Market size, Competition, and the Product Mix of Exporters

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

Broader Context for Analysis of Product-Level Decisions in Trade

- Firms' choice of product quality, range of products, and product mix is just one of many "technology" dimensions (broadly defined) that interact with internalization strategy of firms
- Also:
  - Integration with suppliers
  - Labor screening for worker ability
  - Skill-bias of technology
  - Innovation and R&D
- Aggregate trading environment then affects measured technology through those firm-level choices
- In a dynamic environment there is also an important feedback loop between technology and international market participation
- Product range and product mix is an attribute of "technology" that can now be measured quite accurately – as well as its interactions with international market participation

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)

	Number of countries			
No. of products	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 €)

	Number of countries			
No. of products	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.

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- Most product creation and destruction occurs within existing firms
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  - 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

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  - Possibly due to composition effects between exported and non-exported goods
  - ... or increased skewness for both export and domestic sales

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- 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

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  - Skewness of firm product mix $\longrightarrow$ firm productivity
- When firms export to 'tougher' markets:
  - Firms skew their export sales towards their 'better' products
  - Firms no longer export 'marginal' products
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- When firms export to 'tougher' markets:
  - Firms skew their export sales towards their 'better' products
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  - 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

Literature Review

Competition effect (endogenous markups)

- Feenstra & Ma (2008) and Eckel & Neary (2010) 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 and geography on French exporters' product mix

Preferences and Demand

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

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

- Leads to linear residual demand curves for each variety i
  - With threshold prices (goods can be priced out of the market)
  - Endogenous price elasticity of demand
  - $\longrightarrow$ Both respond to the "toughness" of competition in the market (# of competing products and their average price)

Firms and Products

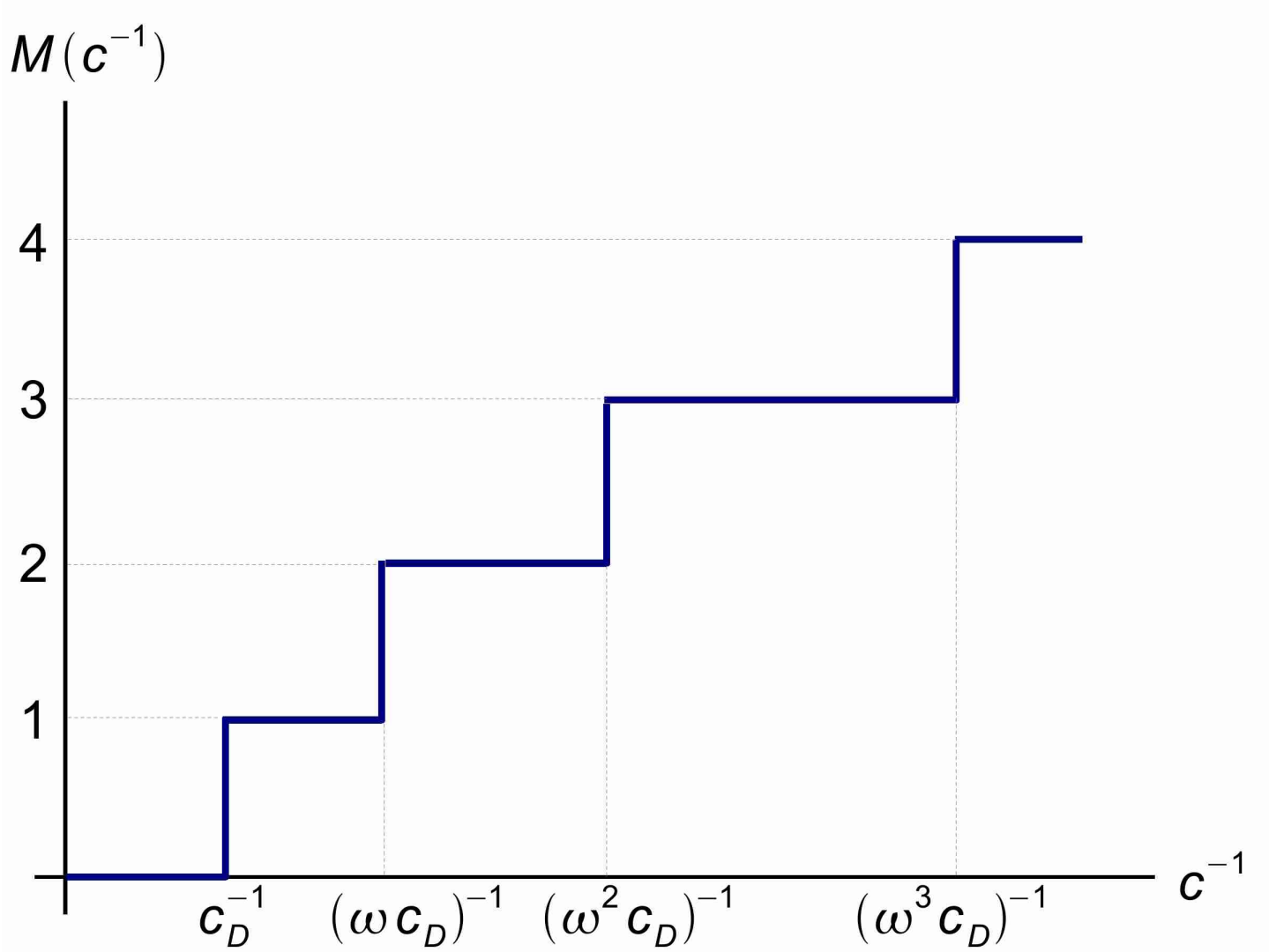
- A firm can produce multiple varieties/products
- Production of additional varieties moves a firm away from its unique 'core' competency
- ... which entails additional customization costs
- Each additional variety/product produced entails an additional customization cost (geometric step $\omega^{-1}, \omega \in (0, 1)$)
- A firm with core competency c produces its core product at that cost and each subsequent variety at an additional cost
- 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)
- Prior to entry, identical firms face some initial uncertainty concerning their future core competency c
- Firms must pay sunk investment cost to enter (no other restrictions to entry)
- Firm core competency is then learned/revealed
- Firm then decides how many varieties (possibly none) to produce

Firm Survival and Product Range Decision

- Firm survival follows cutoff rule: $c \leq c_D$



Comparative Statics for the Closed Economy

- Increases in market size, technology (better productivity draws, lower entry costs), and variety substitutability lead to decreases in the survival cutoff c_D and increases in the mass of varieties produced/sold
- $\longrightarrow$ tougher competition and higher aggregate productivity

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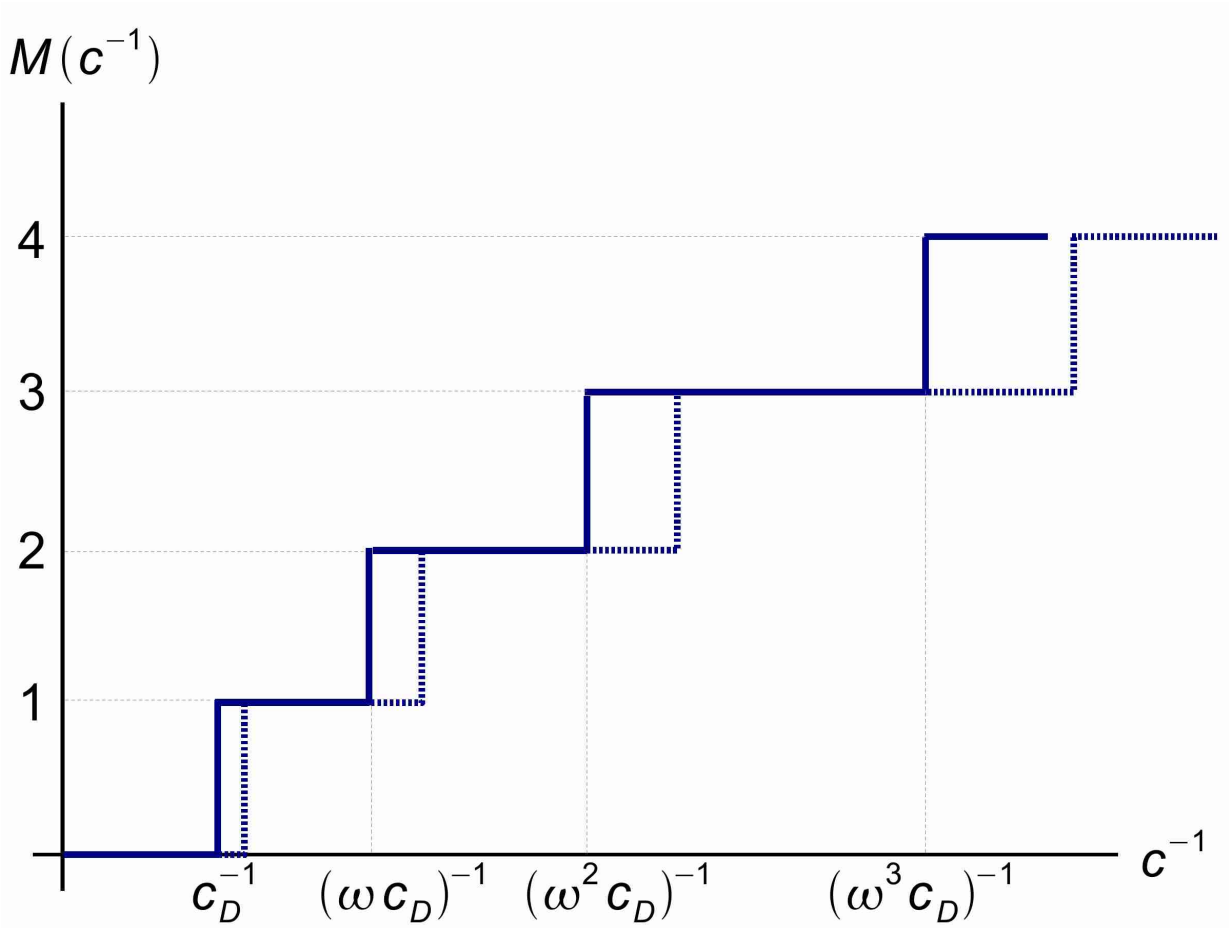
- All firms respond to the tougher competition by decreasing the number of products produced
- $\longrightarrow$ Focus on core competency – associated increase in average firm productivity
- Lower average prices and markups (distribution of markups shifts $\searrow$)
- Welfare rises (higher productivity, 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
- Consider the effect on the product sales for a given firm:
  - A firm reallocates output and sales towards its 'core' product (share of products closer to the core increases)
    - $\longrightarrow$ Increased skewness of product mix
    - $\longrightarrow$ Leads to increase in firm-level productivity (over and above effects from product scope)
- These effects are driven by the upward shift in price elasticities across the firm's product line

Open Economy

- Consider an open economy with an arbitrary number of countries (with different sizes)
- Markets are segmented – but firms can export any of their products
- Exporting involves two types of bilateral trade costs:
  - Proportional iceberg trade costs (same for all products exported in a bilateral trading pair)
  - Additional customization cost (increasing across product line)

Open Economy Equilibrium

- The toughness of competition in each market (characterized by the survival cutoff for domestic firms) now depends on
  - Own market size
  - Technology (distribution of productivity draws and entry costs)
  - Product substitution
  - $\longrightarrow$ all vary in same way as in the closed economy
- Additionally, the toughness of competition also depends on geographic remoteness (a function of the bilateral matrix of trade costs)

Exporters' Product Mix Across Destinations

- Consider the effect of the toughness of competition in an export market on the product export sales for a given firm:
  - Tougher competition in an export market induces firms to skew their export sales towards their core products
  - $\longrightarrow$ Again, due to shift up in all price elasticities across product range

Data on French Exporters

- Comprehensive customs data for firm-product exports to 181 destinations in 2003
- Exclude service and wholesale/distribution firms (keep manufacturing and agriculture)
- Products recorded at 8-digit level (over 10,000 product codes)

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- 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
  - Skewness/entropy statistic (Theil, Herfindahl, Std dev logged) over all of the firm's export sales to a destination

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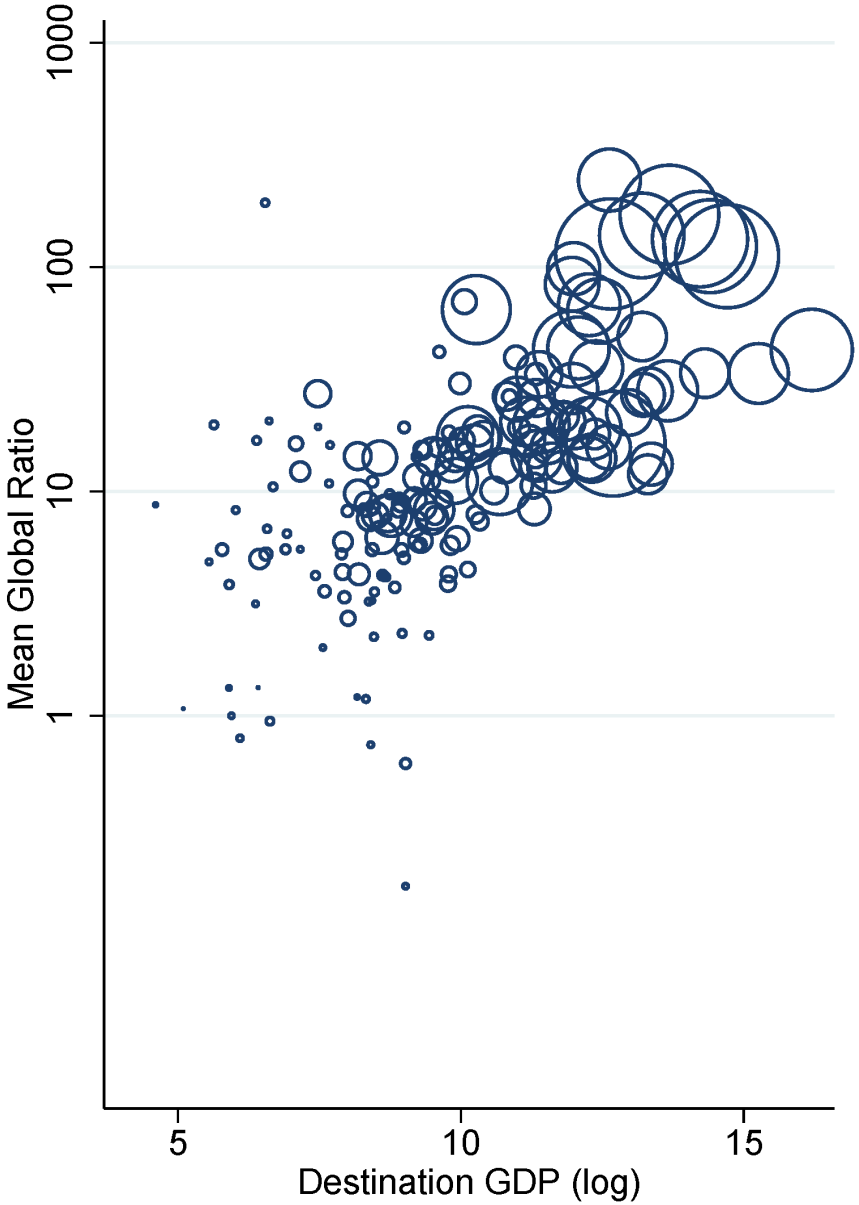
  - Skewness/entropy statistic (Theil, Herfindahl, Std dev logged) over all of the firm's export sales to a destination
- Test for the effects of toughness of competition (market size and geography)
- Measure of geography: Foreign supply potential

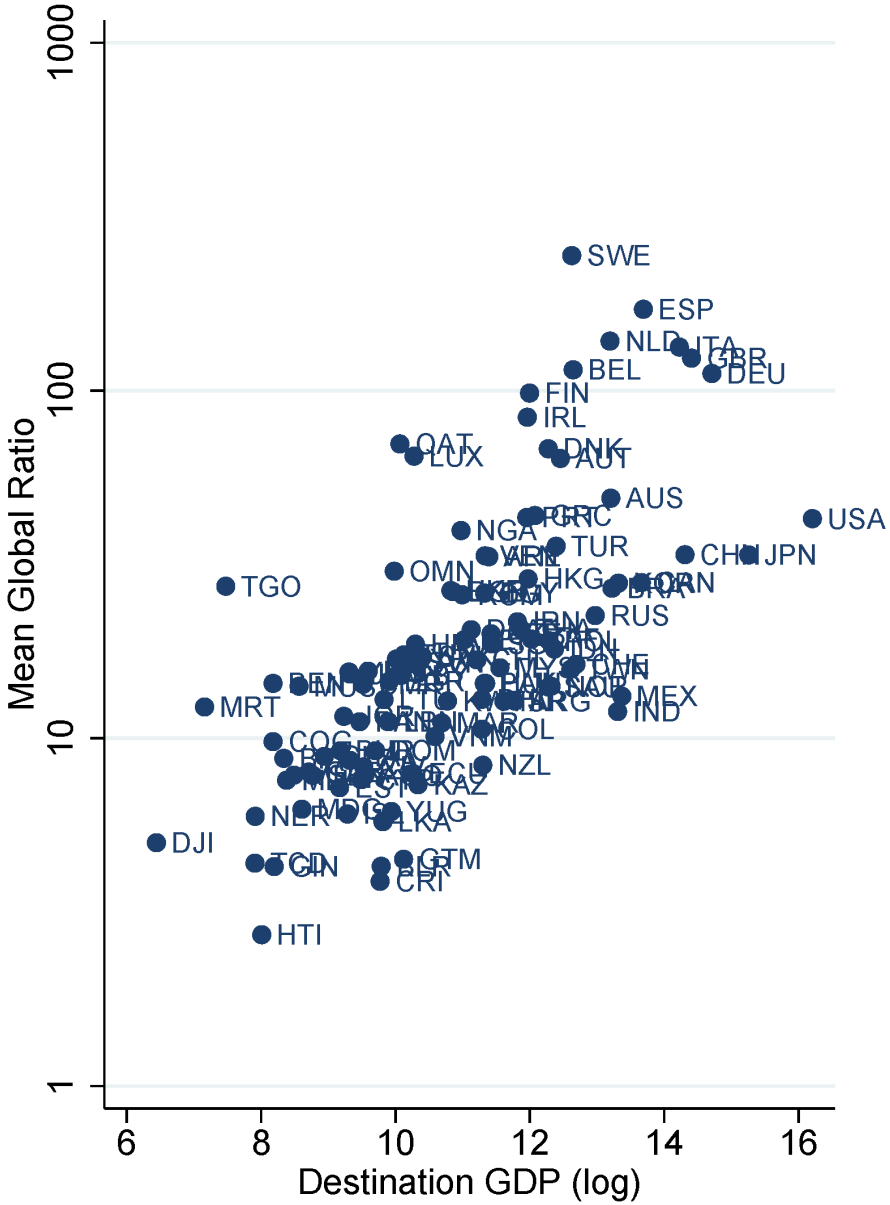
Correlations Between Local and Global Rankings

Table 1: Spearman Correlations Between Global and Local Rankings

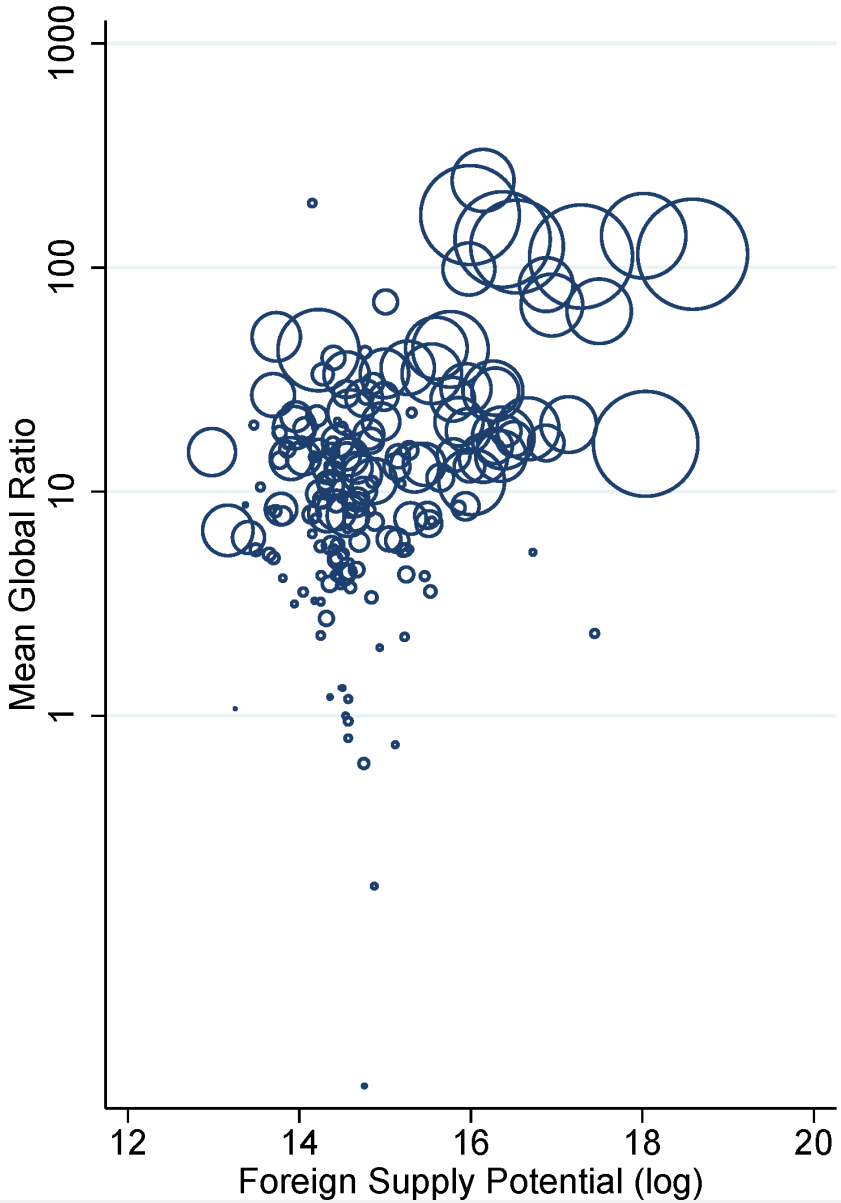
Firms exporting at least:	# products				
to # countries	1	2	5	10	50
1	67.93%	67.78%	67.27%	66.26%	59.39%
2	67.82%	67.74%	67.28%	66.28%	59.39%
5	67.55%	67.51%	67.2%	66.3%	59.43%
10	67.02%	67%	66.82%	66.12%	59.46%
50	61.66%	61.66%	61.64%	61.53%	58.05%

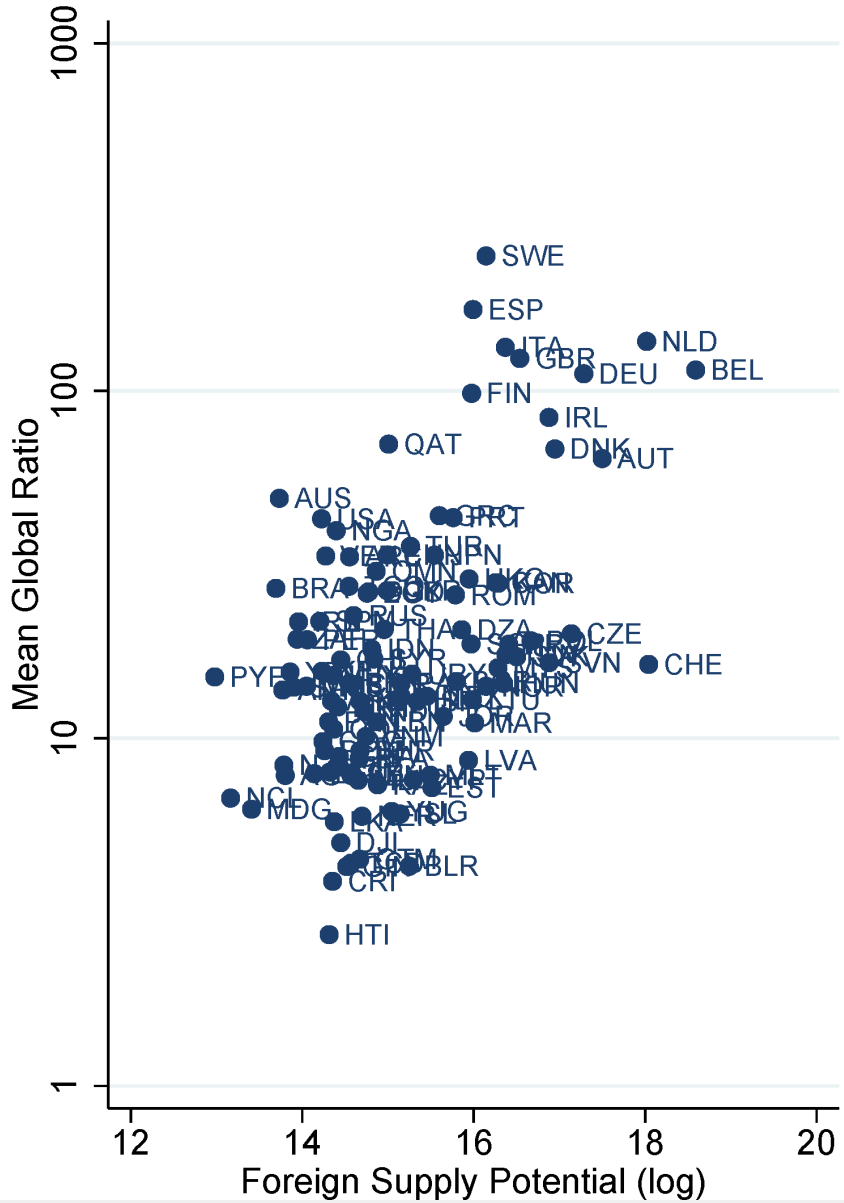
Mean Global Sales Ratio and Destination Market Size





Mean Global Sales Ratio and Foreign Supply Potential





Baseline: Global and Local Sales Ratio

Table 2: Global ratio of core product ($m = 0$) to m' product sales' regressions

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Var.	Ratio of core to second product sales' regressions					
	Global ratio			Local ratio		
ln GDP	0.092***	0.083***	0.107***	0.073***	0.057***	0.077***
	(0.013)	(0.012)	(0.010)	(0.008)	(0.005)	(0.006)
ln supply potential	0.067***	-0.017	0.044***	0.080***	0.018	0.068***
	(0.016)	(0.024)	(0.014)	(0.016)	(0.016)	(0.013)
ln distance		-0.063			-0.046*	
		(0.043)			(0.023)	
contiguity		0.013			-0.108	
		(0.051)			(0.081)	
colonial link		-0.060			-0.041	
		(0.051)			(0.043)	
common language		0.023			-0.048	
		(0.050)			(0.038)	
RTA		0.066			0.004	
		(0.059)			(0.033)	
common currency		0.182***			0.335***	
		(0.047)			(0.037)	
both in GATT		0.006			-0.033	
		(0.046)			(0.026)	
ln freeness of trade			0.096***			0.028
			(0.026)			(0.017)

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Global Sales Ratio

Table 3: Global ratio of core product ($m = 0$) to m' product sales' regressions

	(1)	(2)	(3)	(4)	(5)
ln GDP	0.107***	0.155***	0.110***	0.096***	0.098***
	(0.010)	(0.031)	(0.011)	(0.012)	(0.011)
ln supply potential	0.044***	0.111***	0.038***	0.022*	0.036**
	(0.014)	(0.033)	(0.014)	(0.012)	(0.016)
ln freeness of trade	0.096***	0.020	0.113***	0.137***	0.092***
	(0.026)	(0.057)	(0.032)	(0.038)	(0.026)
ln GDP per cap					0.025
					(0.018)
$m' =$	1	2	1	1	1
Destination GDP/cap	all	all	top 50%	top 20%	all
Observations	56092	5688	50622	40963	56092
Within R^2	0.005	0.018	0.004	0.002	0.005

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	(0.026)	(0.057)	(0.032)	(0.038)	(0.026)
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Local Sales Ratio

Table 4: Local ratio of core product ($m = 0$) to m' product sales' regressions

	(1)	(2)	(3)	(4)	(5)
ln GDP	0.077***	0.100***	0.083***	0.061***	0.066***
	(0.006)	(0.012)	(0.011)	(0.016)	(0.008)
ln supply potential	0.068***	0.064***	0.051***	0.028*	0.057***
	(0.013)	(0.022)	(0.018)	(0.016)	(0.014)
ln freeness of trade	0.028	0.013	0.059	0.092*	0.025
	(0.017)	(0.042)	(0.039)	(0.052)	(0.017)
ln GDP per cap					0.029**
					(0.013)
$m' =$	1	2	1	1	1
Destination GDP/cap	all	all	top 50%	top 20%	all
Observations	96876	49554	84706	64652	96876
Within R^2	0.007	0.009	0.005	0.002	0.007

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Within R^2	0.007	0.009	0.005	0.002	0.007

Theil Index

Table 5: Theil index regressions

	(1)	(2)	(3)	(4)	(5)	(6)
ln GDP	0.141***	0.019***	0.047***	0.052***	0.047***	0.041***
	(0.010)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
ln supply potential	0.125***	0.016***	0.037***	0.033***	0.023***	0.031***
	(0.023)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
ln freeness of trade	0.096***	0.007*	0.021**	0.032**	0.045**	0.021**
	(0.036)	(0.004)	(0.009)	(0.013)	(0.022)	(0.009)
ln GDP per cap						0.013**
						(0.005)
Dep. Var.	s.d. ln x	herf	theil	theil	theil	theil
Destination GDP/cap	all	all	all	top 50%	top 20%	all
Observations	82090	82090	82090	73029	57076	82090
Within R^2	0.107	0.164	0.359	0.356	0.341	0.359

Theil Index

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	(1)	(2)	(3)	(4)	(5)	(6)
ln GDP	0.141***	0.019***	0.047***	0.052***	0.047***	0.041***
	(0.010)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)
ln supply potential	0.125***	0.016***	0.037***	0.033***	0.023***	0.031***
	(0.023)	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
ln freeness of trade	0.096***	0.007*	0.021**	0.032**	0.045**	0.021**
	(0.036)	(0.004)	(0.009)	(0.013)	(0.022)	(0.009)
ln GDP per cap						0.013**
						(0.005)
Dep. Var.	s.d. ln x	herf	theil	theil	theil	theil
Destination GDP/cap	all	all	all	top 50%	top 20%	all
Observations	82090	82090	82090	73029	57076	82090
Within R^2	0.107	0.164	0.359	0.356	0.341	0.359