\sigma} - f_X w$$

Productivity cutoffs

- Like in the closed economy, we let φ^* be the cutoff to enter the domestic market
- In addition, let φ_X^* be the export cutoff
- In order to have both exporters and non-exporters in equilibrium, $\varphi_X^* > \varphi^*$, we assume that $\tau^{\sigma-1} f_X > f$

Selection into exports

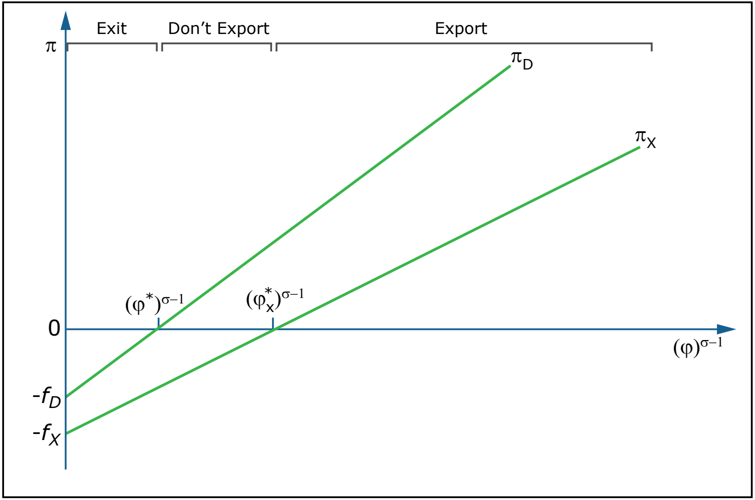
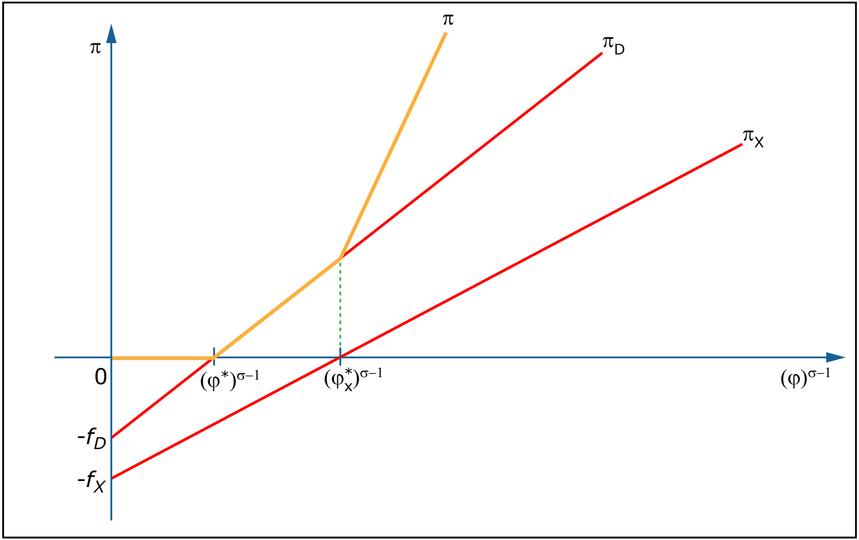


Image by MIT OpenCourseWare.

Profits and productivity in the open economy



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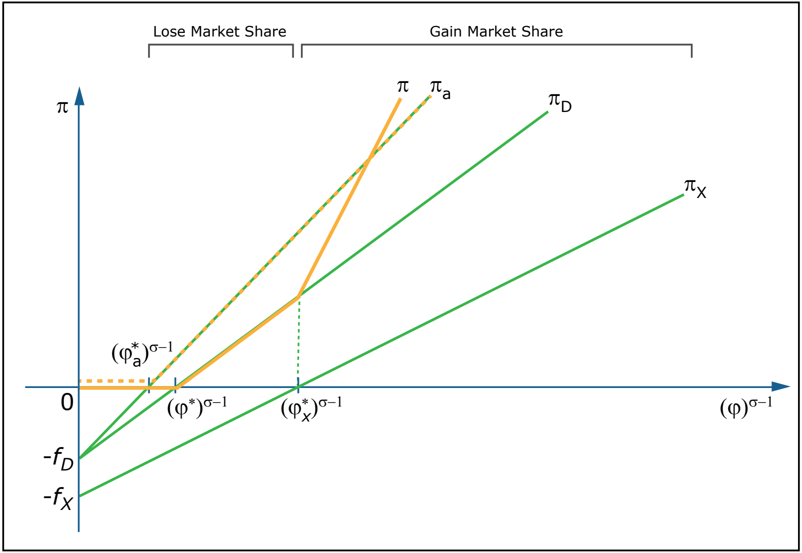
The impact of trade



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The impact of trade

- In line with empirical evidence, exposure to trade forces the least productive firms to exit: $\varphi^* > \varphi_a^*$
- **Intuition:**
  - For exporters: Profits $\uparrow$ due to export opportunities, but $\downarrow$ due to the entry of foreign firms in the domestic market ($P \downarrow$)
  - For non-exporters: only the negative second effect is active

Other comparative static exercises

- Starting from autarky and moving to trade is theoretically standard, but not empirically appealing
- Melitz (2003) also considers:
  - Increase in the number of trading partners n
  - Decrease in iceberg trade costs τ
  - Decrease in fixed exporting costs f_X
- Same qualitative insights in all scenarios:
  - Exit of least efficient firms
  - Reallocation of market shares from less from more productive firms
  - Welfare gains

Outline of the Lecture

Question

- Workhorse model in int. economics: Melitz (2003)

$$\begin{array}{c} \text{Monopolistic} \\ \text{competition (MC)} \\ + \\ \text{CES demand} \end{array} \Rrightarrow \begin{cases} \text{Constant markups} \\ \\ 100\% \text{ passthrough} \end{cases}$$

- Proliferation of alternatives to CES with variable elasticity:
  - Quadratic preferences: Melitz-Ottaviano (2008)
  - Stone-Geary LES: Simonovska (2010)
  - Translog: Feenstra-Weinstein (2010)
  - CARA: Behrens-Murata (2007)
  - Bulow-Pfleiderer: Atkin-Donaldson (2012)

- How do assumptions about demand affect comparative statics questions?

  $\rightarrow$ The **Demand Manifold**: representation of perceived demand in elasticity-curvature space

Introducing the Demand manifold: A Core Model

- Monopoly firm facing an inverse demand function $p(x), p' < 0$
- Consistent with monopolistic competition
  - Firm's-Eye View of Demand
  - Firm takes the demand function as given: "perceived"
  - In general/industry equilibrium, the demand function has extra arguments ... see later
- Fixed marginal cost c

Profit maximisation

- First-order condition:

$$p(x) + xp'(x) = c$$

- Second-order condition:

$$2p'(x) + xp''(x) < 0$$

which can be re-written as

$$\frac{p(x)}{c} = \frac{\varepsilon(x)}{\varepsilon(x) - 1}$$

$$\rho(x) < 2$$

where

- $\varepsilon(x) \equiv -\frac{p(x)}{xp'(x)}$ is the demand elasticity/slope
- $\rho(x) \equiv -\frac{xp''(x)}{p'(x)}$ is the demand convexity/curvature

Two key demand parameters

1. Elasticity ε:

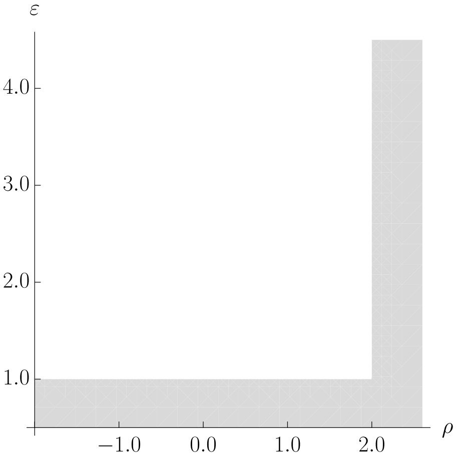
$$p(x) + xp'(x) = c \geq 0$$

$$\Rightarrow \boxed{\varepsilon(x) \geq 1}$$

2. Convexity ρ:

$$2p'(x) + xp''(x) < 0$$

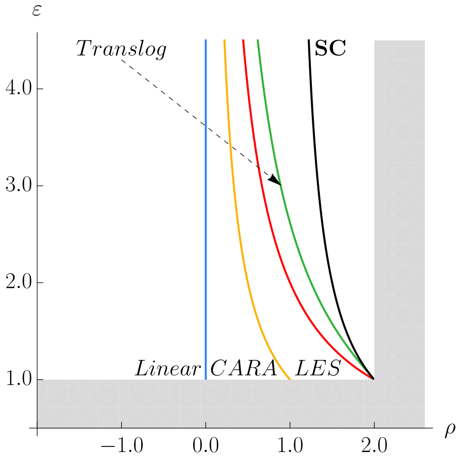
$$\Rightarrow \boxed{\rho(x) < 2}$$



The Demand Manifold

$=$ visualisation of the demand function $p(x)$ in the (ε, ρ) space

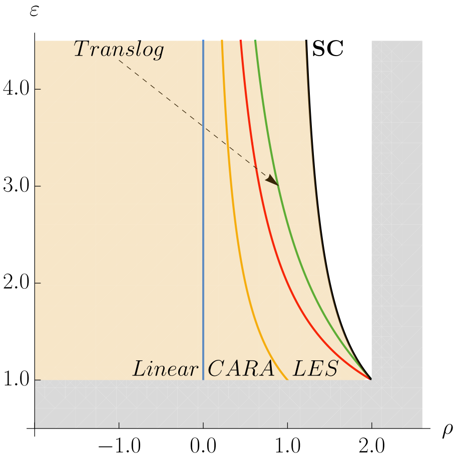
- In general, both ε and ρ vary with sales $\rightarrow$ a curve
- Exception: CES/iso-elastic case: $p(x) = \beta x^{-1/\sigma}$
  $\Rightarrow \quad \varepsilon = \sigma, \;\; \rho = \frac{\sigma+1}{\sigma}$
  $\Rightarrow$ Point manifold: $\boxed{\rho = \dfrac{\varepsilon + 1}{\varepsilon}}$



Invariance

Subconvexity

- $p(x)$ is subconvex at x^0 IFF:
  - $p(x)$ is less convex than a CES demand function with the same elasticity: $\rho < \frac{\varepsilon+1}{\varepsilon}$
  - $\log p(x)$ is concave in $\log x$
  - ε is decreasing in sales: $\varepsilon_x = \frac{\varepsilon}{x}\left[\rho - \frac{\varepsilon+1}{\varepsilon}\right] < 0$
- Subconvexity = "Marshall's 2^{nd} Law of Demand"
  - confirmed empirically
  - theoretically plausible (Dixit-Stiglitz, Krugman, etc.)



Manifold: Definition and Existence

Given a demand function $p = p_0(x)$ defined over a range $X(p_0) \subseteq R_{\geq 0}$:

$$\Omega(p_0) \equiv \left[(\varepsilon, \rho) : \varepsilon = -\frac{p_0(x)}{xp_0'(x)},\ \rho = -\frac{xp_0''(x)}{p_0'(x)}, \forall x \in X(p_0) \right]$$

Proposition

For every continuous, three-times differentiable, strictly-decreasing demand function, $p_0(x)$, other than the CES, the set $\Omega(p_0)$ corresponds to a smooth curve in $\{\varepsilon, \rho\}$ space.

- Exception: CES manifold is a point

Manifold Invariance

- When is the demand manifold invariant to shocks? Graph
  - Linear: $p(x) = a - bx$
  - CARA: $x(p) = a + b \log p$
  - LES: $x(p) = a + bp^{-1}$
  - Translog: $x(p) = (a + b \log p)/p$

  $\Big\}$ Manifold is invariant to a and b

  - CES: $p(x) = \beta x^{-1/\sigma}$ $\rightarrow$ Manifold is invariant to β, not to σ

Proposition

Assume that ρ_x is non-zero. Then, the demand manifold is invariant with respect to a vector parameter ϕ if and only if both ε and ρ depend on x and ϕ through a common sub-function of either (a) x and ϕ; or (b) p and ϕ; i.e.:

$$\varepsilon(x, \phi) = \tilde{\varepsilon}[F(x, \phi)] \quad \textit{and} \quad \rho(x, \phi) = \tilde{\rho}[F(x, \phi)]; \quad \textit{or} \tag{8}$$

$$\varepsilon(p, \phi) = \tilde{\varepsilon}[G(p, \phi)] \quad \textit{and} \quad \rho(p, \phi) = \tilde{\rho}[G(p, \phi)] \tag{9}$$

Competition Effects of a Globalization Shock: Setup

- Krugman (1979) $\rightarrow$ Melitz (2003) and beyond
- L identical consumers in a given country, k identical countries
- Globalization: increase in k
- Firms sell in many markets, they sell x to an individual consumer, total output: $y = kLx$
- Additive separability $\Rightarrow$ demand function for a typical good $u'(x) = \lambda p$
- Ex-post profits of a typical firm:

$$\pi(\underset{-}{c}, \underset{-}{\lambda}, \underset{+}{k}) \equiv \max_{y} \Big(p(y, \lambda, k) - c\Big) y$$

where $p(y, \lambda, k) = \lambda^{-1} u'(y/kL)$

Free-entry Condition

- Expected value of firm profits $\bar{v}(\lambda, k)$ = sunk entry cost f_e:

$$\bar{v}(\underset{-}{\lambda}, \underset{+}{k}) \equiv \int_{\underline{c}}^{\bar{c}} v(c, \lambda, k) g(c) \, \mathrm{d}c = f_e$$

with

$$v(c, \lambda, k) \equiv \max\left(0, \pi(c, \lambda, k) - f\right)$$

where $g(c)$ is the distribution of firm marginal costs

Effects of a Globalization on Profits

- Effects of globalization on every firm's profits:

$$\frac{d\log\pi(c,\lambda,k)}{d\log k}=\underbrace{\frac{\partial\log\pi(c,\lambda,k)}{\partial\log k}}_{(M)}+\underbrace{\frac{\partial\log\pi(c,\lambda,k)}{\partial\log\lambda}\frac{d\log\lambda}{d\log k}}_{(C)}$$

where the change in the level of competition is determined in turn by:

$$\frac{d\log\lambda}{d\log k}=-\frac{\partial\log\bar{v}(\lambda,k)}{\partial\log k}\Bigg/\frac{\partial\log\bar{v}(\lambda,k)}{\partial\log\lambda}$$

Globalization as a Two-Edged Sword

Effects of globalization on every firm's profits:

1. Direct effect: Market Expansion
   - Raises its profits
2. Indirect effect: Competition
   - Raises *all* firms' profits $\Rightarrow$ Encourages entry
     $\Rightarrow$ Increases competition
     $\Rightarrow$ Reduces each firm's profits

- Net effect ambiguous in general...

Globalization as a Two-Edged Sword

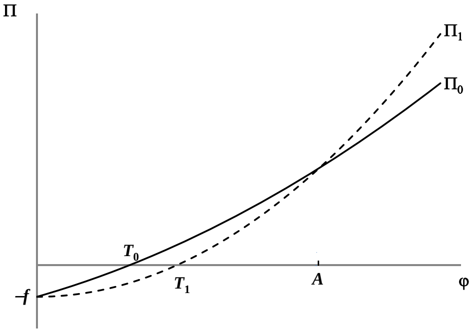
- With additive separability:

$$\frac{d\log\pi(c,\lambda,k)}{d\log k} = \underbrace{1}_{(M)} - \underbrace{\frac{\varepsilon(c,\lambda,k)}{\bar{\varepsilon}(\lambda,k)}}_{(C)}$$

where $\bar{\varepsilon}(\lambda,k) \equiv \int_{\underline{c}}^{\overline{c}} \frac{v(c,\lambda,k)}{\bar{v}(\lambda,k)}\varepsilon(c,\lambda,k)g(c)\,\mathrm{d}c$ is the firm-value-weighted average elasticity of demand across all firms

$\Rightarrow$ Globalization raises profits of larger firms and reduces those of smaller firms IFF demands are subconvex. ("Mathew Effect")

The Matthew Effect of Globalization



With subconvex demand:

- Large firms expand, small firms contract, some exit
- On average, exporters become more productive