Market size, Competition, and the Product Mix of Exporters

Thierry Mayer, Marc J. Melitz, and Gianmarco I.P. Ottaviano

Evidence on Multi-Product Firms and Trade

Multi-product firms dominate world trade flows:

Table 3: Distribution of French exporters over products and markets[9]

Share of French exporters in 2003 (total number exporters: 99259)

No. of products	Number of countries			
	1	5	10+	Total
1	29.61	0.36	0.22	34.98
5	0.76	0.45	0.62	4.73
10+	0.95	0.89	10.72	18.57
Total	42.59	4.12	15.54	100

Share of French exports in 2003 (total exports: 314.3 billion €)

No. of products	Number of countries			
	1	5	10+	Total
1	0.7	0.08	0.38	1.86
5	0.3	0.08	1.06	1.97
10+	0.28	0.45	76.3	81.36
Total	2.85	1.55	85.44	100

Source: EFIM.

Why Is the Firm Product Margin Important?

- Most product creation and destruction occurs within existing firms
  - Bernard, Redding, & Schott (2009) and Broda & Weinstein (2008)

Why Is the Firm Product Margin Important?

- Most product creation and destruction occurs within existing firms
  - Bernard, Redding, & Schott (2009) and Broda & Weinstein (2008)
- Firms respond to market conditions by adjusting the product margin
  - Changes in domestic and export market conditions over time: Macroeconomic shocks and trade liberalization
  - Differences in export market conditions: in response to 'gravity' variables such as economic distance and destination market size

Why Is the Firm Product Margin Important?

- Most product creation and destruction occurs within existing firms
  - Bernard, Redding, & Schott (2009) and Broda & Weinstein (2008)
- Firms respond to market conditions by adjusting the product margin
  - Changes in domestic and export market conditions over time:
    Macroeconomic shocks and trade liberalization
  - Differences in export market conditions: in response to 'gravity'
    variables such as economic distance and destination market size
- In all these cases, empirical evidence for many countries confirms a firm
  product ladder that is
  - Highly skewed
  - Stable over time and across markets: firms adjust product margin at
    the 'bottom'

Why Is the Firm Product Margin Important?

- Most product creation and destruction occurs within existing firms
  - Bernard, Redding, & Schott (2009) and Broda & Weinstein (2008)
- Firms respond to market conditions by adjusting the product margin
  - Changes in domestic and export market conditions over time: Macroeconomic shocks and trade liberalization
  - Differences in export market conditions: in response to 'gravity' variables such as economic distance and destination market size
- In all these cases, empirical evidence for many countries confirms a firm product ladder that is
  - Highly skewed
  - Stable over time and across markets: firms adjust product margin at the 'bottom'
- Firms also respond to market conditions by adjusting their product mix
  - If skewed distribution across products is indicative of productivity/quality differences, then changes in product mix can have important repercussions on firm productivity and welfare

The Effects of Trade Liberalization in North America on Multi-Product Firms

Bernard, Redding, & Schott (2008) for the U.S.; Baldwin & Gu (2009) for Canada; Iacovone & Javorcik for Mexico

- Induces firms to reduce product scope

The Effects of Trade Liberalization in North America on Multi-Product Firms

Bernard, Redding, & Schott (2008) for the U.S.; Baldwin & Gu (2009) for Canada; Iacovone & Javorcik for Mexico

- Induces firms to reduce product scope
- Increases skewness of production runs across products
  - Possibly due to composition effects between exported and non-exported goods
  - ... or increased skewness for both export and domestic sales

The Effects of Trade Liberalization in North America on Multi-Product Firms

Bernard, Redding, & Schott (2008) for the U.S.; Baldwin & Gu (2009) for Canada; Iacovone & Javorcik for Mexico

- Induces firms to reduce product scope
- Increases skewness of production runs across products
  - Possibly due to composition effects between exported and non-exported goods
  - ... or increased skewness for both export and domestic sales
- Evidence for Mexico:
  - Increased skewness in the distribution of export sales
    - $\longrightarrow$ Highest export increases for products (within firms) with highest export shares
  - Intensive margin effect in product mix responses dominates effect of extensive product margin

What We Do in This Paper

- Develop a multi-country model with multi-product firms and arbitrary differences in geography
- Explains the link:
  - Market size and geography $\longrightarrow$ toughness of competition (distribution of markups across products)
  - Toughness of competition $\longrightarrow$ skewness of firm product mix
  - Skewness of firm product mix $\longrightarrow$ firm productivity

What We Do in This Paper

- Develop a multi-country model with multi-product firms and arbitrary differences in geography
- Explains the link:
  - Market size and geography $\longrightarrow$ toughness of competition (distribution of markups across products)
  - Toughness of competition $\longrightarrow$ skewness of firm product mix
  - Skewness of firm product mix $\longrightarrow$ firm productivity
- When firms export to 'tougher' markets or when trade costs fall:
  - Firms skew their export sales towards their 'better' products
  - Firms no longer export 'marginal' products
  - Firm productivity increases (combination of both effects)

4

What We Do in This Paper

- Develop a multi-country model with multi-product firms and arbitrary differences in geography
- Explains the link:
  - Market size and geography $\longrightarrow$ toughness of competition (distribution of markups across products)
  - Toughness of competition $\longrightarrow$ skewness of firm product mix
  - Skewness of firm product mix $\longrightarrow$ firm productivity
- When firms export to 'tougher' markets or when trade costs fall:
  - Firms skew their export sales towards their 'better' products
  - Firms no longer export 'marginal' products
  - Firm productivity increases (combination of both effects)
- We find very strong confirmation for the effects of market size and geography on the skewness of French exporters' product mix
  - Indirect evidence of large differences in competitive environment across export market destinations

4

Literature Review

Competition effect (endogenous markups)

- Feenstra & Ma (2008) and Eckel & Neary (2009) incorporate cannibalization effect of increasing product range
- In our model, there is no cannibalization as firms produce a discrete number of varieties and never attain finite mass
- Competition effect comes from demand side: mass of competing sellers and their average price
- Main advantage of simplifying assumption:
  - Can solve for multi-country asymmetric world equilibrium
- Nocke & Yeaple (2008) and Baldwin & Gu (2009) also incorporate competition effect but with symmetric products

Literature Review (Cont.)

Nested C.E.S. preferences with a continuum of firms and products

- Cannibalization is ruled out by restricting nests in which firms can introduce products $\longrightarrow$ exogenous markups
- $\longrightarrow$ No differences in the toughness of competition across markets or due to trade liberalization
- $\longrightarrow$ No effects of competition on the skewness of the product mix
- Focus on effects of trade on the product scope decision (and potential effect of trade costs on the product mix)

Outline

Theory

- Closed economy
  - Introduce preferences and firm product ladder
  - Effect of market size on competition and firm product mix
- Open economy
  - Skip two-country version and effect of trade liberalization (similar to effect of bigger market size in closed economy)
  - Effects of market size and geography on exporter's product mix

Empirics

- Effects of market size, geography, and trade barriers on French exporters' product mix

Model Setup: Preferences and Demand

- Continuum of differentiated varieties $i \in \Omega$ and a homogeneous good (numeraire)
- Consumer utility and individual consumption levels:

$$U = q_0^c + \alpha \int_{i \in \Omega} q_i^c \, di - \frac{1}{2}\gamma \int_{i \in \Omega} (q_i^c)^2 \, di - \frac{1}{2}\eta \left(\int_{i \in \Omega} q_i^c \, di \right)^2$$

- Demand parameters:
  - γ: index of product differentiation
    - $\gamma = 0 \implies$ perfect substitutes
    - Consumer only cares about $Q^c = \int_{i \in \Omega} q_i^c \, di$
    - As $\gamma \nearrow$, increasing weight on consumption distribution across varieties
  - α and η: substitution with numeraire good
    - $\alpha \nearrow$ and $\eta \searrow$ shift out demand for differentiated varieties

Preferences and Demand (Cont.)

- Quadratic utility leads to linear inverse demand for all varieties:

$$p_i = \alpha - \gamma q_i^c - \eta Q^c$$

- There are L consumers in a market $\longrightarrow$ index of market size
  - Market demand is $q_i = L q_i^c$

Preferences and Demand (Cont.)

- Quadratic utility leads to linear inverse demand for all varieties:

$$p_i = \alpha - \gamma q_i^c - \eta Q^c$$

- There are L consumers in a market $\longrightarrow$ index of market size
  - Market demand is $q_i = L q_i^c$
- Marginal utilities are bounded $\implies$ threshold price level:

$$p_i \leq \frac{1}{\eta + \gamma/M} \left(\frac{\gamma}{M} \alpha + \eta \bar{p} \right) \equiv p_{\max}$$

  where $\bar{p}$ is average price of consumed varieties

  - Threshold $\searrow$ as $M \nearrow$ or $\bar{p} \searrow$ (tougher competition)

Preferences and Demand (Cont.)

- Quadratic utility leads to linear inverse demand for all varieties:

$$p_i = \alpha - \gamma q_i^c - \eta Q^c$$

- There are L consumers in a market $\longrightarrow$ index of market size
  - Market demand is $q_i = L q_i^c$
- Marginal utilities are bounded $\implies$ threshold price level:

$$p_i \leq \frac{1}{\eta + \gamma/M} \left(\frac{\gamma}{M}\alpha + \eta\bar{p} \right) \equiv p_{\max}$$

  where $\bar{p}$ is average price of consumed varieties

- Threshold $\searrow$ as $M \nearrow$ or $\bar{p} \searrow$ (tougher competition)
- Endogenous price elasticity of residual demand:

$$\varepsilon_i \equiv \left| \frac{\partial q_i}{\partial p_i} \frac{p_i}{q_i} \right| = \left(\frac{p_{\max}}{p_i} - 1 \right)^{-1}$$

Firms and Products

- A firm can produce multiple varieties/products
- Production of additional varieties moves a firm away from its unique 'core' competency
- ... which entails additional customization costs
- Each additional variety/product produced entails an additional customization cost

Firms and Products

- A firm can produce multiple varieties/products
- Production of additional varieties moves a firm away from its unique 'core' competency
- ... which entails additional customization costs
- Each additional variety/product produced entails an additional customization cost
- We model these customization costs along a geometric ladder with step $\omega^{-1} > 1$ ($\omega \in (0,1)$):
- A firm with core competency c produces its core product at this cost and each subsequent variety m at cost $v(m, c) = \omega^{-m} c$
- There is no upper bound limit on the number of products a firm can produce

Production and Firm Behavior

- One factor of production: labor (inelastically supplied)
- Homogeneous good and labor markets are competitive
  $\implies$ unit wages (so marginal costs are always equal to unit labor requirements)
- Prior to entry, identical firms face some initial uncertainty concerning their future core competency c
- Firms must pay sunk investment cost f_E to enter
- Firm core competency is then learned/revealed:
  - Draw from a common cost distribution $G(c)$ with support on $[0, c_M]$

Monopolistic Competition with Multi-Product Firms

- Given the assumptions on the costs of additional products, a firm will produce a countable set of products

  - ... and there will be a continuum of firms

- With products on a continuum, a firm will never achieve discrete mass (measure zero) and the cross-price effects on the multiple varieties vanish

- This is the monopolistic competition equilibrium where a firm independently maximizes profits on any variety produced, taking the total mass of varieties and their average price $\bar{p}$ as given

Product Performance Measures

- All performance measures (price, output, markup, revenue, profits) can be defined both at the product and firm level
- Consider the product level measures:
  - Let $\pi(v)$ represent the maximized profit from a variety with marginal cost v (this is independent of the firm producing that particular variety)
  - Let v_D represent the cutoff cost level for profitable production:

$$v_D = \sup \{v \mid \pi(v) \geq 0\}$$

Product Performance Measures (Cont.)

- All product level performance measures can be written as a function of this cutoff cost level v_D:

$$p(v) = \frac{1}{2}\left(v_D + v\right) \quad \text{(price)} \qquad q(v) = \frac{L}{2\gamma}\left(v_D - v\right) \quad \text{(output)}$$
$$\lambda(v) = \frac{1}{2}\left(v_D - v\right) \quad \text{(markup)} \qquad r(v) = \frac{L}{4\gamma}\left[\left(v_D\right)^2 - v^2\right] \quad \text{(revenue)}$$
$$\pi(v) = \frac{L}{4\gamma}\left(v_D - v\right)^2 \quad \text{(profit)}$$

- Prices decrease with variety cost v, while markups, output, revenue, and profits increase

- $\longrightarrow$ cost/productivity gain is not entirely passed on to consumers due to endogenous markup

Product Performance Measures (Cont.)

- All product level performance measures can be written as a function of this cutoff cost level v_D:

$$p(v) = \frac{1}{2}(v_D + v) \quad \text{(price)} \qquad q(v) = \frac{L}{2\gamma}(v_D - v) \quad \text{(output)}$$
$$\lambda(v) = \frac{1}{2}(v_D - v) \quad \text{(markup)} \qquad r(v) = \frac{L}{4\gamma}\left[(v_D)^2 - v^2\right] \quad \text{(revenue)}$$
$$\pi(v) = \frac{L}{4\gamma}(v_D - v)^2 \quad \text{(profit)}$$

- Prices decrease with variety cost v, while markups, output, revenue, and profits increase
- $\longrightarrow$ cost/productivity gain is not entirely passed on to consumers due to endogenous markup
- Endogenous v_D summarizes 'competitive' environment

Product Range Decision for a Firm

- $c_D = v_D$ will also be the cost cutoff for firm survival
  - The cutoff firm produces only its core variety
- A firm with core competency c will produce at least m additional varieties so long as $v(m, c) \leq v_D \iff c \leq \omega^m c_D$

Product Range Decision for a Firm

- $c_D = v_D$ will also be the cost cutoff for firm survival
  - The cutoff firm produces only its core variety
- A firm with core competency c will produce at least m additional varieties so long as $v(m, c) \leq v_D \iff c \leq \omega^m c_D$

- A firm will produce any variety that delivers non-negative profits.
  - A firm with core competency c thus produces a total number of varieties
  $$M(c) = \left\{ \begin{array}{ll} 0 & \text{if } c > c_D \\ \max\left\{m \mid c \leq \omega^m c_D\right\} + 1 & \text{if } c \leq c_D \end{array} \right.$$

Product Range Decision for a Firm

- $c_D = v_D$ will also be the cost cutoff for firm survival
  - The cutoff firm produces only its core variety
- A firm with core competency c will produce at least m additional varieties so long as $v(m, c) \leq v_D \iff c \leq \omega^m c_D$

- A firm will produce any variety that delivers non-negative profits.
  - A firm with core competency c thus produces a total number of varieties
$$M(c) = \left\{ \begin{array}{ll} 0 & \text{if } c > c_D \\ \max \left\{ m \mid c \leq \omega^m c_D \right\} + 1 & \text{if } c \leq c_D \end{array} \right.$$
- A firm's total profit is then
$$\Pi(c) = \sum_{m=0}^{M(c)-1} \pi \left(\omega^{-m} c \right)$$

Product Range Decision for a Firm

- $c_D = v_D$ will also be the cost cutoff for firm survival
  - The cutoff firm produces only its core variety
- A firm with core competency c will produce at least m additional varieties so long as $v(m, c) \leq v_D \iff c \leq \omega^m c_D$

- A firm will produce any variety that delivers non-negative profits.
 - A firm with core competency c thus produces a total number of varieties
  $$M(c) = \left\{ \begin{array}{cc} 0 & \text{if } c > c_D \\ \max\{m \mid c \leq \omega^m c_D\} + 1 & \text{if } c \leq c_D \end{array} \right.$$

- A firm's total profit is then
  $$\Pi(c) = \sum_{m=0}^{M(c)-1} \pi\left(\omega^{-m} c\right)$$

- Overall firm productivity across all product lines, measured either as physical output per worker or sales (valued added) per worker varies monotonically (inversely) with core competency c

Product Range Decision (Cont.)
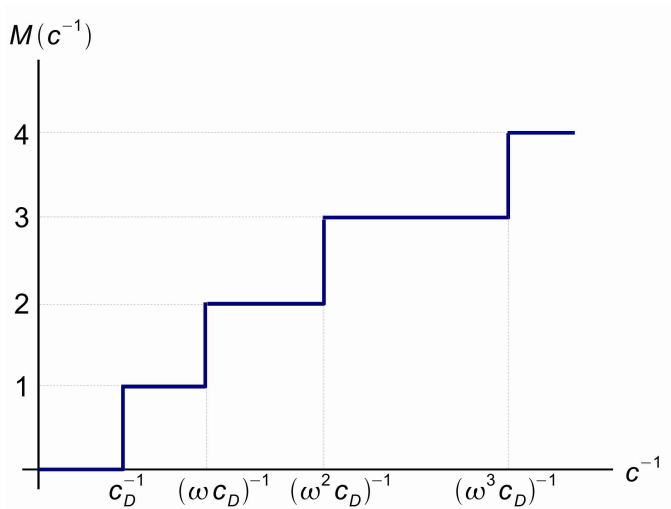
Equilibrium Conditions: Firm Entry and Exit

- Firm survival obeys cutoff rule:
  - Low productivity firms with $c > c_D$ exit
- Free entry:
  - Entry is unrestricted
  - Firms enter until expected profit (ex-ante) is driven to zero:

$$\int_0^{c_D} \Pi(c) dG(c) - f_E = 0$$

Parametrization of Cost Draws

- For simplicity, we use a parametrization of the distribution of cost draws $G(c)$
- We use a Pareto distribution for productivity $1/c$

$$G(c) = \left(\frac{c}{c_M}\right)^k, \ c \in [0, c_M] \qquad (k \geq 1)$$

- k is an inverse measure of dispersion
- $k = 1 \implies$ uniform cost distribution
- As $k \nearrow$, distribution becomes more concentrated towards c_M

Equilibrium Under Pareto

- If firm core competencies c are distributed Pareto, then the distribution of all varieties produced by these firms will also be distributed Pareto.
- The cost cutoff c_D is then given by

$$c_D = \left(\frac{\gamma \phi}{\Omega L} \right)^{\frac{1}{k+2}}$$

where

- $\phi = 2(k+1)(k+2)c_M^k f_E$ is an (inverse) index of technology
  - $\phi \nearrow$ with $c_M \nearrow, f_E \nearrow$
- $\Omega \equiv \left(1 - \omega^k \right)^{-1} > 1$ is an index of multi-product flexibility
  - In equilibrium, Ω is also the average number of varieties produced per firm

Comparative Statics for the Closed Economy

Recall

$$c_D = \left(\frac{\gamma\phi}{\Omega L}\right)^{\frac{1}{k+2}}$$

Increases in market size, technology (c_M, $f_E \searrow$), and variety substitutability ($\gamma \searrow$) lead to decreases in the cutoff c_D and increases in the mass of varieties produced/sold

- $\longrightarrow$ tougher competition and higher aggregate productivity

Comparative Statics for the Closed Economy

Recall

$$c_D = \left(\frac{\gamma\phi}{\Omega L}\right)^{\frac{1}{k+2}}$$

Increases in market size, technology ($c_M, f_E \searrow$), and variety substitutability ($\gamma \searrow$) lead to decreases in the cutoff c_D and increases in the mass of varieties produced/sold

- $\longrightarrow$ tougher competition and higher aggregate productivity
- Although the average number of varieties per firm Ω remains constant, all firms respond to the tougher competition by decreasing the number of products produced: $M(c) \searrow$ (weakly) $\forall c$
- $\longrightarrow$ Focus on core competency – associated increase in average firm productivity

Comparative Statics for the Closed Economy

Recall
$$c_D = \left(\frac{\gamma\phi}{\Omega L}\right)^{\frac{1}{k+2}}$$

Increases in market size, technology ($c_M, f_E \searrow$), and variety substitutability ($\gamma \searrow$) lead to decreases in the cutoff c_D and increases in the mass of varieties produced/sold

- $\longrightarrow$ tougher competition and higher aggregate productivity
- Although the average number of varieties per firm Ω remains constant, all firms respond to the tougher competition by decreasing the number of products produced: $M(c) \searrow$ (weakly) $\forall c$
- $\longrightarrow$ Focus on core competency – associated increase in average firm productivity
- Average Ω remains constant due to selection effects: higher cost firms producing the smallest product ranges exit

Comparative Statics for the Closed Economy

Recall

$$c_D = \left(\frac{\gamma\phi}{\Omega L}\right)^{\frac{1}{k+2}}$$

Increases in market size, technology ($c_M, f_E \searrow$), and variety substitutability ($\gamma \searrow$) lead to decreases in the cutoff c_D and increases in the mass of varieties produced/sold

- $\longrightarrow$ tougher competition and higher aggregate productivity
- Although the average number of varieties per firm Ω remains constant, all firms respond to the tougher competition by decreasing the number of products produced: $M(c) \searrow$ (weakly) $\forall c$
- $\longrightarrow$ Focus on core competency – associated increase in average firm productivity
- Average Ω remains constant due to selection effects: higher cost firms producing the smallest product ranges exit
- Lower average prices and markups (distribution of markups shifts $\searrow$)
- Welfare rises (higher productivity, product variety, and lower markups)
- If market size increases, then output and sales per variety increase

Effect of Tougher Competition on Product Range
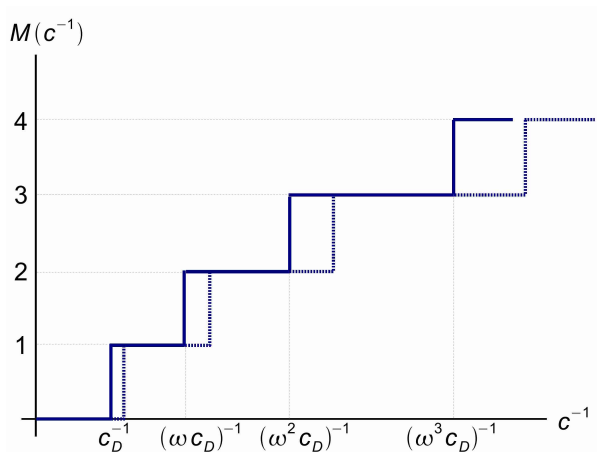
Effect of Tougher Competition on Product Mix

This increase in the competitive environment is also associated with additional within-firm reallocations across products:

- Sales of variety m by firm c:

$$r(v(m,c)) = r(\omega^{-m}c) = \frac{L}{4\gamma}\left[(v_D)^2 - (\omega^{-m}c)^2\right]$$

For any 2 varieties $m < m'$ produced by same firm, the sales ratio (m to m') increases (given $v_D \searrow$)

Effect of Tougher Competition on Product Mix

This increase in the competitive environment is also associated with additional within-firm reallocations across products:

- Sales of variety m by firm c:

$$r(v(m,c)) = r(\omega^{-m}c) = \frac{L}{4\gamma}\left[(v_D)^2 - (\omega^{-m}c)^2\right]$$

  For any 2 varieties $m < m'$ produced by same firm, the sales ratio (m to m') increases (given $v_D \searrow$)
- A firm reallocates output and sales towards its 'core' product:
  - $\longrightarrow$ Increased skewness of product mix
  - $\longrightarrow$ Leads to increase in firm-level productivity (over and above effects from product scope)

Effect of Tougher Competition on Product Mix

This increase in the competitive environment is also associated with additional within-firm reallocations across products:

- Sales of variety m by firm c:

$$r(v(m, c)) = r(\omega^{-m} c) = \frac{L}{4\gamma} \left[(v_D)^2 - \left(\omega^{-m} c \right)^2 \right]$$

  For any 2 varieties $m < m'$ produced by same firm, the sales ratio (m to m') increases (given $v_D \searrow$)

- A firm reallocates output and sales towards its 'core' product:
  - $\longrightarrow$ Increased skewness of product mix
  - $\longrightarrow$ Leads to increase in firm-level productivity (over and above effects from product scope)

- The effect of an increase in the toughness of competition (measured as an upward shift in price elasticities at any given prices) on the skewness of firm product sales holds for a wide class of demand parametrization

Open Economy

- Countries $h = 1, .., J$ with size L^h
- Markets are segmented – but firms can export any of their products
- Exporting involves two types of additional costs:

Open Economy

- Countries $h = 1, .., J$ with size L^h
- Markets are segmented – but firms can export any of their products
- Exporting involves two types of additional costs:
  - Proportional iceberg trade costs from l to h: $\tau^{lh} > 1$

Open Economy

- Countries $h = 1, .., J$ with size L^h
- Markets are segmented – but firms can export any of their products
- Exporting involves two types of additional costs:
  - Proportional iceberg trade costs from l to h: $\tau^{lh} > 1$
  - Additional customization cost with step cost $\left(\theta^{lh}\right)^{-1} \geq 1$ from l to h
    - So the total delivered cost of variety m is $\tau^{lh} \left(\theta^{lh}\omega\right)^{-m} c$

Open Economy

- Countries $h = 1, .., J$ with size L^h
- Markets are segmented – but firms can export any of their products
- Exporting involves two types of additional costs:
  - Proportional iceberg trade costs from l to h: $\tau^{lh} > 1$
  - Additional customization cost with step cost $(\theta^{lh})^{-1} \geq 1$ from l to h
    - So the total delivered cost of variety m is $\tau^{lh} (\theta^{lh}\omega)^{-m} c$
- This customization cost allows for variations (across destinations) in the ratio of delivered cost (across varieties) for a given firm
  - The ratio of delivered cost to h of variety m relative to m' is $(\theta^{lh}\omega)^{m'-m}$

Open Economy

- Countries $h = 1, .., J$ with size L^h
- Markets are segmented – but firms can export any of their products
- Exporting involves two types of additional costs:
  - Proportional iceberg trade costs from l to h: $\tau^{lh} > 1$
  - Additional customization cost with step cost $\left(\theta^{lh}\right)^{-1} \geq 1$ from l to h
    - So the total delivered cost of variety m is $\tau^{lh} \left(\theta^{lh}\omega\right)^{-m} c$
- This customization cost allows for variations (across destinations) in the ratio of delivered cost (across varieties) for a given firm
  - The ratio of delivered cost to h of variety m relative to m' is $\left(\theta^{lh}\omega\right)^{m'-m}$
- Empirically, we find that it is important to account for such variations in this ratio across destinations

Open Economy Equilibrium

- Variety cost cutoffs for production and export in country l:

$$v_D^l = \sup\left\{c : \pi_D^l(v) > 0\right\} = p_{\max}^l \,, \ v_X^{lh} = \sup\left\{c : \pi_X^{lh}(v) > 0\right\} = \frac{p_{\max}^h}{\tau^{lh}}$$

- Based on those cutoffs, a firm in country l decides how many products $M_D^l(c)$ to produce, and how many products $M_X^{lh}(c)$ to export

Open Economy Equilibrium

- Variety cost cutoffs for production and export in country l:

$$v_D^l = \sup\left\{c : \pi_D^l(v) > 0\right\} = p_{\max}^l \, , \; v_X^{lh} = \sup\left\{c : \pi_X^{lh}(v) > 0\right\} = \frac{p_{\max}^h}{\tau^{lh}}$$

- Based on those cutoffs, a firm in country l decides how many products $M_D^l(c)$ to produce, and how many products $M_X^{lh}(c)$ to export
- Firm level cutoffs for survival and export are also given by variety cost cutoffs: $c_D^l = v_D^l$, $c_X^{lh} = v_X^{lh} = v_D^h / \tau^{lh}$

Open Economy Equilibrium (Cont.)

- Set of free entry conditions in every country jointly determine cutoffs:

$$c_D^l = \left(\frac{\gamma \phi}{\Omega} \frac{\sum_{h=1}^{J} |C_{hl}|}{|P|} \frac{1}{L^l} \right)^{\frac{1}{k+2}}$$

where $|P|$ and $|C_{hl}|$ are the determinant and co-factor of the matrix of trade costs $P = \left[\rho^{lh} \right]_{lh}$ that combines the effects of τ^{lh} and θ^{lh}

- Cutoff $c_D^l = v_D^l$ in each country completely summarizes the competitive environment in l

Open Economy Equilibrium (Cont.)

- Set of free entry conditions in every country jointly determine cutoffs:

$$c_D^l = \left(\frac{\gamma \phi}{\Omega} \frac{\sum_{h=1}^J |C_{hl}|}{|P|} \frac{1}{L^l} \right)^{\frac{1}{k+2}}$$

  where $|P|$ and $|C_{hl}|$ are the determinant and co-factor of the matrix of trade costs $P = \left[\rho^{lh} \right]_{lh}$ that combines the effects of τ^{lh} and θ^{lh}

- Cutoff $c_D^l = v_D^l$ in each country completely summarizes the competitive environment in l

- Competition is affected both by market size L^l and geography via the effect of remoteness captured by $\sum_{h=1}^J |C_{hl}| / |P|$

Open Economy Equilibrium (Cont.)

- Set of free entry conditions in every country jointly determine cutoffs:

$$c_D^l = \left(\frac{\gamma\phi}{\Omega} \frac{\sum_{h=1}^J |C_{hl}|}{|P|} \frac{1}{L^l} \right)^{\frac{1}{k+2}}$$

  where $|P|$ and $|C_{hl}|$ are the determinant and co-factor of the matrix of trade costs $P = \left[\rho^{lh} \right]_{lh}$ that combines the effects of τ^{lh} and θ^{lh}

- Cutoff $c_D^l = v_D^l$ in each country completely summarizes the competitive environment in l

- Competition is affected both by market size L^l and geography via the effect of remoteness captured by $\sum_{h=1}^J |C_{hl}| / |P|$

- Multilateral trade liberalization induces effects in every country that are very similar to an increase in market size in the open economy

Exporters' Product Mix Across Destinations

- A firm from l that exports variety m to location h generates export sales

$$r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma}\left\{\left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m}c\right]^2\right\}$$

- For any given firm c, the relative export sales of any two exported varieties $m < m'$ (ratio m to m'):

Exporters' Product Mix Across Destinations

- A firm from l that exports variety m to location h generates export sales

$$
r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma} \left\{ \left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m} c\right]^2 \right\}
$$

- For any given firm c, the relative export sales of any two exported varieties $m < m'$ (ratio m to m'):

  - Depends only on toughness of competition in destination h (via effect on cutoff v_D^h) and bilateral trade costs τ^{lh} and θ^{lh}
  - Increases with tougher competition ($\searrow v_D^h$) in destination market
    $\longrightarrow$ Export sales are skewed towards core products

Exporters' Product Mix Across Destinations

- A firm from l that exports variety m to location h generates export sales

$$r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma}\left\{ \left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m} c\right]^2 \right\}$$

- For any given firm c, the relative export sales of any two exported varieties $m < m'$ (ratio m to m'):

  - Depends only on toughness of competition in destination h (via effect on cutoff v_D^h) and bilateral trade costs τ^{lh} and θ^{lh}
  - Increases with tougher competition ($\searrow v_D^h$) in destination market
    $\longrightarrow$ Export sales are skewed towards core products

- This prediction holds for more general demand parametrization (assuming an upward shift in price elasticities)

Exporters' Product Mix Across Destinations (Cont.)

- Recall
$$r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma} \left\{ \left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m}c\right]^2 \right\}$$

- For exported varieties $m < m'$, the relative export sales (m to m'):
  - Increases with higher proportional cost τ^{lh}
    - Price elasticities increase as firm is pushed up linear demand curve: similar effect to tougher competition

Exporters' Product Mix Across Destinations (Cont.)

- Recall
$$r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma} \left\{ \left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m} c\right]^2 \right\}$$

- For exported varieties $m < m'$, the relative export sales (m to m'):
  - Increases with higher proportional cost τ^{lh}
    - Price elasticities increase as firm is pushed up linear demand curve: similar effect to tougher competition
  - Increases with higher customization cost increment $1/\theta^{lh}$
    - Driven both by tougher competition and direct effect on relative delivered cost $\left(\theta^{lh}\omega\right)^{m'-m}$

Exporters' Product Mix Across Destinations (Cont.)

- Recall
$$r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma}\left\{\left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m}c\right]^2\right\}$$

- For exported varieties $m < m'$, the relative export sales (m to m'):
  - Increases with higher proportional cost τ^{lh}
    - Price elasticities increase as firm is pushed up linear demand curve: similar effect to tougher competition
  - Increases with higher customization cost increment $1/\theta^{lh}$
    - Driven both by tougher competition and direct effect on relative delivered cost $\left(\theta^{lh}\omega\right)^{m'-m}$
- If trade costs τ^{lh} and $1/\theta^{lh}$ are (weakly) positively correlated:
  - Export sales ratio increases

Exporters' Product Mix Across Destinations (Cont.)

- Recall
$$r_X^{lh}(v_X^{lh}(m,c)) = \frac{L^h}{4\gamma} \left\{ \left(v_D^h\right)^2 - \left[\tau^{lh}\left(\theta^{lh}\omega\right)^{-m} c\right]^2 \right\}$$

- For exported varieties $m < m'$, the relative export sales (m to m'):
  - Increases with higher proportional cost τ^{lh}
    - Price elasticities increase as firm is pushed up linear demand curve: similar effect to tougher competition
  - Increases with higher customization cost increment $1/\theta^{lh}$
    - Driven both by tougher competition and direct effect on relative delivered cost $\left(\theta^{lh}\omega\right)^{m'-m}$

- If trade costs τ^{lh} and $1/\theta^{lh}$ are (weakly) positively correlated:
  - Export sales ratio increases

- If they are negatively correlated, then export sales ratio can decrease (if negative correlation is strong enough)
  - $\longrightarrow$ Increase in delivered cost across product line is smaller when trade cost for core variety is high

Data on French Exporters

- Comprehensive customs data for firm-product exports to 181 destinations in 2000
- Exclude service and wholesale/distribution firms (keep manufacturing and agriculture)
- Products recorded at 8-digit level (over 10,000 product codes)

Data on French Exporters

- Comprehensive customs data for firm-product exports to 181 destinations in 2000
- Exclude service and wholesale/distribution firms (keep manufacturing and agriculture)
- Products recorded at 8-digit level (over 10,000 product codes)
- Construct 3 measures of skewness of export sales – for a given firm-destination pair
  - Ratio 1/2 and 1/3 based on world exports ranking
  - Ratio 1/2 and 1/3 based on destination specific ranking
  - Theil index (a measure of entropy) over all of the firm's export sales to a destination

Data on French Exporters

- Comprehensive customs data for firm-product exports to 181 destinations in 2000
- Exclude service and wholesale/distribution firms (keep manufacturing and agriculture)
- Products recorded at 8-digit level (over 10,000 product codes)
- Construct 3 measures of skewness of export sales – for a given firm-destination pair
  - Ratio $1/2$ and $1/3$ based on world exports ranking
  - Ratio $1/2$ and $1/3$ based on destination specific ranking
  - Theil index (a measure of entropy) over all of the firm's export sales to a destination
- Test for the effects of toughness of competition (market size and geography) and trade costs (distance and common language)
- Measure of geography: Foreign supply potential

Mean Global Sales Ratio and Destination Market Size
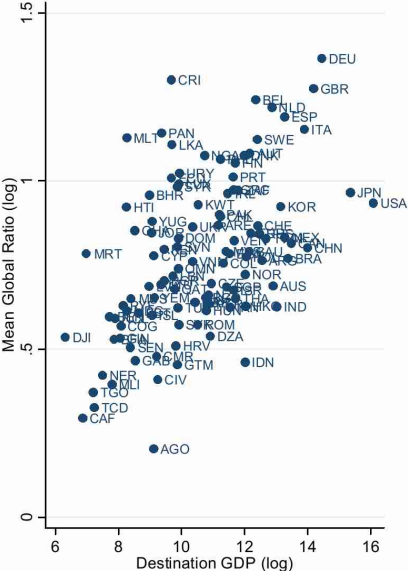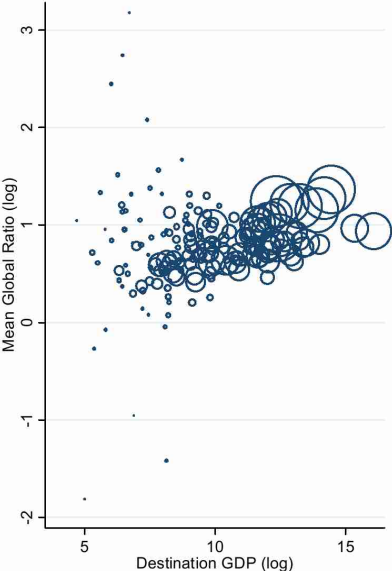
Mean Global Sales Ratio and Foreign Supply Potential
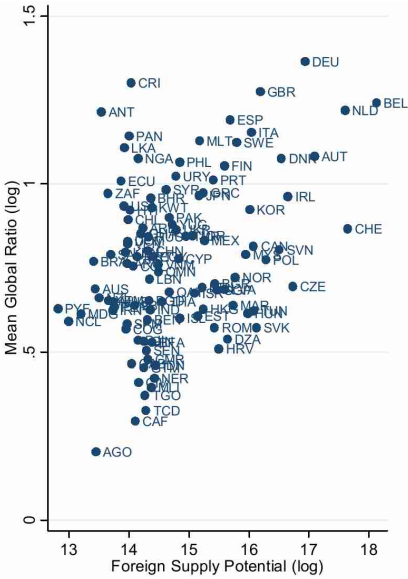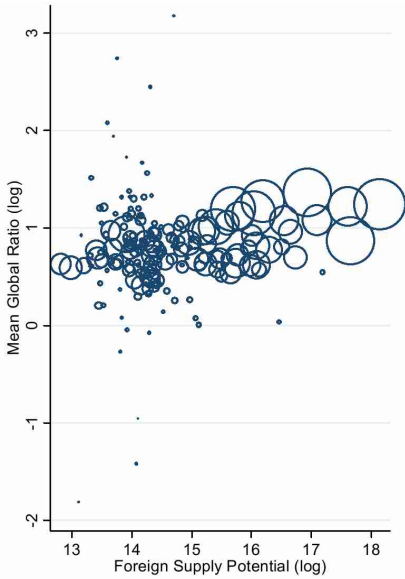
Global Sales Ratio

	Global Ratio			
	1 to 2	1 to 3	1 to 2	1 to 2
GDP (log)	0.060a	0.077a	0.071a	0.059a
	(0.007)	(0.014)	(0.008)	(0.010)
Supply Potential (log)	0.007	0.015	0.026c	0.016
	(0.014)	(0.024)	(0.015)	(0.018)
Distance (log)	-0.097a	-0.111a	-0.103a	-0.124a
	(0.019)	(0.032)	(0.020)	(0.023)
Common Language	-0.073a	-0.100b	-0.117a	-0.132a
	(0.028)	(0.042)	(0.030)	(0.036)
Obervations	68809	32859	64892	53723
R-squared (within)	0.006	0.008	0.006	0.005

Notes:

Constant and firm fixed effects supressed

Robust standard errors in parentheses (clustered by firm)

a,b,c represent singificance level at 1%,5%,10%

Local Sales Ratio

	Local Ratio			
	1 to 2	1 to 3	1 to 2	1 to 2
GDP (log)	0.033a	0.045a	0.039a	0.012a
	(0.003)	(0.004)	(0.003)	(0.004)
Supply Potential (log)	0.026a	0.047a	0.038a	0.049a
	(0.005)	(0.008)	(0.006)	(0.007)
Distance (log)	-0.093a	-0.102a	-0.096a	-0.100a
	(0.008)	(0.011)	(0.008)	(0.009)
Common Language	-0.182a	-0.285a	-0.223a	-0.294a
	(0.010)	(0.015)	(0.011)	(0.015)
Obervations	151017	96672	138019	106129
R-squared (within)	0.017	0.025	0.014	0.012

Notes:

Constant and firm fixed effects supressed

Robust standard errors in parentheses (clustered by firm)

a,b,c represent singificance level at 1%,5%,10%

Theil Index

	Theil Index		
# Products	0.027a	0.026a	0.026a
	(0.001)	(0.001)	(0.001)
GDP (log)	0.051a	0.057a	0.055a
	(0.001)	(0.001)	(0.002)
Supply Potential (log)	0.002	0.011a	0.011a
	(0.002)	(0.002)	(0.003)
Distance (log)	-0.072a	-0.077a	-0.091a
	(0.003)	(0.003)	(0.003)
Common Language	0.003	-0.022a	-0.047a
	(0.004)	(0.004)	(0.006)
Obervations	96684	89585	70791
R-squared (within)	0.365	0.354	0.332

Notes:

Constant and firm fixed effects supressed

Robust standard errors in parentheses (clustered by firm)

a,b,c represent singificance level at 1%,5%,10%