Getting Import Concentration and the Least-Traded Products Margin Right[1]

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[1]The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Canada.

Motivation I: Getting Import Concentration Right

- Traditional quantitative trade models **can get export concentration right**
  - Richer countries more diversified (Imbs and Wacziarg 2003; Hummels and Klenow 2005; Cadot, Carrière and Strauss-Kahn 2011)
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  - Enrich EK model with simple, stylized non-homothetic preferences

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  - **but never in Ricardian trade models**
- Build a quantitative trade model to get the Least-Traded-Products margin in a Ricardian environment

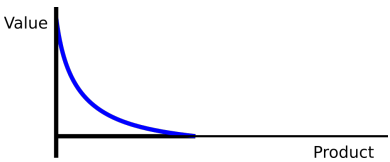
Visual representation of export and import concentration

Figure: Extensive product margin (number of goods)

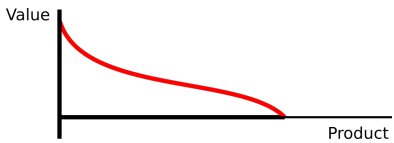
(a) Exports

(b) Imports

Figure: Intensive product margin (distribution of value)



(a) Exports



(b) Imports

Concentration facts I

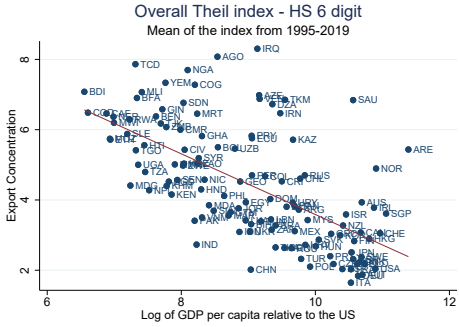
- Data: HS 6 digit 2012

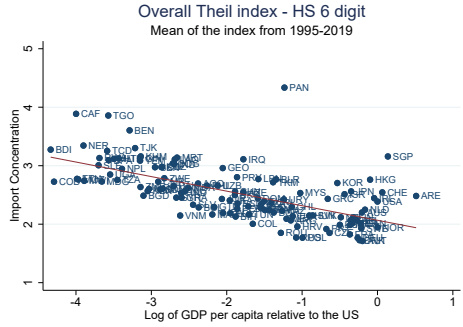
	Theil Exports			Theil Imports		
	Total	Extensive Margin	Intensive Margin	Total	Extensive Margin	Intensive Margin
Mean	4.44	0.77	3.67	2.54	0.22	2.32
Share		14%	86%		8%	92%

The average country in our sample

- exports 46% of all products
- imports 80% of all products
- receives ≈ 49% of export revenue on top 1% of exported products
- spends ≈ 41% of import expenditure on top 1% of imported products

Concentration facts II





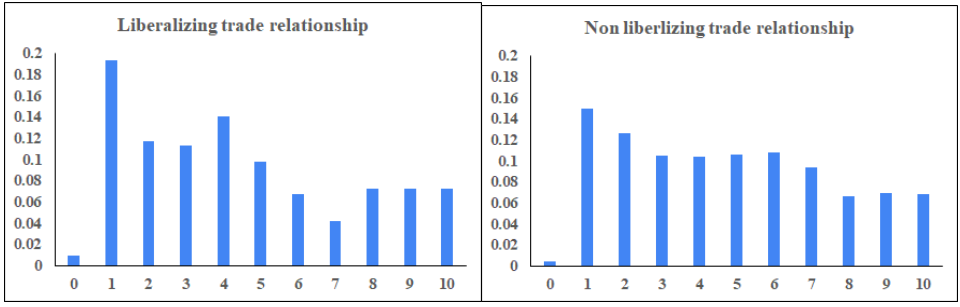
- Poorer countries are more concentrated on exports **and** imports
- Cross-country patterns driven by extensive and intensive margins

Concentration facts III

	Theil Exports			Theil Imports		
	Total	Extensive Margin	Intensive Margin	Total	Extensive Margin	Intensive Margin
Log(GDPpc.)	-0.807***	-0.474***	-0.333***	-0.227***	-0.147***	-0.080***
	[0.079]	[0.030]	[0.067]	[0.028]	[0.015]	[0.022]
Year FE	No	No	No	No	No	No
R2	0.36	0.55	0.12	0.26	0.44	0.05
Observations	3025	3025	3025	3025	3025	3025

- Negative relationship between concentration and income for **exports and imports** on all margins
- Robust to inclusion of country size (population) and year fixed effects

Least-Traded Products facts (from Kehoe and Ruhl, 2013 JPE)



- After a trade liberalization, massive increase in Least-Traded Products (left figure)
  - Canada-US, 1985-1995, SITC Rev1 5-digit
  - Note that "zeroes" play a small part — not "New Goods Margin"
- If no trade liberalization, no change in Least-Traded Products (right figure)
  - USA-Italy, 1985-1995, SITC Rev1 5-digit

Summary

- Concentration:
  1. Export > Import
  2. Intensive margin > extensive margin
  3. More important in poorer countries

- Least-Traded Products:
  1. After a trade liberalization, LTPs experience more-than-normal growth
  2. The LTP margin is **not** coming from "zeroes"

Model

- Build a multi-country multi-product Ricardian trade theory
- Standard Eaton-Kortum production for every product
- S-Branch utility tree (Brown and Heien, 1972) preferences
  - Class of Non-homothetic preferences with linear expenditure system
  - Endogenously generates zero demand for some products; more so for poorer countries
  - Number of imported products increases with income

Production (EK for every product)

$$q(u,x) = x^{-\theta}(u)l(u)$$

- $x(u)$ .. productivity ($x(u) \sim \exp(\lambda)$) with $E(x) = \lambda$ (absolute advantage)
  - Productivity distribution is independent of product u
  - Country can supply variety (x,u) even without domestic demand
- θ .. productivity dispersion (degree of comparative advantage)
- $l(u)$ .. labor input

Perfect competition and free movement of labor across products; domestic price:

$$p(u,x) = x^{\theta}(u)w$$

Household

S-Branch utility tree

$$\max_{q(u)} Q = \left(\int_0^1 (q(u) + \kappa u)^{\frac{\sigma-1}{\sigma}} du \right)^{\frac{\sigma}{\sigma-1}}$$

- u .. designates the product (standard EK: $\kappa = 0$)
- $q(u)$ .. tradable variety within product u
- σ .. elasticity of substitution

Budget constraint:

$$\int_0^1 q(u)p(u)du = wL$$

Demand for product $q(u)$:

$$q(u) = \max \left(q(0) \times \left(\frac{p(u)}{p(0)} \right)^{-\sigma} - u > 0, 0 \right)$$

Number of products increases with income

- Cut-off price for products with positive demand:

$$\bar{p}(u) = p(0)\left(\frac{q(0)}{u}\right)^{1/\sigma}$$

- Range of products consumed with price below cut-off:

$$Prob(0 < p(u,x) < \bar{p}(u)) = Prob\left(0 < x < (\bar{p}(u)/w)^{1/\sigma}\right)$$

- Richer countries (higher w) demand more products

Trade pattern determined by relative unit cost of production

- Country i buys variety u from country j with lowest price

$$p_i(u,x) = \min_j \left[\left(w_j / \kappa_{ij} \right) x_j^{\theta}(u) \right]$$

  - κ_{ij} ... inverse of trade costs

- Probability that country i imports variety x from country j

$$D_{ij}(u) = \frac{\left(w_j / \kappa_{ij} \right)^{-1/\theta} \lambda_j}{\sum_{k=1}^{I} \left(w_k / \kappa_{ik} \right)^{-1/\theta} \lambda_k}$$

  - If demanded, import decision does not depend on product characteristic.

Equilibrium conditions

- Balance of payments condition

$$\underbrace{L_i \sum_{j=1}^{I} D_{ij} \int_0^1 E(q_{ij}(u)p_{ij}(u)du}_{\text{Expenditure (domestic + imports)}} = \underbrace{\sum_{k=1}^{I} L_k D_{ki} \int_0^1 E(q_{ki}(u)p_{ki}(u)du}_{\text{Sales (domestic + exports)}} + \underbrace{D_i}_{\text{deficit}}$$

  - D_i .. exogenous current account deficit (taken as given)

- Labor market clearing

$$L_i = \int_0^1 l(u)du$$

$\Rightarrow$ Find equilibrium vector w_i that clears all markets

Concentration on the extensive margin

- Probability that j exports good u to i

$$D_{ij}(u) = \frac{\left(w_j/\kappa_{ij}\right)^{-1/\theta}\lambda_j}{\mu_i} \quad \text{where} \quad \mu_i = \sum_{k=1}^{I}\left(w_k/\kappa_{ik}\right)^{-1/\theta}\lambda_k$$

  - Absolute advantage ($\lambda_j \uparrow$): j has less export concentration
  - Trade costs decrease ($\kappa_{ij} \uparrow$): j has less export concentration, i has less import concentration
  - Comparative advantage ($\theta \uparrow$) : cross-country differences matter more for concentration

- Share of goods that i imports

$$N_i^I = \int_0^1 \sum_{j\neq i}^{I} D_{ij}(u)du_i = \int_0^1 \int_0^{(\bar{p}_i(u_i)/w_i)^{1/\sigma}} (1 - D_{ii})\mu_i e^{-\mu_i x_i} dx_i du_i$$

  - i has less concentration if more productive ($\lambda_i \uparrow$) and lower trade costs ($\kappa_{ij} \downarrow$)

Concentration on the intensive margin

- Heterogeneity in production (θ) and demand (σ) are the same across countries
  - With Fréchet distribution (case for product $u = 0$), concentration of sales and expenditures depends only on θ and σ

$$T_i^{IN} = \log\left(\Gamma(1+\theta(1-\sigma))\right) - \int_0^{\infty} \log\left(y^{\theta(\sigma-1)}\right) y^{\theta(\sigma-1)} e^{-y} dy$$

    - i will concentrate with higher $\theta \uparrow$ and elasticity of substitution $\sigma \uparrow$
  - For truncated Frechet (case for products $u > 0$), truncation at lower end of productivity draws increases concentration
- Across products, concentration of sales/expenditures depends on:
  - $\theta \uparrow$, $\sigma \uparrow$ and range of products exported $\downarrow$ and imported $\downarrow$

Computational exercise

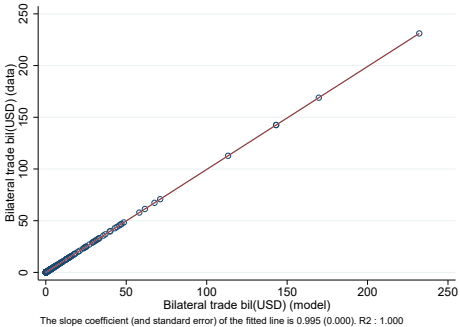
Sample and sources:

- Use 24 largest countries in the world (new results with 77 largest countries soon)
- Variance of productivity draws: $\theta = 0.15$ (Waugh, 2012)
- Elasticity of substitution: $\sigma = 5$ (Head and Mayer, 2013)
- Labor endowments and GDP per capita are from Penn World Table

Strategy:

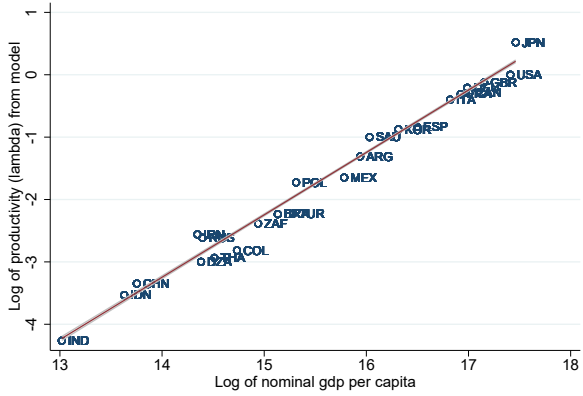
- Discretize u in 100,000 cells; map cells to HS 6-digit products using trade volume (many cells-to-products)
- Calibrate trade costs, productivity to match bilateral trade flows and cross-country income differences
- Validate exercise by simulating concentrations and comparing to data

Calibrated bilateral trade and trade costs



- Bilateral trade match perfectly by construction
- Model implied trade costs match trade costs from gravity
  - Gravity variables: border, distance, origin/destination fixed effects

Estimated technology versus income per capita



- Model implied productivity correlates well with income per capita

Simulated concentration levels

	Theil Exports			Theil Imports		
	Total	Extensive Margin	Intensive Margin	Total	Extensive Margin	Intensive Margin
Mean (Data)	4.44	0.77	3.67	2.54	0.22	2.32
Share (Data)		14%	86%		8%	92%
Mean (Benchmark)	3.83	2.1	1.73	2.48	1.05	1.43
Share (Benchmark)		53%	47%		41%	59%
Mean (Homothetic)	3.4	1.59	1.81	2.14	0.59	1.55
Share (Homothetic)		47%	53%		28%	72%

- Simulation results are broadly consistent with overall concentration
  - Not for split between extensive and intensive

Simulated concentration levels: cross-country differences

	Theil Exports			Theil Imports		
	Total	Extensive Margin	Intensive Margin	Total	Extensive Margin	Intensive Margin
			Data			
Log(GDPpc.)	-0.807***	-0.474***	-0.333***	-0.227***	-0.147***	-0.080***
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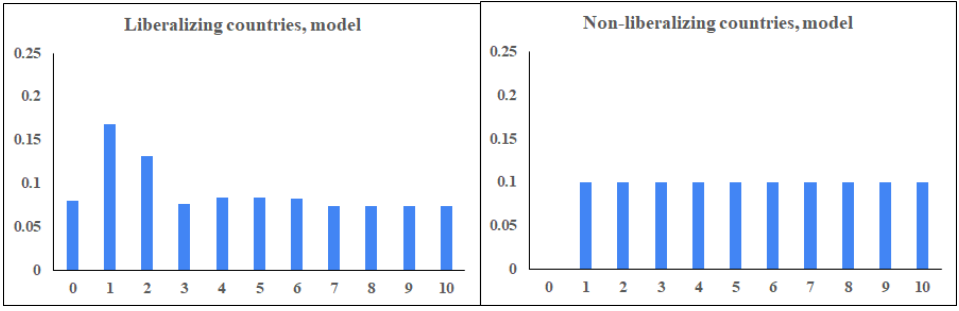
R2	0.36	0.55	0.12	0.26	0.44	0.05
			Benchmark			
Log(GDPpc.)	-0.385***	-0.426***	0.041	-0.176***	-0.274***	0.098***
	[0.076]	[0.097]	[0.055]	[0.026]	[0.045]	[0.022]
R2	0.54	0.47	0.02	0.68	0.63	0.47
			Homothetic			
Log(GDPpc.)	-0.333***	-0.353***	0.020	-0.007	-0.019	0.013
	[0.064]	[0.095]	[0.063]	[0.016]	[0.037]	[0.022]
R2	0.55	0.39	0.00	0.01	0.01	0.01

Simulated results for concentration

- Benchmark model matches:
  - Export > Import concentration
  - Concentration intensive margin > extensive margin
  - Concentration declines with per capita income
- Model doesn't match concentration at extensive and intensive margin
  - First: Analyze results with 77 countries; action in intensive margins comes from smaller countries, absent in our exercise
  - Second: Fine-tune the calibration (σ and θ) may be necessary; maybe play with functional form on u

Simulated results for LTP, benchmark



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  - Consistent with LTP facts
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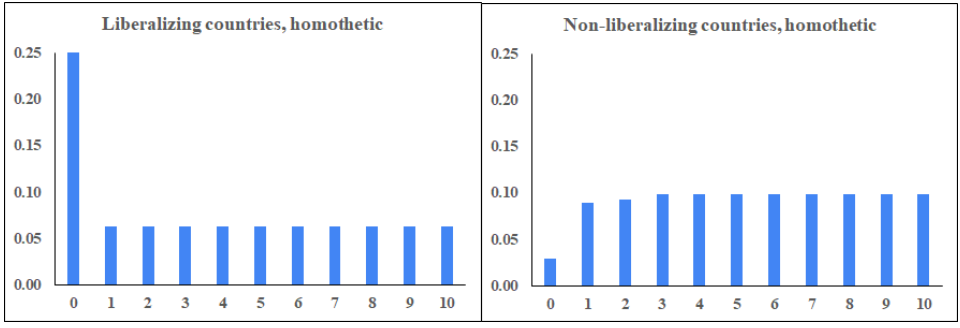
Simulated results for LTP, homothetic



- After a trade liberalization, no increase in Least-Traded Products (left figure)
  - Not consistent with LTP facts
  - All the action in the "zeroes"
- If no trade liberalization, no change in Least-Traded Products (right figure)

Conclusion

- A small tweak to the preferences in the Eaton-Kortum trade model delivers:
  - a quantitative a model that matches import and export concentration
  - a quantitative model that account for the Least-Traded Products margin