IO for Export(s)

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IO for Export(s)?

1. IO for *Exports*: Structure of Export Markets
    - Which firms export?
    - Does trade foster competition?
    - etc., etc.
2. IO for *Export*: Which IO Models are Used in Trade?
    - Monopolistic competition *not* oligopoly
    - Especially CES special case [Dixit-Stiglitz (1977), Krugman (1980, etc.]
    - Extended to firm heterogeneity [Melitz (2003)]
    - IO for export only!

Monopolistic Competition in International Trade

- Monopolistic competition the dominant paradigm in intl. trade
- Not the only approach:
  - "Strategic" trade policy
  - Oligopoly in General Equilibrium: "GOLE"
    - Neary (2003, 2017), Atkeson-Burstein (2008)
    - Applications to: cross-border mergers; multi-product exporters
  - Superstar Firms in Oligopoly
    - Oligopolistic superstars, with a monopolistically competitive fringe
    - Neary (2010), Shimomura-Thisse (2012), Parenti (2017), Cabral (2018)
- But there are good reasons why it has remained dominant:
  - Partial versus general equilibrium
  - Entry
  - Data

This Paper

- Overview of recent theoretical work in trade, from an IO perspective
- Recurring theme:
  - CES is highly restrictive
  - Natural alternatives for many questions:
    - Constant-Response Demand Functions

Background

MRÁZOVÁ, M., AND J. P. NEARY (2017): "Not so Demanding: Demand Structure and Firm Behavior," *American Economic Review*, 107(12), 3835–3874.

——— (2019): "Selection Effects with Heterogeneous Firms," forthcoming in *Journal of the European Economic Association*.

MRÁZOVÁ, M., J. P. NEARY, AND M. PARENTI (2015): "Sales and Markup Dispersion: Theory and Empirics," Discussion Paper No. 774, Department of Economics, University of Oxford.

Topics

1. Pass-Through:
   - Bulow-Pfleiderer (1983), Weyl-Fabinger (2013)
2. Selection effects:
   - Bertoletti-Epifani (2014), Mrázová-Neary (2019), Bache-Laugesen (2013)
3. Competition effects:
   - Zhelebodko et al. (2013), Bertoletti-Epifani (2014)
   - Alternatives to CES:
     - Quadratic preferences: Melitz-Ottaviano (2008)
     - Stone-Geary LES: Simonovska (2015)
     - Translog: Feenstra-Weinstein (2017)
     - Negative exponential/CARA: Behrens-Murata (2007)
     - QMOR: Feenstra (2018)
4. Matching the size distribution of firm sales:
   - Pareto: Helpman-Melitz-Yeaple (2004), Chaney (2006)
   - Mixture of thin- and fat-tailed Pareto: Edmonds et al. (2012)
   - Log-normal: Head-Mayer-Thoenig (2014), Bee-Schiavo (2014)
5. Market versus social optimum:
   - Feenstra-Kee (2008), Dhingra-Morrow (2019), Mrázová-Neary-Parenti (wip)

Outline

Outline

A Core Model

- Monopoly firm facing an inverse demand function $p(x)$
  - Consistent with monopolistic competition
  - 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 maximization:

$$p + xp' = c \quad \text{and} \quad 2p' + xp'' < 0$$

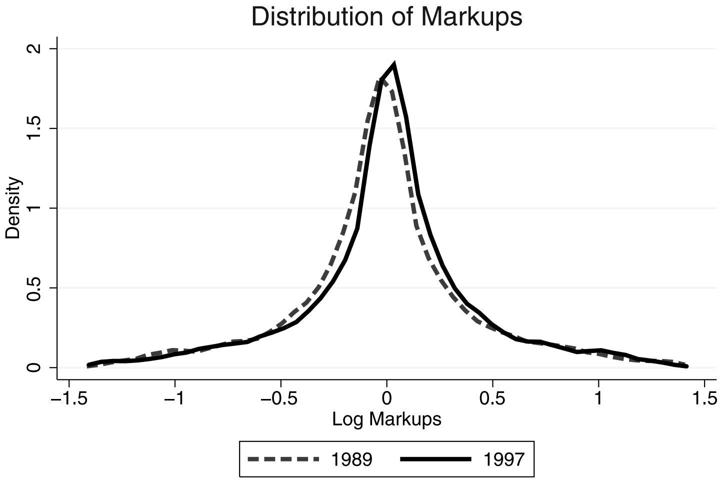
  - Or, using demand elasticity ($\varepsilon \equiv -\frac{p}{xp'}$) and convexity ($\rho \equiv -\frac{xp''}{p'}$):

$$\frac{p}{c} = \frac{\varepsilon}{\varepsilon - 1} \quad \text{and} \quad \rho < 2$$

  - CES special case:

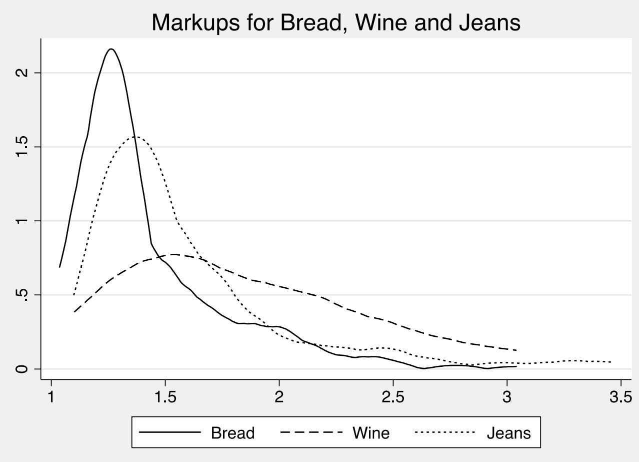
$$\frac{p}{c} = \frac{\sigma}{\sigma - 1}$$

Empirical Evidence on MarkUps



From: de Loecker, Goldberg, Khandelwal and Pavcnik (2016)

Empirical Evidence on MarkUps II



From: Lamorgese, Linarello and Warzynski (2014)

Theory

Outline

Pass-Through in Industrial Organization

- Simple and Important: How large is $\frac{dp}{dc}$?
- Easy to calculate from the first-order condition:

$$p + xp' = c \quad \Rightarrow \quad \boxed{\frac{dp}{dc} = \frac{1}{2-\rho}}$$

- So, threshold for full (dollar-for-dollar) pass-through or more:

▸ By contrast ...

$$\frac{dp}{dc} - 1 = \frac{\rho - 1}{2 - \rho} \geq 0$$

- Demand functions implying constant pass-through: Bulow-Pfleiderer Family

$$\boxed{p(x) = \alpha + \beta x^{\frac{1-a}{a}}}$$

  - Constant pass-through: $\frac{dp}{dc} = a$
  - Special cases:
    - $a = \frac{1}{2}$, $\rho = 0$: linear demand
    - $a \to 1$, $\rho = 1$: log-linear demand: $\log x(p) = \gamma + \delta p$
    - $a > 1$, $\rho > 1$: Log-convex demand

▸ By contrast ...

Pass-Through in International Economics

- A different question! Proportional not absolute pass-through
  - Compare (e.g.): Weyl-Fabinger (2013) versus Gopinath-Itskhoki (2010)
- How large is $\frac{d \log p}{d \log c}$?
- Again, from the first-order condition:

$$\boxed{\frac{d \log p}{d \log c} = \frac{\varepsilon - 1}{\varepsilon} \frac{1}{2 - \rho}}$$

- So, threshold for full (100%) or more pass-through:

$$\frac{d \log p}{d \log c} - 1 = \frac{\varepsilon\rho - \varepsilon - 1}{2 - \rho} \geq 0$$

Recall absolute pass-through

Proportional Pass-Through and Demand

- Exactly 100% pass-through (constant markups): CES demand

$$p(x) = -\beta x^{-1/\sigma} \quad \Rightarrow \quad \varepsilon = \sigma,\ \rho = \frac{\sigma+1}{\sigma} \quad \Rightarrow \quad \frac{d\log p}{d\log c} = 1$$

- Non-CES demand:
  - More than 100% pass-through: "Superconvex" demand: $\rho > \frac{\varepsilon+1}{\varepsilon}$
  - Less than 100% pass-through: "Subconvex" demand: $\rho < \frac{\varepsilon+1}{\varepsilon}$
- Demand functions implying constant proportional pass-through?
- The CPPT Family [Mrázová-Neary (2017)]

$$\boxed{p(x) = \frac{\beta}{x}\left(x^{\frac{k-1}{k}} + \gamma\right)^{\frac{k}{k-1}}}$$

  - Constant proportional pass-through: $\frac{d\log p}{d\log c} = k$
  - Very different from Bulow-Pfleiderer

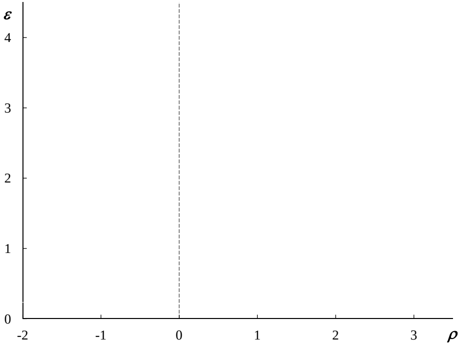
Recall ...

Digression: How to Compare Demand Functions?

- Inverse demand function:

$$p = p(x) \qquad p' < 0$$

- Two key demand parameters:
  1. Slope/Elasticity:
     $\varepsilon(x) \equiv -\frac{p(x)}{xp'(x)} > 0$
  2. Curvature/Convexity:
     $\rho(x) \equiv -\frac{xp''(x)}{p'(x)}$



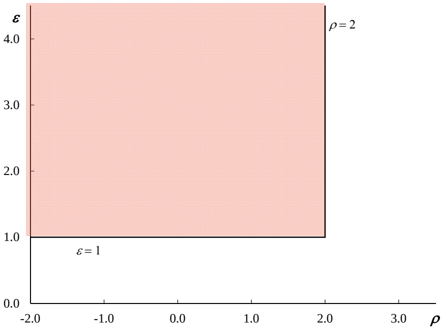
The Admissible Region

- First-order condition:

$$p + xp' = c \geq 0 \quad \Rightarrow \quad \varepsilon \geq 1$$

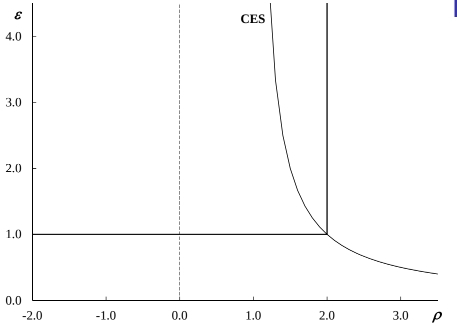
- Second-order condition:

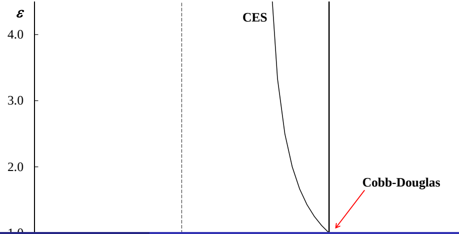
$$2p' + xp'' < 0 \quad \Rightarrow \quad \rho < 2$$



CES Demands

- In general, both ε and ρ vary with sales
- Exception: CES/iso-elastic case:
  - $p = \beta x^{-1/\sigma}$
  - $\Rightarrow \quad \varepsilon = \sigma, \;\; \rho = \frac{\sigma+1}{\sigma} > 1$
  - $\Rightarrow \quad \varepsilon = \frac{1}{\rho - 1}$

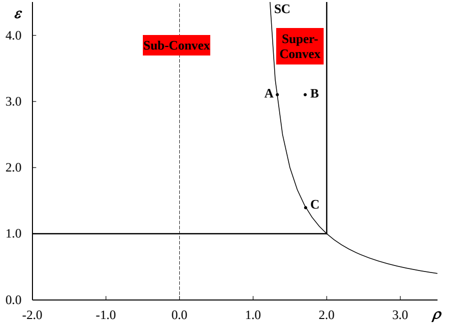


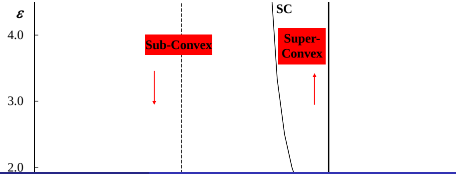


Sub- and Superconvexity

$p(x)$ is subconvex at x^0 IFF:

- $\log p(x)$ is concave in $\log x$
- $p(x)$ is less convex than a CES demand function with the same elasticity: $\rho < \frac{\varepsilon+1}{\varepsilon}$
- ε is decreasing in sales:
  - $\varepsilon_x = \frac{\varepsilon}{x}\left[\rho - \frac{\varepsilon+1}{\varepsilon}\right]$

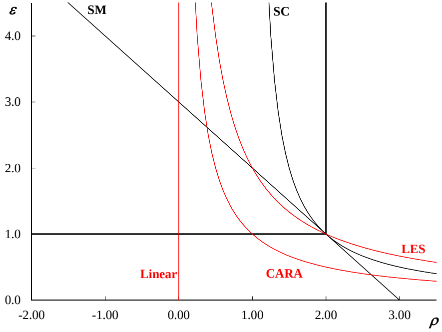




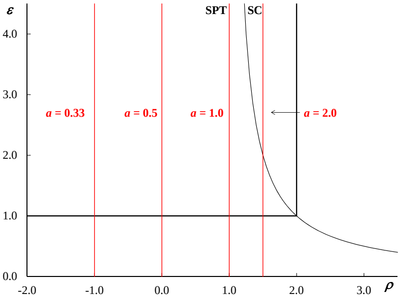
From Demand Functions to Demand Manifolds

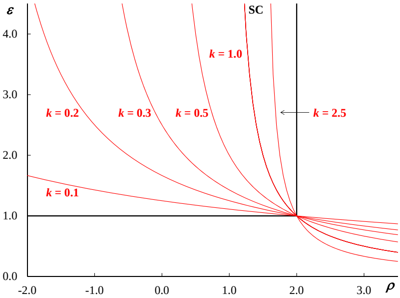
- Represent demand functions in $\{\varepsilon, \rho\}$ space by their *Demand Manifold*
  - *Definition*: A curve in (ε, ρ) space corresponding to the demand function $p(x)$
  - *Existence*: A smooth manifold corresponds to every demand function
    - Except for CES: Manifold is a point
  - *Invariance*: $\varepsilon(x, \phi)$ and $\rho(x, \phi) \quad \Rightarrow \quad \rho(\varepsilon)$?
    - Necessary and sufficient condition in Mrázová-Neary (2017)

Demand Manifolds for Some Common Demand Functions



Back to Pass-Through





- Constant absolute pass-through

$$p(x) = \alpha + \beta x^{\frac{1-a}{a}}$$

$$\Rightarrow \quad \rho = 2 - \frac{1}{a}$$

- Constant proportional pass-through

$$p(x) = \frac{\beta}{x}\left(x^{\frac{k-1}{k}} + \gamma\right)^{\frac{k}{k-1}}$$

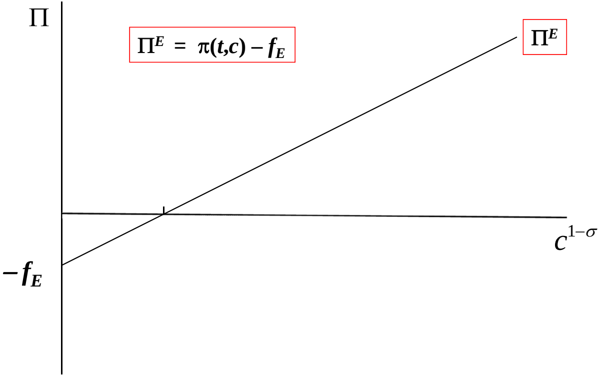
$$\Rightarrow \quad \bar{\rho}(\varepsilon) = 2 - \frac{1}{k}\,\frac{\varepsilon - 1}{\varepsilon}$$

Constant-Response Demand Functions

	Response	Demand Function	Manifold
Bulow-Pfleiderer	$\frac{dp}{dc} = \kappa$	$p(x) = \alpha + \beta x^{\frac{1-\kappa}{\kappa}}$	$\rho = 2 - \frac{1}{\kappa}$
CPPT	$\frac{d \log p}{d \log c} = \kappa$	$p(x) = \frac{\beta}{x}\left(x^{\frac{\kappa-1}{\kappa}} + \gamma\right)^{\frac{\kappa}{\kappa-1}}$	$\bar{\rho}(\varepsilon) = 2 - \frac{1}{\kappa}\frac{\varepsilon-1}{\varepsilon}$

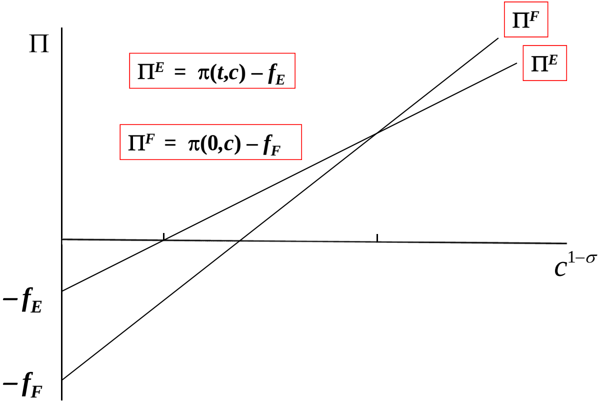
Outline

Which Firms Export?



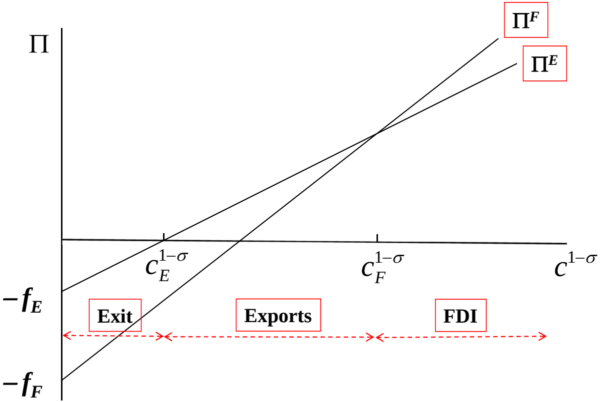
- More productive firms select into exporting
- Very robust result: Not sensitive to CES
  - Requires only that ex post profits π are decreasing in c
- Counter-examples can be explained in other ways: e.g., Lu (2011)

Exports versus FDI

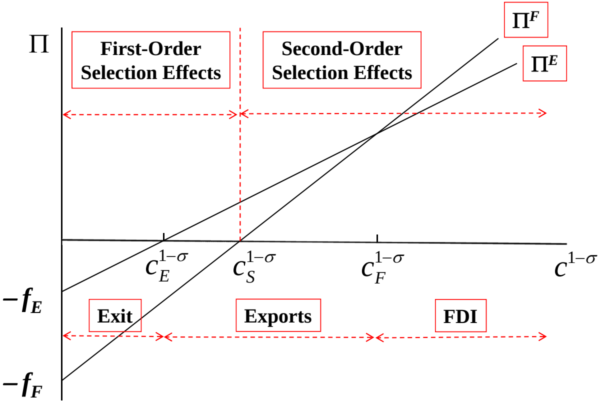


With CES demand: Helpman-Melitz-Yeaple (2004)

Which Firms Export and Which Engage in FDI?

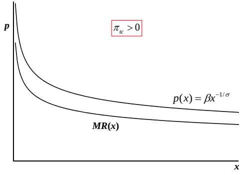


First- and Second-Order Selection Effects

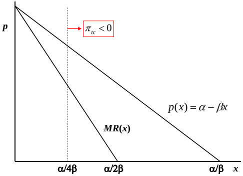


- Second-order selection effects less robust
  - Only guaranteed if Π^F is steeper than Π^E $\Leftrightarrow$ $\pi_c(c,0) < \pi_c(c,\tau)$
  - i.e. $\pi_c(c,\tau)$ *supermodular* in $\{c,\tau\}$ $\Leftarrow$ $\pi_{c\tau} > 0$
  - $\Leftrightarrow$ Elasticity of output with respect to marginal cost (MCEO) > 1

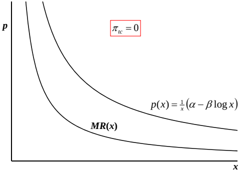
Second-Order Selection Effects and Demand



(a) CES



(b) Linear



(c) CEMR $= 1$

- Selection into FDI by large firms requires MCEO > 1
  - CES: MCEO > 1: 10% fall in $c \Rightarrow > 10\%$ rise in output
    - So more efficient firms have higher profits when they engage in FDI
  - Linear demands: MCEO < 1 for larger firms: Reverse selection effects
  - "CEMR" demands: MCEO $= 1 \Rightarrow$ No selection effects

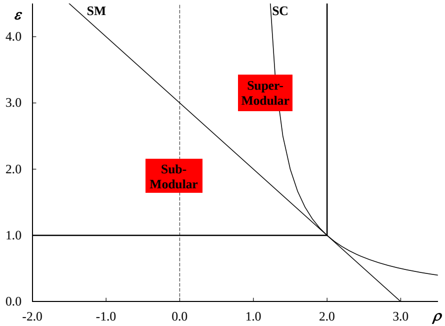
▸ General Condition ▸ Illustration

Constant-Response Demand Functions

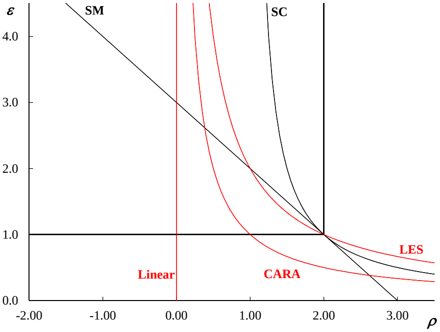
	Response	Demand Function	Manifold
Bulow-Pfleiderer	$\frac{dp}{dc} = \kappa$	$p(x) = \alpha + \beta x^{\frac{1-\kappa}{\kappa}}$	$\rho = 2 - \frac{1}{\kappa}$
CPPT	$\frac{d \log p}{d \log c} = \kappa$	$p(x) = \frac{\beta}{x} \left(x^{\frac{\kappa-1}{\kappa}} + \gamma \right)^{\frac{\kappa}{\kappa-1}}$	$\bar{\rho}(\varepsilon) = 2 - \frac{1}{\kappa} \frac{\varepsilon-1}{\varepsilon}$
CEMR/Inverse PIGL	$\frac{d \log x}{d \log c} = -\kappa$	$p(x) = \frac{1}{x}(\alpha + \beta x^{\frac{\kappa-1}{\kappa}})$	$\bar{\rho}(\varepsilon) = 2 - \frac{1}{\kappa}(\varepsilon - 1)$

Second-Order Selection Effects: Supermodularity

- Lower-c firms choose FDI IF:
  - $\pi(t, c)$ supermodular in $\{t, c\}$
  - $\Leftrightarrow$ MCEO > 1
  - $\Leftrightarrow \ \varepsilon + \rho > 3$
- Clearly: SupC $\Rightarrow$ SupM

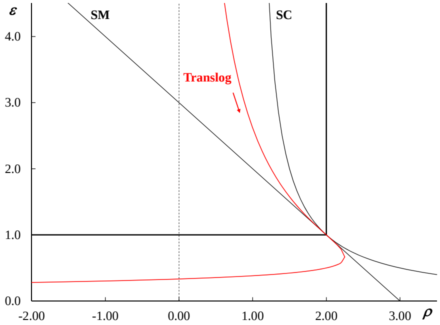


Can We Have Subconvexity and Supermodularity?



- Most common demand functions are:
  - Subconvex $\Rightarrow$ Competition effects
  - Submodular for large firms $\Rightarrow$ Reverse selection effects

Can We Have Subconvexity and Supermodularity?



- Most common demand functions are:
  - Subconvex $\Rightarrow$ Competition effects
  - Submodular for large firms $\Rightarrow$ Reverse selection effects
- Exception: AIDS/Translog

Outline

Two Kinds of Competition Effects

- Competition Effects of Globalization:
  1. Squeeze on markups
  2. "Matthew Effect" on Profit Profile
     - "To those who have, more shall be given"
- Both occur IFF demand is *subconvex*:
  1. Squeeze on markups:
     - $m \equiv \frac{p}{c} = \frac{\varepsilon(x)}{\varepsilon(x)-1}$
     - m increasing in x IFF ε is decreasing in x
     - $\Rightarrow \begin{cases} \text{Cross-Section: Larger firms have higher markups} \\ \text{Time Series: Globalization squeezes incumbents' markups} \end{cases}$
  2. "Matthew Effect" on Profit Profile

Globalization as a Two-Edged Sword

Effects of globalization on every firm's profits (including the threshold firm's):

1. Direct effect: Market Expansion
   - Raises its profits $\Rightarrow$ Threshold productivity tends to $\uparrow$
2. Indirect effect: Competition
   - Raises *all* firms' profits $\Rightarrow$ Encourages entry
     $\Rightarrow$ Increases competition
     $\Rightarrow$ Reduces profits of marginal firm
     $\Rightarrow$ Threshold productivity tends to $\downarrow$

- Net effect ambiguous in general:

$$\hat{\pi}(c) = \Bigg(\underbrace{1}_{(1)} - \underbrace{\frac{\varepsilon(c)}{\bar{\varepsilon}}}_{(2)} \Bigg) \hat{k}$$

  - $\varepsilon(c)$: Elasticity faced by the firm
  - $\bar{\varepsilon} \equiv \int_0^c \frac{\pi(c)}{\Pi} \varepsilon(c) g(c) \, \mathrm{d}c$: Elasticity faced by the average firm

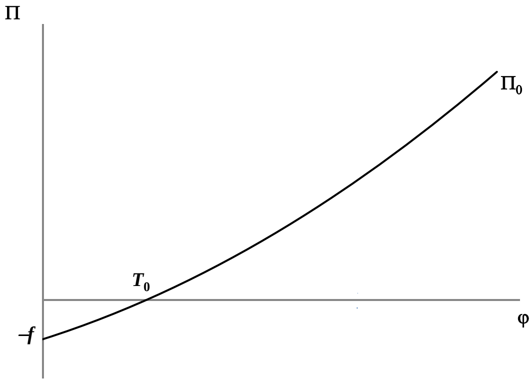
Globalization as a Two-Edged Sword

$$\hat{\pi}(c) = \left(1 - \frac{\varepsilon(c)}{\bar{\varepsilon}}\right)\hat{k}$$

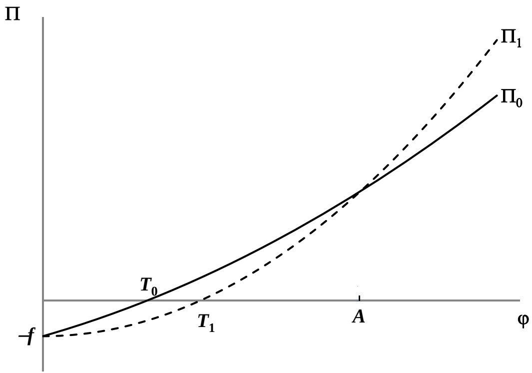
- CES: Direct and indirect effects exactly cancel!
- The Matthew Effect with Subconvexity:
  - Direct, market expansion, effect dominates for larger firms: $\varepsilon(c) < \bar{\varepsilon}$
  - Indirect, competition, effect dominates for smaller firms: $\varepsilon(c) > \bar{\varepsilon}$
  - The threshold firm ceases to be profitable and drops out
  - The average productivity of exporters rises

▸ Details

The Matthew Effect of Globalization



The Matthew Effect of Globalization



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

Outline

The Canonical Result

Helpman-Melitz-Yeaple (2004), Chaney (2006): "self-reflection"

Pareto Productivities + **CES Demands** → **Pareto Sales**

Beyond the Canonical Result

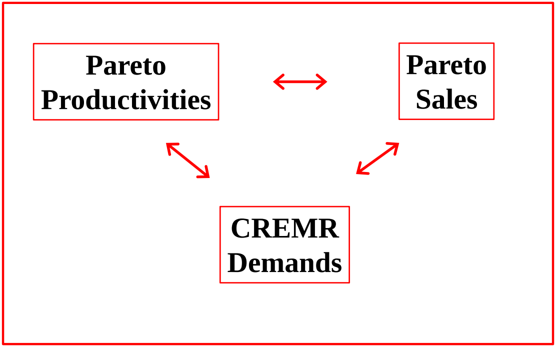
Head-Mayer-Thoenig (2014)

Log-normal Productivities	+	CES Demands	→	Log-normal Sales

Backing Out Demands

Pareto Productivities	+	**CES Demands**	→	**Pareto Sales**
Pareto Productivities	→	**?**	←	**Pareto Sales**

Which Demands are Consistent with Pareto?



Proposition: Any two imply the third

Extends to a wide class of distributions, including Lognormal and Fréchet

Details

CREMR Demands

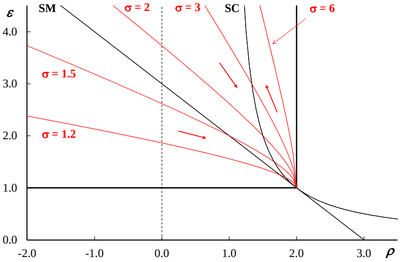
- "CREMR": "Constant Revenue Elasticity of Marginal Revenue"
  - MR=MC $\Rightarrow \quad \varphi = c^{-1} = (r')^{-1}$
  - So: Constant elasticity of sales with respect to productivity

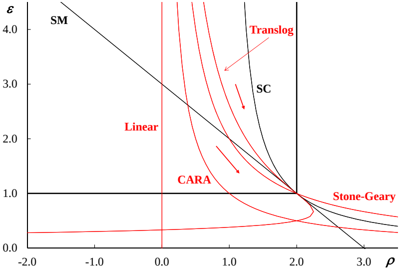
- CREMR demands:

$$\boxed{p(x) = \frac{\beta}{x}(x-\gamma)^{\frac{\sigma-1}{\sigma}}} \quad 1 < \sigma < \infty,\ x > \gamma\sigma,\ \beta > 0$$

- A generalization of CES, allowing variable markups
  - CES a special case: $\gamma = 0 \quad \Rightarrow \quad p(x) = \beta x^{-1/\sigma}$
  - CREMR elasticity of demand: $\varepsilon(x) = \frac{x-\gamma}{x-\gamma\sigma}\sigma$
  - Subconvex IFF $\gamma > 0$
- Implies realistic sales and markup distributions
  - Empirically, outperforms other demand functions
- Relates to Gibrat's Law

CREMR Very Different from Other Demands





$$p(x) = \frac{\beta}{x}(x-\gamma)^{\frac{\sigma-1}{\sigma}}$$

$$\Rightarrow \quad \bar{\rho}(\varepsilon) = 2 - \frac{1}{\sigma-1}\frac{(\varepsilon-1)^2}{\varepsilon}$$

Constant-Response Demand Functions

	Response	Demand Function	Manifold
Bulow-Pfleiderer	$\frac{dp}{dc} = \kappa$	$p(x) = \alpha + \beta x^{\frac{1-\kappa}{\kappa}}$	$\rho = 2 - \frac{1}{\kappa}$
CPPT	$\frac{d \log p}{d \log c} = \kappa$	$p(x) = \frac{\beta}{x} \left(x^{\frac{\kappa-1}{\kappa}} + \gamma \right)^{\frac{\kappa}{\kappa-1}}$	$\bar{\rho}(\varepsilon) = 2 - \frac{1}{\kappa} \frac{\varepsilon-1}{\varepsilon}$
CEMR/Inverse PIGL	$\frac{d \log x}{d \log c} = -\kappa$	$p(x) = \frac{1}{x}(\alpha + \beta x^{\frac{\kappa-1}{\kappa}})$	$\bar{\rho}(\varepsilon) = 2 - \frac{1}{\kappa}(\varepsilon - 1)$
CREMR	$\frac{d \log r}{d \log c} = -\kappa$	$p(x) = \frac{\beta}{x}(x - \gamma)^{\frac{\kappa}{\kappa+1}}$	$\bar{\rho}(\varepsilon) = 2 - \frac{1}{\kappa} \frac{(\varepsilon-1)^2}{\varepsilon}$

Gibrat's Law

- Gibrat's Law: Firm growth rates are independent of size
- Typical explanation:
  - Firms subject to both idiosyncratic and industry-wide shocks
  - i.i.d. idiosyncratic shocks cumulate to give an asymptotic log-normal distribution of firm size, all growing at the same rate
- Usually demonstrated with perfect competition *or* CES monopolistic competition
- Is it consistent with other demand functions?
- Proposition: In monopolistic competition, CREMR demand is necessary and sufficient for Gibrat's Law to hold following both idiosyncratic and industry-wide shocks to firm productivity

Gibrat's Law: Industry-Wide Shocks

- Productivity process for firm i: $\varphi_{it} = \varphi_t \gamma_{it}$ $\begin{cases} \varphi_t\text{: industry-wide} \\ \gamma_{it}\text{: idiosyncratic} \end{cases}$

1. Industry-Wide Shocks:
    - Self-reflection is a "cross-section" property
        - Constant elasticity of marginal revenue with respect to total revenue
    - Gibrat's Law for industry-wide shocks is a "time-series" property
        - An industry-wide productivity shock has the same effect on sales of all firms
        - i.e., a constant elasticity of revenue with respect to marginal cost
    - But the two properties are equivalent
        - Since marginal revenue = marginal cost
    - Hence CREMR demand is necessary and sufficient for Gibrat's Law to hold following industry-wide shocks to firm productivity

Gibrat's Law: Idiosyncratic Shocks

2. Idiosyncratic shocks (i.i.d.):
   - Such shocks cumulate to give an asymptotic log-normal distribution:

$$\gamma_{it} - \gamma_{i,t-1} = \epsilon_{it}\gamma_{i,t-1} \quad \rightarrow \quad \log\gamma_{it} = \log\gamma_{0t} + \prod_{t'=0} \log\epsilon_{it'} \quad \rightarrow \quad \frac{\log\gamma_{it}}{t} \sim N(\mu, \sigma^2)$$

   - Standard results derive Gibrat's Law from this, following both:
     - Sales shocks in perfect competition
     - Productivity shocks in monopolistic competition with CES demands
   - But: $\varphi_{it} = \varphi_i\gamma_{it} = c_{it}^{-1} = (r'_{it})^{-1}$
     - So i.i.d. shocks to productivity cumulate to give an asymptotic log-normal distribution of marginal revenues
     - and CREMR is necessary and sufficient for that to imply a log-normal distribution of sales
   - Hence CREMR demand is necessary and sufficient for Gibrat's Law to hold in the long run following idiosyncratic shocks to firm productivity

Outline

Conclusion

Monopolistic competition:

- The dominant paradigm in international trade
- Not the only approach
- But there are good reasons why it has remained dominant
- Important results
  - Selection effects, competition effects, size distribution, efficiency
- Relaxing CES goes part of the way to making its view of firms more realistic
  - Alternatives to CES: Constant-response demand functions
- IO and Trade: Complements not substitutes in understanding!

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Supermodularity and the MCEO

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- Sufficient condition for second-order selection effects:
  - Π^F is steeper than Π^E
  - $\Leftrightarrow \; \pi_c(c,0) < \pi_c(c,\tau)$
  - $\Leftarrow \; \pi_{c\tau} > 0$
- Necessary and sufficient condition for $\pi_{c\tau} > 0$:
  - $\pi(c,\tau) = [p(x) - \tau c]x, \quad x$ optimal
  - $\Rightarrow \; \pi_c = -\tau x$
  - $\Rightarrow \; \pi_{c\tau} = -x - \tau \frac{\partial x}{\partial \tau} = -x\left(1 + \frac{c}{x}\frac{\partial x}{\partial c}\right)$
  - $\Rightarrow \; \pi_{c\tau} > 1$ IFF $-\frac{c}{x}\frac{\partial x}{\partial c} > 1$

Free-Entry Equilibrium with Heterogeneous Firms

Maximum profits:

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$$\pi(\underset{-}{c}, \underset{-}{\lambda}, \underset{+}{k})$$

- c: Firm marginal cost
- λ: Market aggregate, endogenous to industry, exogenous to firms
  - Interpretation: "competition"
  - Appears naturally with additive separability (ZKPT, Bertoletti-Epifani)
  - Also nests quasi-linear quadratic preferences (Melitz-Ottaviano)
- k: "Globalization": World market size

Free-entry condition:

$$c_0: \quad \pi(c_0, \lambda, k) = f$$

Zero-profit condition:

$$\Pi(\lambda, k) \equiv \int_0^{c_0} [\pi(c, \lambda, k) - f] g(c) dc = f_e$$

Comparative Statics

Determination of the marginal firm:

$$\pi(c_0, \lambda, k) = f \quad \Rightarrow \quad dc_0 = -\tfrac{1}{\pi_c}(\pi_\lambda d\lambda + \pi_k dk)$$

Determination of the level of competition:

$$\Pi(\lambda, k) = f + f_e \quad \Rightarrow \quad d\lambda = -\tfrac{\Pi_k}{\Pi_\lambda} dk$$

Combine: Effects of a positive shock on the marginal firm:

$$dc_0 = -\tfrac{1}{\pi_c}\Bigg(\underbrace{\pi_k}_{(1)} - \underbrace{\frac{\pi_\lambda}{\Pi_\lambda}\,\Pi_k}_{(2)}\Bigg)dk$$

1. Direct effect: Raises its profits (from zero) $\Rightarrow$ Cutoff tends to $\uparrow$
2. Indirect effect: Raises *all* firms' profits $\Rightarrow$ Increases competition $\Rightarrow$ Reduces profits of marginal firm $\Rightarrow$ Cutoff tends to $\downarrow$

Special Case: Additive Separability

Rewrite general result in terms of elasticities:

$$\hat{c}_0 = -\frac{\pi}{c\pi_c}\left(\frac{k\pi_k}{\pi} - \frac{\lambda\pi_\lambda}{\pi}\frac{\Pi}{\lambda\Pi_\lambda}\frac{k\Pi_k}{\Pi}\right)\hat{k}$$

Specializing to additive separability:

$$\hat{c}_0 = \frac{1}{\varepsilon_0 - 1}\left(\frac{k\pi_k}{\pi} - \frac{\varepsilon_0}{\bar{\varepsilon}}\frac{k\Pi_k}{\Pi}\right)\hat{k}$$

- $\varepsilon_0 \equiv \varepsilon(c_0)$: Elasticity faced by the marginal firm
- $\bar{\varepsilon} \equiv \int_0^c \frac{\pi(c)}{\Pi}\varepsilon(c)g(c)\,\mathrm{d}c$: Elasticity faced by the average firm

1. CES case: $\varepsilon_0 = \bar{\varepsilon} = \sigma$
2. Subconvex case: marginal firm has lowest x and so highest ε: $\varepsilon_0 > \bar{\varepsilon}$

Application: Globalization

- $\frac{k\pi_k}{\pi} = 1$

So:

$$\hat{\pi}_i = \left(1 - \frac{\varepsilon_i}{\bar{\varepsilon}}\right)\hat{k}$$

1. $= 0$ in CES case: $\varepsilon_0 = \bar{\varepsilon} = \sigma \quad \Rightarrow$ No change in threshold firm
2. < 0 in subconvex case: $\varepsilon_0 > \bar{\varepsilon}$
   $\Rightarrow$ Competition effect forces least efficient firms to exit

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GPF Family of Distributions

- "Generalized Power Function" ["GPF"] Family of Distributions:

$$G(x;\theta) = H\left(\theta_0 + \frac{\theta_1}{\theta_2} x^{\theta_2}\right)$$

  - $H(\cdot)$: Completely general, apart from: $G_x > 0 \quad \Rightarrow \quad \theta_1 H' > 0$
  - Includes: Pareto, truncated Pareto, log-normal, Fréchet, etc.

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