

# COMPARATIVE ADVANTAGES WITH PRODUCT COMPLEXITY AND PRODUCT QUALITY



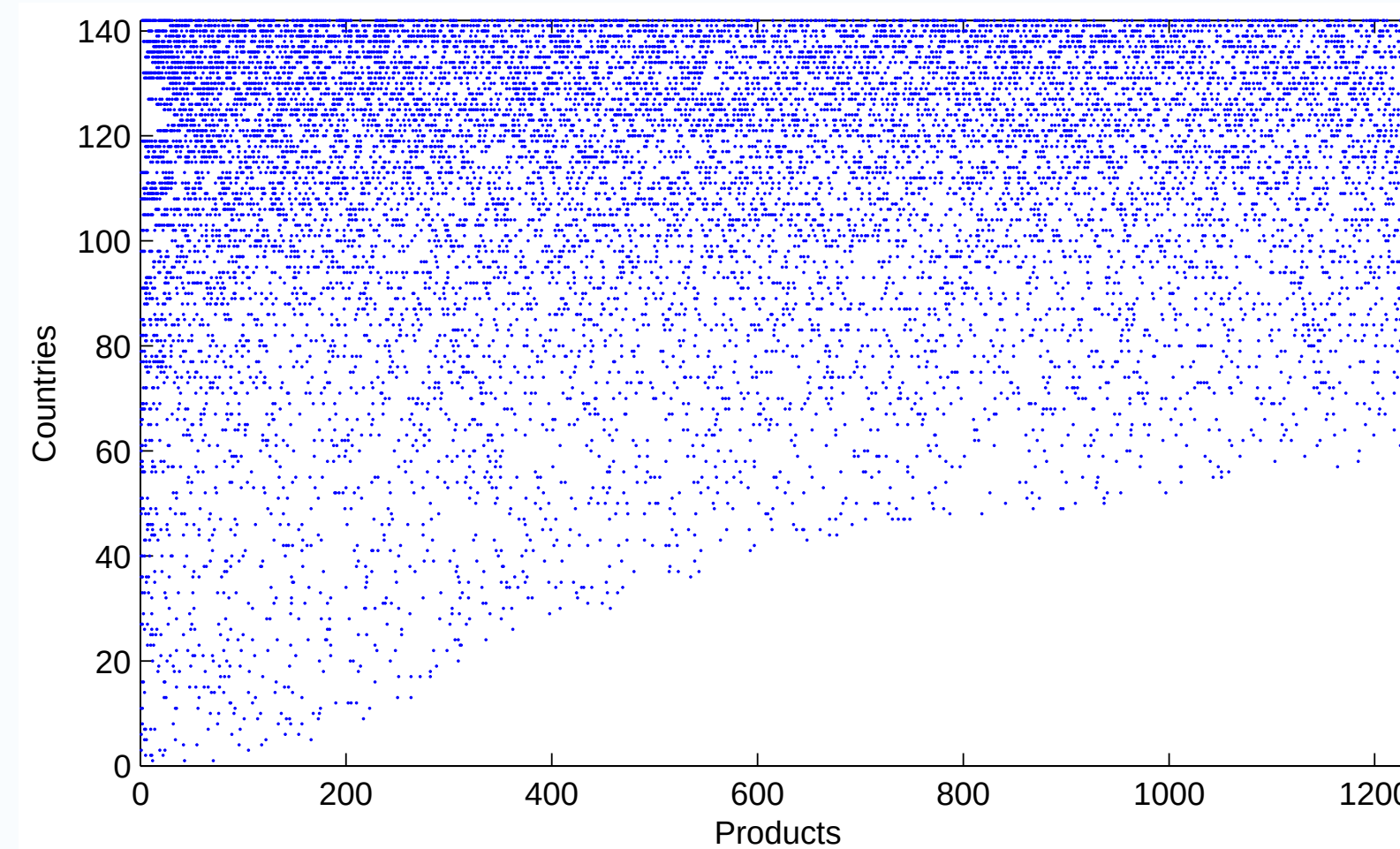
ULRICH.SCHETTER@UNISG.CH

## RESEARCH QUESTION

- It is well known that richer countries export higher quality (Schott, 2004)
- Yet, when analyzing comparative advantages, we typically assume that product characteristics are exogenous (e.g. capital intensity or contract dependence) and that countries compete within products by providing the same good
- How does quality differentiation impact comparative advantages and hence specialization across products?

## KEY RESULTS AND IMPLICATIONS

Quality differentiation supports a 'nestedness' pattern of international specialization

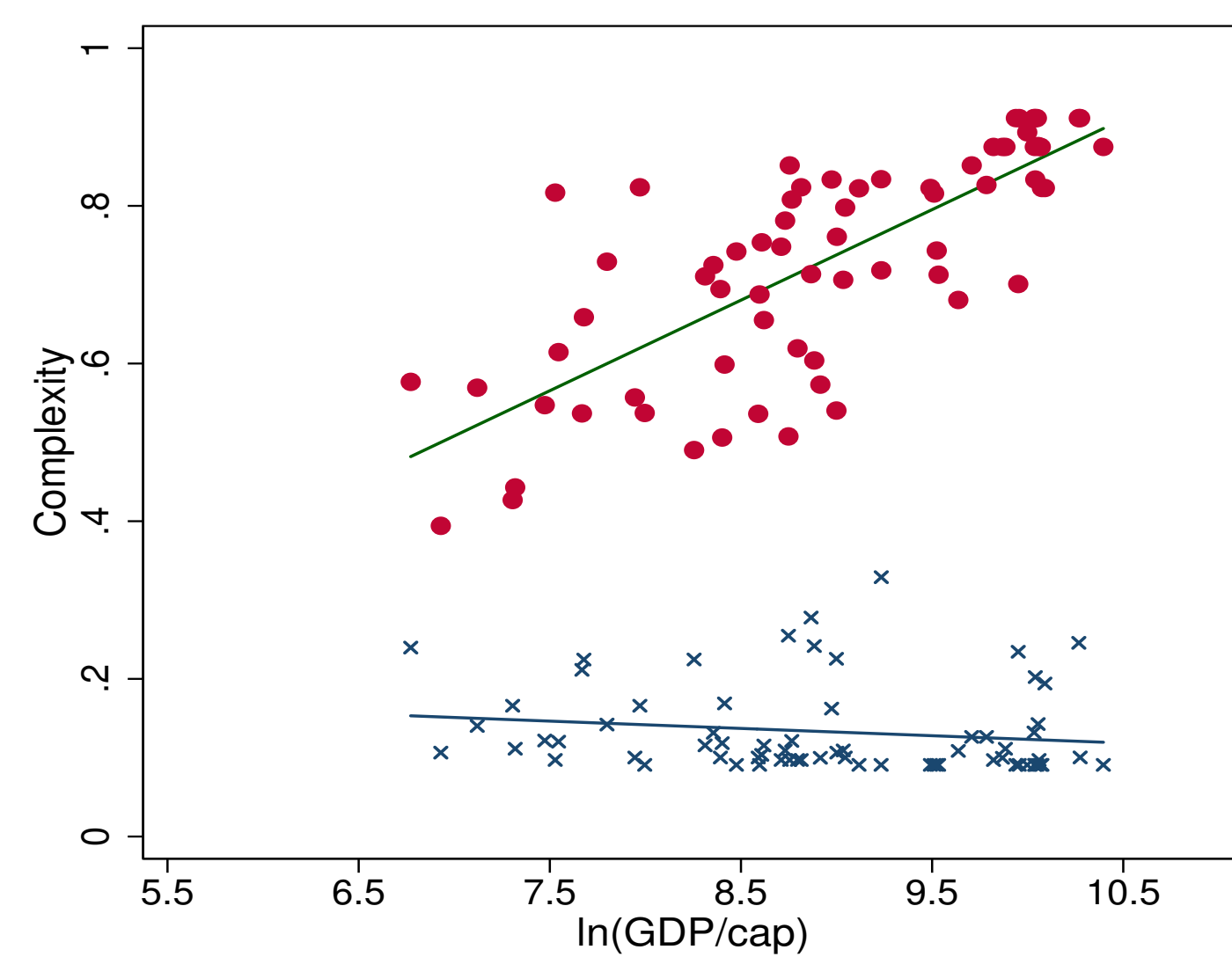


Implications

- Leads to a censored regression model to estimate the link between a country's GDP per capita and the quality of its exports
- Gains from international specialization across products mostly accrue to developing countries
- Can explain why over time rich and poor countries increasingly export the same products

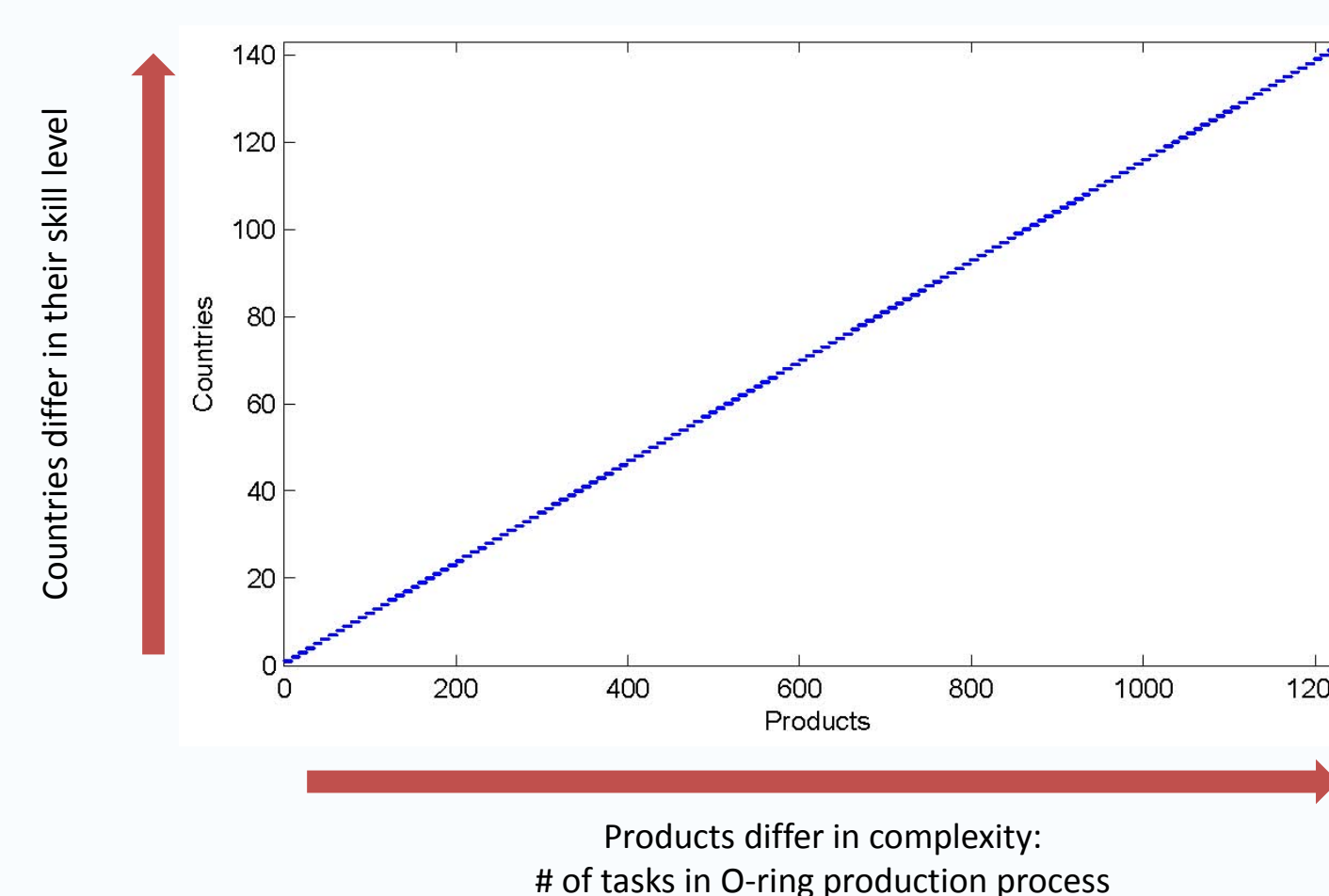
## STYLIZED FACT

Industrialized countries are active across the full range of products while developing countries specialize in 'simpler' products

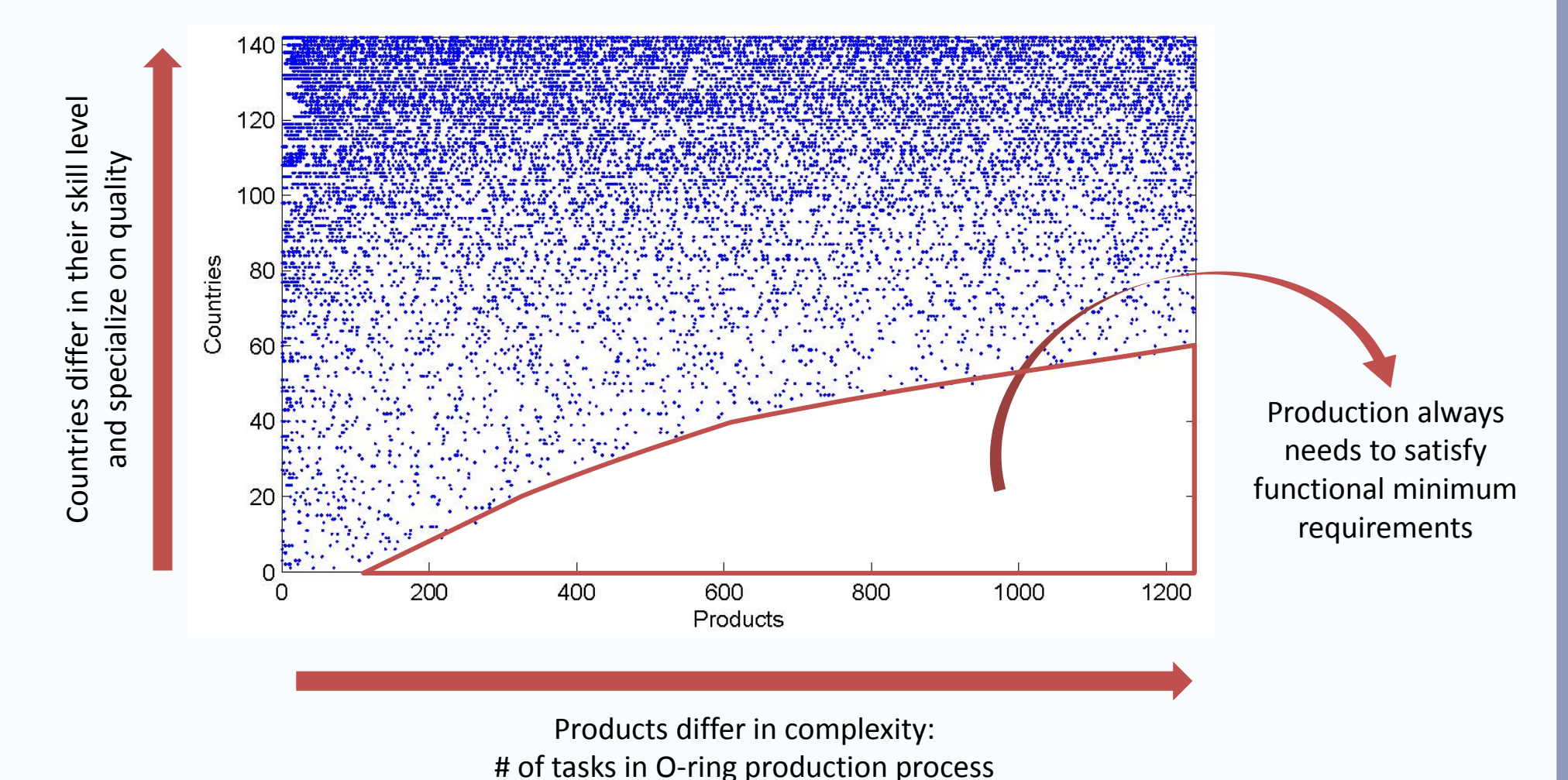


## ECONOMIC ENVIRONMENT AND MAIN MECHANISM

- Ricardian model with many countries that differ in their skill level  $r$  and many products that differ in their complexity  $i$  (based on Costinot, 2009)
- Comparative advantages rooted in a complementarity between a country's skill and the difficulty of production  $\sigma(i, q)$



- Firms take  $i$  as given and endogenously choose quality  $q$
- For a given product, quality differentiation allows firms to tailor their output to better match the skill levels of their workforce
- Quality differentiation subject to functional minimum-requirements (product specific)



## DETAILS

- Box-size-quality preferences

$$U \left( \left\{ v_i \left( \int_{q \in Q_i} q c_{i,q} dq \right) \right\}_{i \in \mathcal{I}} \right)$$

- CRS production technology

$$x_{i,q} = f(r, \sigma(i, q)) L(r)$$

- Optimal quality maximizes productivity in quality-adjusted terms

$$q_i(r) := \arg \max_{q \geq 1} q f(r, \sigma(i, q))$$

- Key assumptions

- Complementarity between skills and difficulty of production

$$\frac{\partial^2 \ln(f(\cdot))}{\partial r \partial \sigma} > 0, \quad \sigma_i > 0, \quad \sigma_q > 0$$

- Quality upgrading more demanding for more complex products

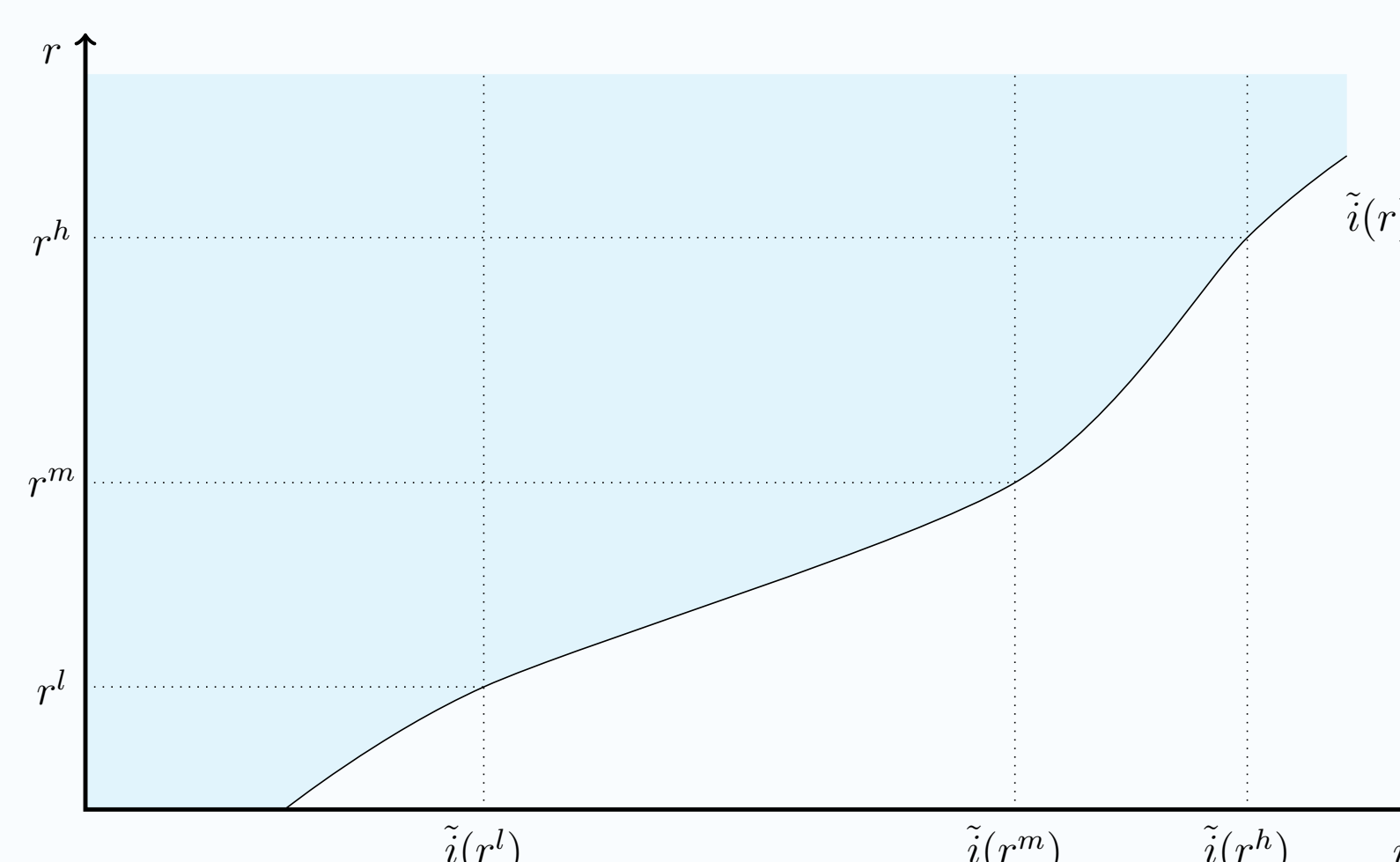
$$\frac{\partial}{\partial i} \left[ \frac{\partial \ln(\sigma(\cdot))}{\partial q} q \right] \geq 0$$

- $q_i(r)$  is increasing in  $r$  (1), decreasing in  $i$  (2), i.e. in country  $r$  all products  $i \leq \tilde{i}(r)$  can be produced at 'preferred quality'

## COMP. ADVANTAGE

- Comparative advantages driven by productivity in quality-adjusted terms

$$\begin{aligned} \frac{d^2 \ln(q_i(r) f(\cdot))}{dr di} &= \underbrace{\frac{\partial^2 \ln(f(\cdot))}{\partial r \partial \sigma}}_{\textcircled{1}: > 0} \underbrace{\sigma_i}_{> 0} \\ &+ \underbrace{\frac{\partial^2 \ln(f(\cdot))}{\partial r \partial \sigma}}_{\textcircled{1}: > 0} \underbrace{\sigma_q}_{> 0} \underbrace{\frac{dq_i(r)}{di}}_{\textcircled{2}: \leq 0} \\ &= 0 \text{ if } \sigma(i, q) = iq \end{aligned}$$



## EMPIRICS

- According to theoretical model: country is competitive for a product iff it can produce at preferred quality
- Censored regression model

$$\ln(\tilde{q}_{i,t}^k) = \mathbf{d}_{i,t} \alpha_i + \beta_i \ln(y_t^k) + u_{i,t}^k$$

$$u_{i,t}^k | \mathbf{d}_{i,t}, y_t^k \sim N(0, \sigma_i^2)$$

$$\ln(q_{i,t}^k) = \begin{cases} \ln(\tilde{q}_{i,t}^k) & \text{if } \tilde{q}_{i,t}^k \geq 1 \\ \text{NaN} & \text{otherwise} \end{cases}$$

|                                         | OLS   | ML    |
|-----------------------------------------|-------|-------|
| Mean $\beta_{\ln(GDP/cap)}$             | 0.13  | 0.96  |
| Share $\beta_{\ln(GDP/cap)}$ pos.       | 82.3% | 99.8% |
| Share $\beta_{\ln(GDP/cap)}$ pos. at 5% | 51.3% | 98.6% |
| Share $\beta_{\ln(GDP/cap)}$ pos. at 1% | 39.2% | 98.3% |
| Share $\beta_{\ln(GDP/cap)}$ neg. at 5% | 4.8%  | 0%    |
| Controls                                | No    | No    |
| Year FE                                 | Yes   | Yes   |
| Mean(R <sup>2</sup> )                   | 0.64  |       |
| Mean(N)                                 | 1429  | 2215  |

## EQUILIBRIUM WITH $\sigma(i, q) = iq$

- With no functional minimum-requirements, production is always at preferred quality, i.e. there are no comparative advantages
- Unique equilibrium wage ( $w_r = 1$ )

$$w_r = \tilde{g}(r) \quad \forall r \in \mathcal{R}$$

$$\tilde{g}(r) := \frac{\tilde{q}_i(r) f(r, \sigma(i, \tilde{q}_i(r)))}{\tilde{q}_i(r) f(r, \sigma(i, \tilde{q}_i(r)))}$$

$\tilde{q}_i(r)$ : preferred quality

- With functional minimum-requirements same equilibrium wage if sufficient skills

$$L \int_{\tilde{r}(\hat{i})}^{\tilde{r}} \tilde{g}(r) dF_r(r) \geq \int_{i \in \mathcal{I}: i \geq \hat{i}} \tilde{L}_i^d di, \quad \forall \hat{i} \in \mathcal{I}$$

- Each country competitive for all products that it can produce at preferred quality  $i \leq \tilde{i}(r)$

- $\tilde{i}(r)$  increasing  $\Rightarrow$  'nestedness'

## GAINS FROM TRADE

- With sufficient skills: country  $r$  competitive for all products  $i \leq \tilde{i}(r)$
- Highest skilled countries with  $\tilde{i}(r) \geq \bar{i}$  competitive for all products
  - Same relative price of imported goods as under autarky
  - No gains from trade for highest skilled countries
- Gains from trade inversely related to  $r$