The Variety and Quality of a Nation's Exports

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Questions

- Observation: large economies export more in absolute terms than small economies
- Question: what do theory and data say about *how* larger economies export more?
  - intensive margin (more quantities of each good)
  - extensive margin (more varieties of goods)
  - quality margin

Findings

- Use detailed (6-digit) U.N. data on exports to assess the importance of the three margins, and ...
- They find that
  - 65% of the greater exports of larger economies is accounted by extensive margin
  - Intensive margins are dominated by higher quantites of each good rather than higher unit prices
  - Richer countries export higher quantities at modestly higher prices – higher quality

Findings

Consider different trade theories to identify ingredients that help explain the facts

- Armington product differentiation: incorrectly predict lower prices for the exports of larger economies
- Krugman: consistent with extensive margin, but overpredicts the rate at which variety responds to exporter size, incorrectly predict countries export to all markets
- Quality (vertical) differentiation: match the price facts
- Fixed costs of exporting: larger economies export a given product to more countries

Data and Strategies

- Decompose exports into (a) intensive margins (price + quantity), and (b) extensive margins
- Compare the margins with country side (GDP per worker or employment)
- Data: UNCTAD's Trade Analysis and Information System CD-ROM. Exports from 126 countries to 59 importers in over 5000 6-digit product categories in 1995
- Measurement:
  - Measure of extensive margin: counting weighted categories of goods by their overall importance in exports to a given country
  - Measure of quality margin: inferred from price and quantity

Why shall we care?

Welfare implications on growth and trade liberalization

- Intensive margin:
  - prices is lower in the world market - terms of trade effects;
  - Acemoglu and Ventura (2002): richer countries lower export price, stationary investment rate across countries and stationary world income distribution
- Extensive margin / quality margin:
  - price does not need to be lower
  - technology diffusion and diminishing returns to capital

Models

- Define variety: x_{jmi}
  j - exporting country, m- destination country, i - category of goods

- Preference of varieties (CES):

$$U_m = [\sum_{j=1}^{J}\sum_{i=1}^{I} Q_{jmi} N_{jmi} x_{jmi}^{1-1/\sigma}]^{\frac{\sigma}{1-\sigma}}$$

s.t.

$$\sum_{j=1}^{J}\sum_{i=1}^{I} N_{jmi} p_{jmi} x_{jmi} \leq Y_m$$

- Countries differ exogenously in A and L

- Reference country variables are all normalized to 1: I, Q, N, x, p, A, L, Y

Armington

- Assume products are differentiated by their country of origin, but the number of varieties supplied by each country is fixed
- Each country produces a single variety in each category $V_j = N_j I_j = 1$ for all j (normalization)
- No quality difference across countries $Q_j = 1$ for all j
- intensive margin: $x_j = A_j L_j$
- $p_j = (A_j L_j)^{-1/\sigma}$, $Y_j = p_j x_j V_j$
- $\ln(x_i) = \frac{\sigma}{1-\sigma} \ln(Y_j/L_j) + \frac{\sigma}{1-\sigma} \ln(L_j)$
  $\ln(p_j) = \frac{-1}{\sigma-1} \ln(Y_j/L_j) + \frac{-1}{\sigma-1} \ln(L_j)$

Acemoglu and Ventura

- Add endogenous capital accumulation and endogenous number of varieties to Armington
- Fixed labor requirement for each variety: $V_j = L_j$
- Intensive margin: $x_j = A_j$ (capital is included in A)
- $p_j = (A_j)^{-1/\sigma}, Y_j = p_j x_j V_j$
- $\ln(x_j) = \frac{\sigma}{\sigma-1} \ln(Y_j/L_j)$
  $\ln(p_j) = \frac{-1}{\sigma-1} \ln(Y_j/L_j)$

Krugman

- Endogenize the number of varieties
- With fixed output costs of producing each variety, $V_j = Y_j = A_j L_j$
- Intensive margin: $x_j = 1$ for all j
- $p_j = 1$ for all j
- conditional on producing a variety, a country exports its variety to all other markets

Quality Differentiation

- Suppose quality and labor endowment vary across countries, but productivity and variety do not $A_j = 1, V_j = 1$ for all j.
- Intensive margin: $x_j = L_j$
- $p_j = Q_j(L_j)^{-1/\sigma}, Y_j = Q_j(L_j)^{1-1/\sigma}$
- $\ln(Q_j) + \frac{1}{\sigma}\ln(N_j) = \ln(p_j) + \frac{1}{\sigma}\ln(N_j x_j)$, Nx is the observed quantities per category.

Model Predictions for Export Margins (Table 1)

	Intensive (px)	Extensive (V)	Price (p)	Quantity (x)
Armington	1	0	-1/(σ-1)	σ/(σ-1)
Acemoglu & Ventura				
Y/L	1	0	-0.6	1.6
L	0	1	0	0
Krugman	0	1	0	0
Quality Differentiation	1	0		
Y/L			1	0
L			0	1

Notes: For discussion of each model, see Section 2 in the text. Entries are model predictions for how exports increase with respect to exporter size. A single entry indicates the same elasticity with respect to both *Y/L* (GDP per worker) and *L* (employment). The Acemoglu and Ventura price and quantity elasticities with respect to Y/L are equal to -1/(σ-1) and σ/(σ-1), but these take on the values -0.6 and 1.6 for their case of σ = 2.6.

Empirics - decomposition methodology (I)

Overall exports $= EM_{jm} IM_{jm}$

- Extensive margin: a weighted count of j's categories relative to k's categories

$$EM_{jm} = \frac{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}{\sum_{i \in I} p_{kmi} x_{kmi}}$$

  - reference country k - the rest of the world
  - I_{jm} the set of observable categories in which $x_{kmi} > 0$
  - I 6-digit UN Harmonised System product code

- Intensive margin: j's nominal exports relative to k's in those categories in which j exports to m.

$$IM_{jm} = \frac{\sum_{i \in I_{jm}} p_{jmi} x_{jmi}}{\sum_{i \in I_{jm}} p_{kmi} x_{kmi}}$$

Empirics - decomposition methodology (II)

$IM_{jm} = P_{jm} X_{jm}$

- Price index for the intensive margin of country m's imports from j vs. k:

$$P_{jm} = \prod_{i \in I_{jm}} \left(\frac{p_{jmi}}{p_{kmi}}\right)^{w_{jmi}}$$

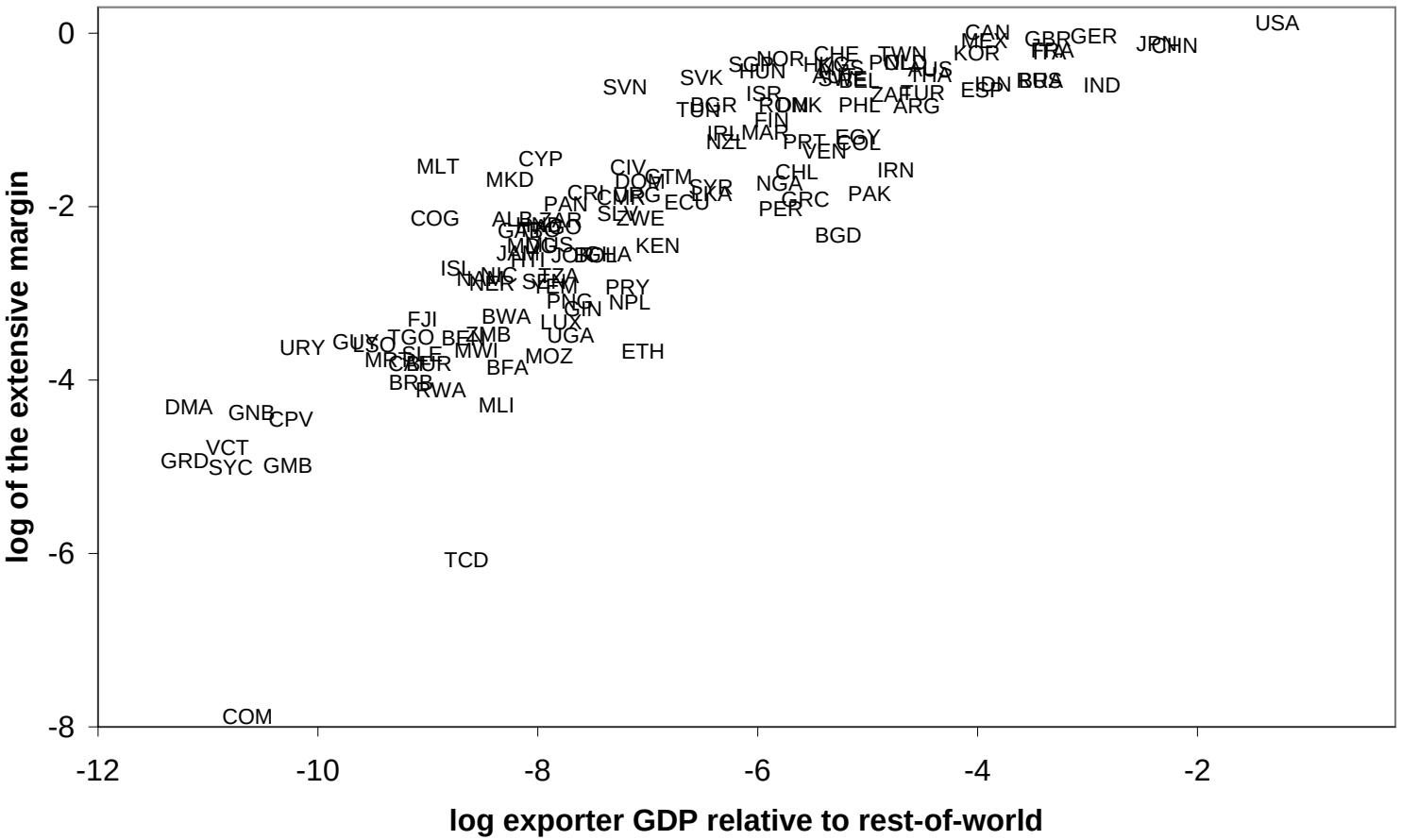
where w_{jmi} is the logarithmic mean of s_{jmi} and s_{kmi}, the share of category i in country j's exports to m and country k's exports to m

Empirics

- $IM_j = \prod_{m \in M_{-j}} (IM_{jm})^{a_{jm}}$
- $EM_j = \prod_{m \in M_{-j}} (EM_{jm})^{a_{jm}}$
- $P_j = \prod_{m \in M_{-j}} (P_{jm})^{a_{jm}}$
- $X_j = \prod_{m \in M_{-j}} (X_{jm})^{a_{jm}}$

Results: extensive margin plays a more prominent role for richer countries' exports

Figure 1



Results: Extensive vs. Intensive Margin

Independent Variable → / Dependent Variable ↓	*Y/L*	*L*	Adj. R^2	*Y*	Adj. R^2
Overall Exports	1.29 (0.07)	0.89 (0.04)	0.86	1.00 (0.04)	0.83
Intensive Margin	0.44 (0.05)	0.36 (0.03)	0.60	0.38 (0.03)	0.60
	34%	**41%**		**38%**	
Extensive Margin	0.85 (0.05)	0.53 (0.03)	0.79	0.61 (0.03)	0.74
	66%	**59%**		**62%**	

- Consistent with Krugman framework on extensive margin

Results: Price vs. Quantity

(within categories and to a given market)

Independent Variable → / Dependent Variable ↓	*Y/L*	*L*	Adj. R^2	*Y*	Adj. R^2
Prices	**0.09** (0.02)	-0.01 (0.01)	0.14	0.02 (0.01)	0.01
Quantities	**0.34** (0.05)	**0.37** (0.03)	0.58	**0.36** (0.03)	0.58

- Both Armington and Acemoglu and Ventura models predict richer countries will export higher quantities of each variety at a lower price
- Krugman + quality margin: by exporting higher quality goods, richer economies can export higher quantities without lowering the prices of their varieties on world markets.

Results: Extensive Margin at Various Levels of Aggregation

Regressor →	Y_j/L_j	L_j	Y_j
6 digit	66%	59%	62%
5 digit	64%	56%	59%
4 digit	62%	49%	54%
3 digit	48%	34%	39%
2 digit	39%	25%	30%
1 digit	15%	9%	11%

Results: Quality, Quality-Adjusted Prices and Within-Category Variety

$$\ln(Q_j) + \frac{1}{\sigma}\ln(N_j) = \ln(p_j) + \frac{1}{\sigma}\ln(N_j x_j)$$

		σ	*Y/L*	*L*
If All Quality	Quality	2.6	.23	.14
		5	.16	.07
		10	.13	.03
	Prices - Quality	2.6	-.13	-.14
		5	-.07	-.07
		10	-.03	-.04
If All Variety	Variety	2.6	.59	.35
		5	.82	.33
		10	1.29	.29
	Prices - Quality	NA	.09	.00
Some of Each	Variety (= Quantity)	NA	.34	.37
	Quality (= Price)	NA	.09	-.01

Top vs Bottom Y/L

Sample	Independent Variables → / Dependent Variable ↓	*Y/L*	*L*	Adj. R^2
Richest 61 countries	Prices	**0.39**	0.00	0.37
		(0.06)	(0.02)	
	Quantities	0.03	**0.39**	0.61
		(0.17)	(0.04)	
Poorest 60 countries	Prices	-0.05	**-0.04**	0.06
		(0.04)	(0.02)	
	Quantities	**0.39**	**0.38**	0.49
		(0.11)	(0.05)	