Romer or Ricardo?

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Romer or Ricardo?

- Classic Krugman and Grossman-Helpman models of Global Product Life-Cycle
  - Rich country creates new varieties (Romer)
  - Poor country imitates rich country's products (Aghion-Howitt, Grossman-Helpman)
  - Rich country exports new varieties (Krugman trade)
  - Poor country exports Ricardian products
- We extend the Krugman/Grossman-Helpman model
- And empirically discipline it based on export and import growth rates by product category

Romer + Ricardo Model

- Relative to Krugman/Grossman-Helpman:
  - Do not make polar assumptions about how countries innovate and what they trade
  - No assumptions about what poor vs. rich countries do
  - 20 countries (covering 95% of world trade) rather than Rich vs. Poor
- Ingredients:
  - Trade due to both horizontal varieties and vertical comparative advantage
  - New variety creation (potentially in every country)
  - Improvements upon quality of imported varieties
    - Imperfect spillovers when poor country imitates an import from rich country
  - Countries improve quality of their own varieties

Why do we care?

- Gains from trade
  - Larger if trade facilitates idea inflows (e.g., creative destruction of imports)
  - Buera and Oberfield (2020), Hsieh, Klenow and Nath (2021)
- Optimal growth
  - Business stealing effects from creative destruction (Atkeson and Burstein, 2019)
  - Countries may not internalize the benefits of their own innovation on growth abroad
- Labor market effects of growth and trade
  - New varieties are less disruptive (require less employment reallocation)
  - Creative destruction is more disruptive (e.g. Dix-Carneiro and Kovak, 2017)

Growth: Innovation from all sources

- World growth (same in all countries) depends on innovation in *all* countries
  - Negative externality from innovation on imports by poor country
  - Own innovation by poor country builds on lower quality
  - Quality improvement on imports by other countries builds on lower quality
- Country specific innovation $\rightarrow$ TFP
  - What matters is innovation from *all* sources
  - Rich (poor) countries do not have to create new varieties (imitate rich countries)

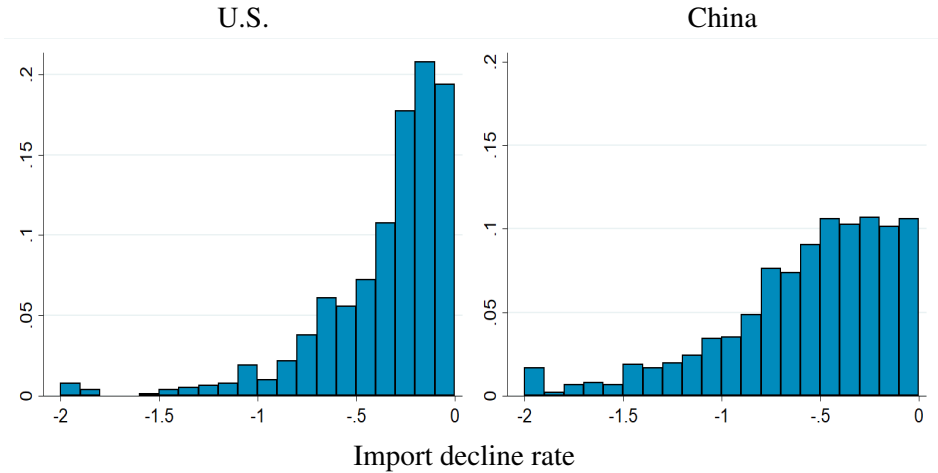
Trade: Innovation on imports vs. new varieties

- Trade in Steady State:
  - New varieties $\rightarrow$ Export Romerian products
  - Innovate on imports $\rightarrow$ Export Ricardian products
- Product Life-Cycle
  - Products reallocate across countries
  - Romer $\rightarrow$ Ricardo
  - Technology diffuses to more countries (become "more Ricardian")
  - Exports diffuse to smaller countries as quality improves/costs fall

Romer + Ricardo Model: Inference

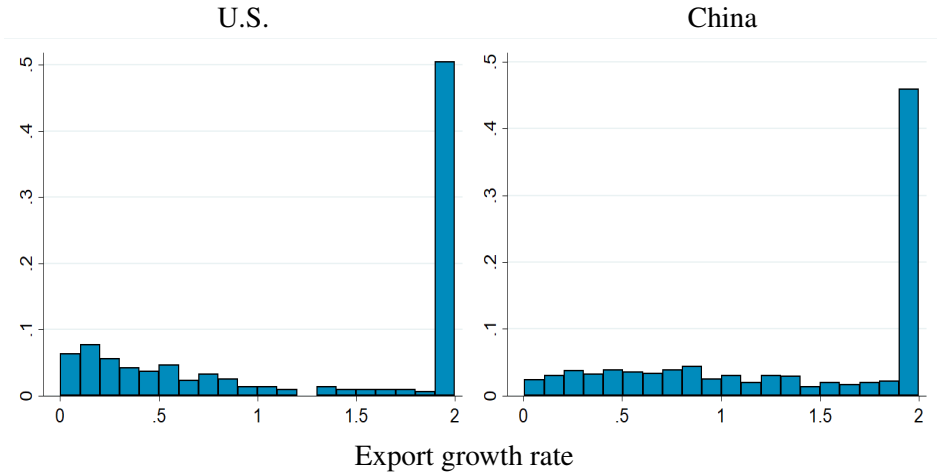
- Growth and trade determined by rates of each type of innovation
- Innovation affects the *distribution* of import and export growth rates
  - New varieties or innovation on imports $\rightarrow$ new exports (or large increases)
  - Innovation on imports $\rightarrow$ exit of imports (or large declines)

Empirical distribution of import decline, U.S. vs. China



More innovation on imports in China compared to U.S.

Empirical distribution of export growth, U.S. vs. China



Innovation on imports + new products about the same in U.S. and China

$\rightarrow$ More creation of new products in U.S.

Preview of our findings

- Growth accounting
  - 43% of growth comes from new products
    - includes products that are new to the country but not the world
  - 44% of growth comes from foreign innovation
    - more important in smaller countries (up to 90%)
  - U.S. is an outlier: 64% from new products, 26% from foreign
- Trade accounting
  - Romerian share: 32% for the World, 87% for the U.S., 1% for China
- Global product life cycle
  - As a product ages, the U.S. share falls and “other rich” share rises

Static portion of our model

- Technology
  - Romerian vs. Ricardian products
  - Linear production in labor (fixed factor)
  - CES demand
  - Fixed cost to sell in each market
  - Variable trade cost to sell in foreign market
- Trade
  - Romerian products sold in countries where profits cover fixed cost
  - Ricardian products also have to be lowest cost supplier in each country
- Distribution of World TFP
  - Technology, labor endowment, and balanced trade

Innovation in country j: Romerian and Ricardian growth

- Creation of new varieties: κ_j
  - Random draw over quality of country j's existing products
- Quality ladder growth on domestic products: λ_j
  - Quality improvement over existing product $\sim$ Pareto $(1, \theta)$
  - Always replace incumbent producer
- Quality ladder growth on imported products: δ_j
  - Quality improvement over foreign incumbent $\sim$ Pareto (α, θ)
  - $\alpha = 1$ for rich and poor on poor; $\alpha < 1$ for poor on rich
  - Probability of success: $\left(\alpha_j \frac{w_k}{w_j} \tau\right)^{\theta}$
  - Diminishing returns to innovation due to relative wage

Arrival rates of innovation in country j

	Domestic Innovation	Foreign Innovation
Existing products in j		
Exported	λ_j	$\delta_k \left(\frac{w_j}{w_k \tau} \right)^{\theta}$
Non-traded	λ_j	$\lambda_k \left(\frac{w_j}{w_k \tau} \frac{A_{ik}}{A_{ij}} \right)^{\theta}$
Imported	$\delta_j \left(\frac{w_k \tau}{w_j} \right)^{\theta}$	λ_k
New products in j		
New to World	κ_j	κ_k
New to country j	–	$\delta_k \left(\frac{w_l}{w_k} \right)^{\theta}$

Decomposing growth into quality improvements versus new varieties

$$\mathbb{E}\left[(1+g_j)^{\sigma-1}\right] = 1 + \underbrace{\left(x_j^x + x_j^n\right)\,\lambda_j\,S_{\lambda_j} + x_j^x\delta_j^*\,S_{\delta_j^*} + x_j^n\lambda_j^*\,S_{\lambda_j^*}}_{\text{quality improvement on domestic products}}$$

$$+ \underbrace{x_j^m\left[\widetilde{\delta}_j\,S_{\widetilde{\delta}_j} + \widetilde{\lambda}_j^*\,S_{\widetilde{\lambda}_j^*}\right]}_{\text{quality improvement on imports}} + \underbrace{\left(x_j^x + x_j^n\right)\left[\kappa_j\,S_{\kappa_j} + \kappa_j^*\,S_{\kappa_j^*}\right] + x_j^o\,\widetilde{\delta}_j^*\,S_{\widetilde{\delta}_j^*}}_{\text{new varieties}}$$

$$- \chi_j\,S_{\chi_j} - \chi_j^*\,S_{\chi_j^*}$$

Decomposing growth into domestic and foreign sources

$$\mathbb{E}\left[(1+g_j)^{\sigma-1}\right] = 1 + \underbrace{\left(x_j^x + x_j^n\right)\lambda_j\, S_{\lambda_j} + x_j^m\, \widetilde{\delta}_j\, S_{\widetilde{\delta}_j} + \left(x_j^x + x_j^n\right)\kappa_j\, S_{\kappa_j}}_{\text{domestic innovation}}$$

$$+ \underbrace{x_j^x\, \delta_j^*\, S_{\delta_j^*} + x_j^n\, \lambda_j^*\, S_{\lambda_j^*} + x_j^m\, \widetilde{\lambda}_j^*\, S_{\widetilde{\lambda}_j^*} + \left(x_j^x + x_j^n\right)\kappa_j^*\, S_{\kappa_j^*} + \widetilde{\delta}_j^*\, S_{\widetilde{\delta}_j^*}}_{\text{foreign innovation}}$$

$$- \chi_j\, S_{\chi_j} - \chi_j^*\, S_{\chi_j^*}$$

Indirect Inference

- Data on relative wages
  - Innovation rate (from all sources) relative to the U.S.
- Data on trade shares
  - Trade costs (fixed costs and variable costs)
- Data on the share of large export growth rates
  - New varieties and creative destruction of imports
- Data on the frequency of big import declines
  - Creative destruction of imports
- Data on the share of small export growth rates
  - Innovation on domestic varieties
- Aggregate growth rate
  - Quality step size

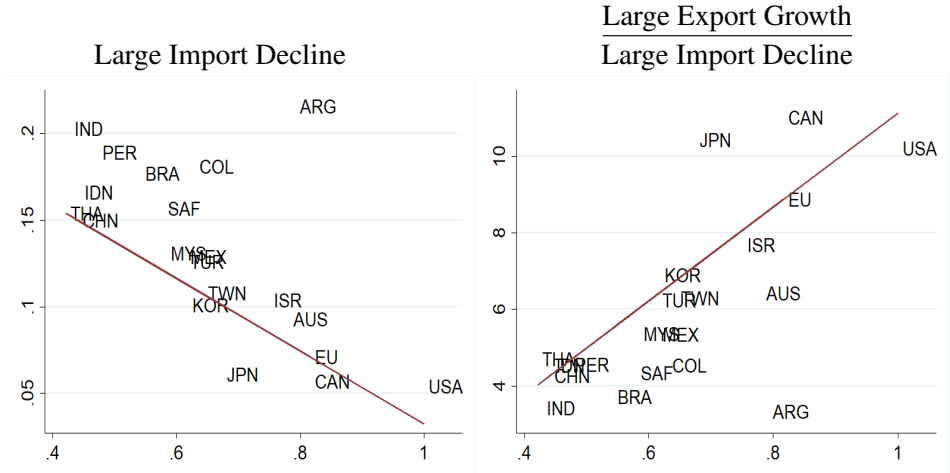
Dataset

- 4-digit SITCs in Feenstra's dataset (average of 1991-1996 through 2011-2016)
- 20 countries (EU is one country) accounting for 95% of world trade
- Normalize total growth of exports and imports of each country to zero
  - Growth rate of exports between t and $t + 5 = \Delta$ exports / average exports
  - New exports = +2, Exiting exports = –2
- Exports with strong positive growth
  - Share of growing export categories with growth rate > 1
- Imports with strongly negative growth
  - Share of shrinking import categories with growth rate < -1
- Imports with strongly negative growth from poor countries versus from rich countries

20 countries

Rich Countries		Poor Countries	
U.S.	South Korea	Thailand	Mexico
Canada	Colombia	Turkey	South Africa
EU	Israel	China	Indonesia
Japan	Australia	Malaysia	Peru
Argentina	Taiwan	India	Brazil

Import declines, export growth, and TFP levels

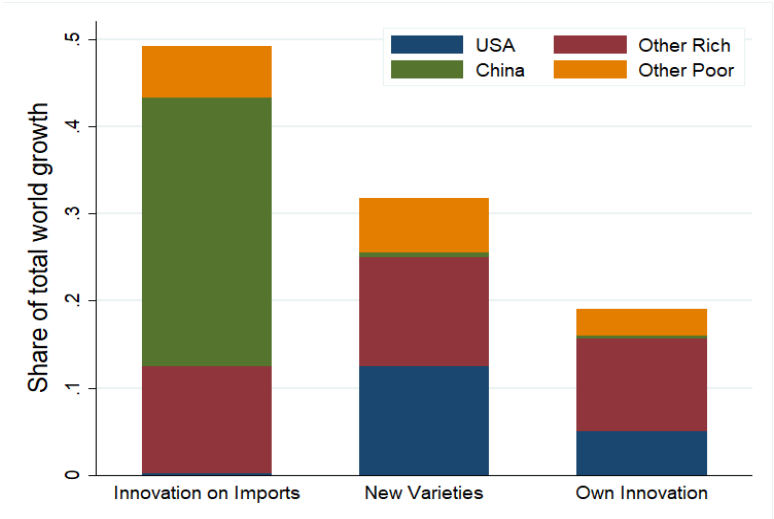


TFP (U.S.=1)

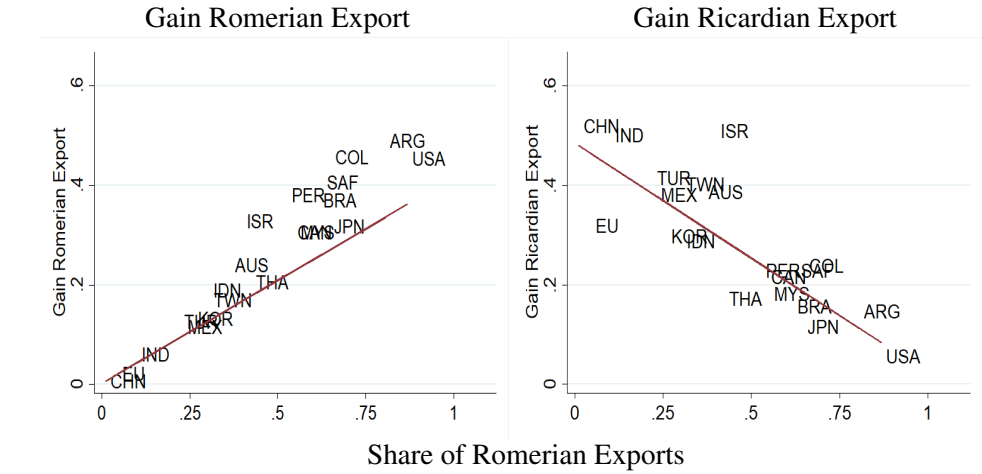
Growth from innovation on imports and creation of new products

	U.S.	Other Rich	China	Other Poor
Innovation on imports	9.3%	28.2%	82.8%	48.6%
Creation of new products	62.4%	43.8%	11.0%	28.8%

Sources of *world* growth



Gain of Romerian/Ricardian exports vs. Romerian trade share

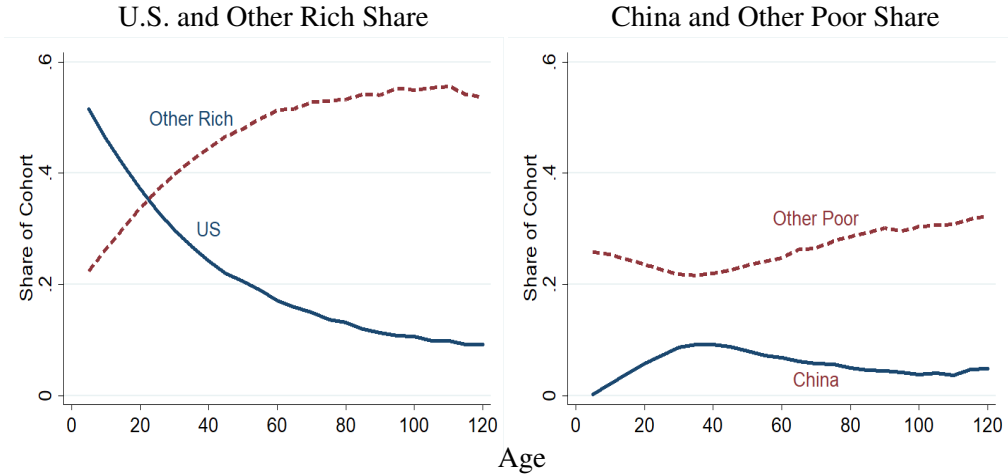


Share of Romerian Exports

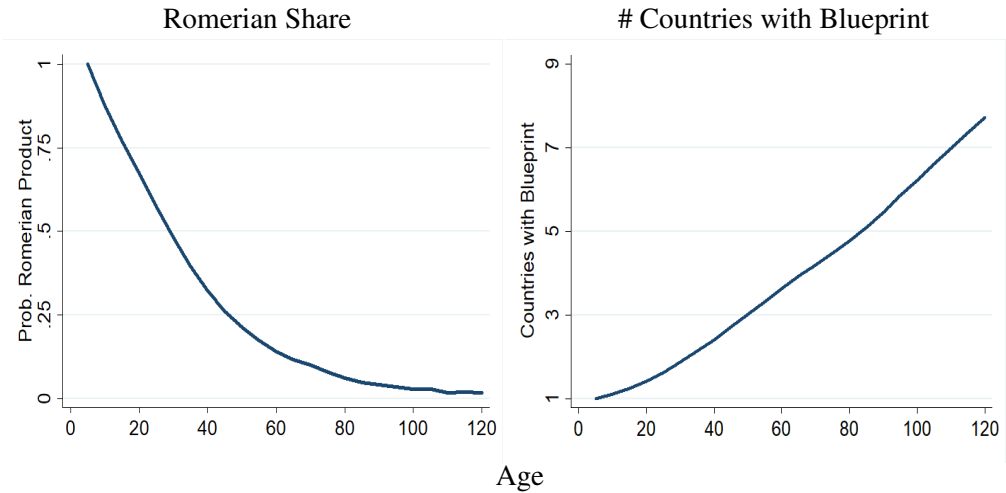
Mostly Romerian exports: US, Argentina

Mostly Ricardian exports: India, China, EU

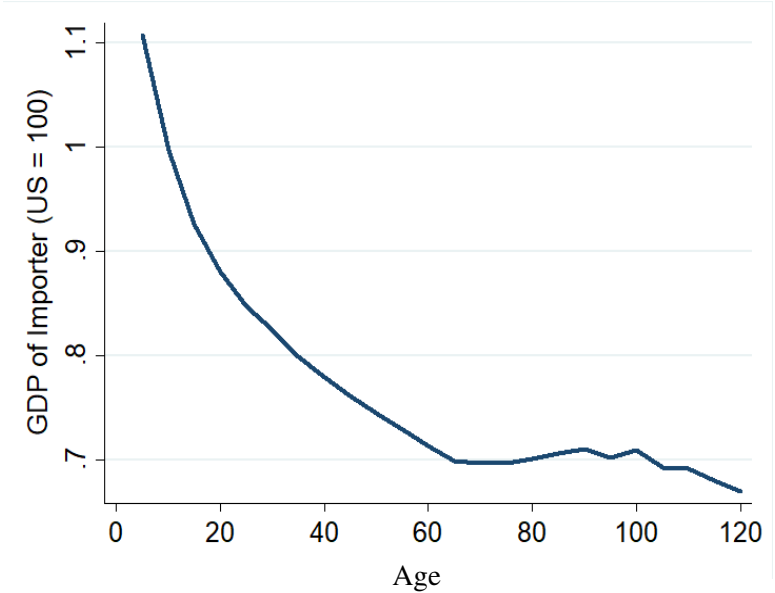
Reallocation of products across countries



Products become “more Ricardian” with age



Exports diffuse to smaller countries with age



Recap of our findings

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  - 43% of growth is Romerian
  - 44% of growth is from foreign innovation
  - U.S. is an outlier: 64% Romerian, 26% from foreign
- Trade accounting
  - Romerian share: 32% for the World, 87% for U.S., 1% for China
- Global product life cycle
  - U.S. share falls, and “other rich” share rises as products age