

# International Trade, Technology, and the Skill Premium

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Comment by  
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# Comments

- 1 Contributions of the paper
- 2 Empirical background
- 3 Theoretical background
- 4 Two types of skill-premia
- 5 Two types of skill-bias in technology
- 6 Interpreting the key mechanism

# Contributions of the paper

- Theoretical contribution: Better understanding of trade-related determinants of the high-skilled wage premium
  - All encompassing theoretical model (Ricardo, Heckscher-Ohlin, Melitz)
  - Allowing for within-sector reallocation
  - New channel: Skill-biased “technology mechanism”
  - Complexity  $\Rightarrow$  intractable analytically
- Empirical contribution: Orders of magnitude
  - Novel multi-country empirical calibration of the model
  - Effect of trade on skill premium
  - Effect of trade liberalization on skill premium
  - Other scenarios: China - TFP  $\uparrow$
- Readdress information content of “factor content of trade”

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# Empirical background

- Increase in wage premium for high-skill labor **across the world**
- Increase in high-skill labor relative to low-skill employment
- Heterogeneity across firms within industry regarding
  - Size and exporter status
  - But also skill-intensity of production

## Empirical background – void in existing literature

- Standard HO has strong predictions about skill premium, but predictions don't square well with facts
  - inter-industry reallocation only
  - opposite skill premium changes in developing / developed countries
- HO remains silent about heterogeneity
- Ricardo and “new new” trade theory are mostly silent about skill premium

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# Bits of explanation along traditional lines

- Non-standard HO-type insights:
  - Feenstra & Hanson (1999): North-South offshoring
    - ⇒ North (South) loses (gains) skill-intensive activity
    - ⇒ ubiquitous increase in skill-intensity
  - Epifani & Gancia (2008): Increase in country size
    - ⇒ increase in aggregate skill-intensity of production
- Feenstra & Hanson (2003): Empirically, intermediate input trade affects wages more than final goods trade
- Krugman (2008): Offshoring more to blame than conventional trade

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# This paper – questioning the consensus

- Consensus in the literature:
  - Trade explains little of what we observe in the way of rising skill premia
  - It's mostly technology!
  - Factor contents have limited information content
- This paper: This consensus misses a crucial **trade-related** mechanism
  - Intra-sectoral (inter-firm) labor reallocation
  - Skill-biased technology mechanism working in this reallocation
- Broader conclusion: corrected factor content of trade as a sufficient statistic for skill-premium effects

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# Theoretical background: conventional theory

- **Ricardian mechanism**

- Hicks-neutral cross-country differences in relative TFP
- Trade increases real rewards to **all** factors if industries are uniform in factor intensities
- HO-type factor price effects if industries differ in terms of factor intensities, even if there is no HO-type comparative advantage

- **Heckscher-Ohlin (HO)** type comparative advantage

- Differences in relative endowments with skilled labor determine comparative advantage
- Trade and trade liberalization **favor** the relatively abundant factor

⇒ **inter-sectoral** reallocation of high-/low-skilled labor drives wage effects

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# New theory: allowing for firm heterogeneity I

## Melitz (2003) firm-selection mechanism

- Costly market entry with probabilistic firm-specific productivity level
- Cut-off productivity levels for exit and export entry
- Product differentiation  $\Rightarrow$  common markup by differently productive firms  $\Rightarrow$  firm-specific market shares
- Trade (liberalization)  $\Rightarrow$  selection and inter-firm reallocation effects  $\Rightarrow$  aggregate productivity effects



## New theory: explaining firm heterogeneity II

### Bertrand-Eaton-Jensen-Kortum (2003, BEJK) selection mechanism

- Potential entry of firms with probabilistic firm-specific productivity levels, with country-specific (Ricardian) component
- No product differentiation  $\Rightarrow$  for any good  $j$  and market  $n$ :
  - Single lowest cost producer, actually producing
  - 2<sup>nd</sup>-lowest cost producer constraining the markup
- Single supplier for  $j$  in  $n$  !  $\Rightarrow$  introduce variety dimension  $\omega$

## New theory: explaining firm heterogeneity II

### Bertrand-Eaton-Jensen-Kortum (2003, BEJK) selection mechanism

- Given  $n$  and  $j$ , cost of supplier from  $i$  depends on:
  - $i$ 's technology,
  - $i$ 's distance to  $n$ ,
  - $i$ 's factor prices and
  - dispersion of firm-specific productivity values

..... relative to other source countries
- For each  $n$ - $i$  pair: endogenous fraction of goods  $j$  with lowest-cost-status of  $i$
- Implies endogenous range of firms with different productivity levels in each country, each producing a different good  $(j, \omega)$

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## Extension in this model relative to existing theory

- Either paradigm: no role for factor endowments / factor intensities
- Melitz-paradigm dominating in the literature, not used here!
- This model: **Adding HO-structure to BEJK**
- $J$  different BEJK-“economies” (sectors  $j$ ) within each country  $i$ 
  - Continuum of goods (varieties)  $\omega$  within each sector  $j$
  - Short (long) run: immobility (mobility) of factors between traded and non-traded sectors
- As in BEJK:
  - Exogenous supply of high-skill and low-skill labor
  - Perfect labor markets

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## Ricardian skill premium

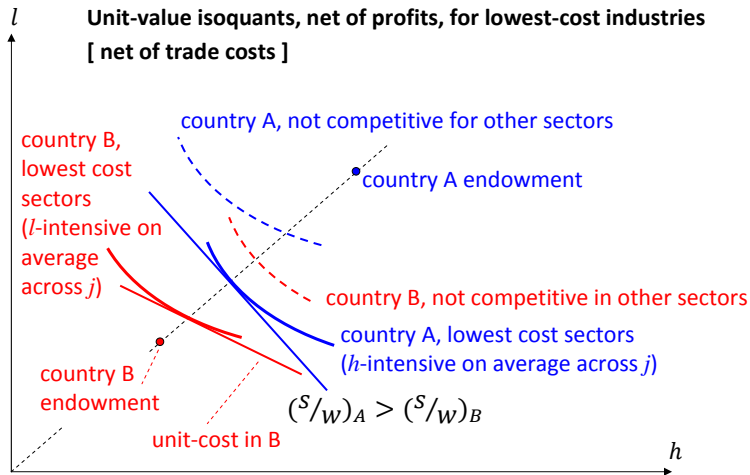
- Common endowment ratio but different technology:
  - Suppose on average across  $j$  a country B is “lowest-cost-supplier” in relatively low-skill-labor intensive goods, and conversely for A
  - $l$ -biased comparative advantage must be compensated by relatively cheap (expensive) high-skill (low-skill) labor in B:  $(s/w)_A > (s/w)_B$
- Country  $i$ 's general equilibrium: unit-value isoquants for all sectors  $j$  in  $h$ - $l$ -space (ignoring firm heterogeneity):

$$y(j)[h, l] = \left[ p_n(j) \frac{\eta - 1}{\eta} / \tau_{in}(j) \right]^{-1}$$

tangent to unit cost-line  $s_i h + w_i l = 1$  if  $y(j) > 0$

[ assuming unconstrained mark-up ]

# Ricardian skill premium





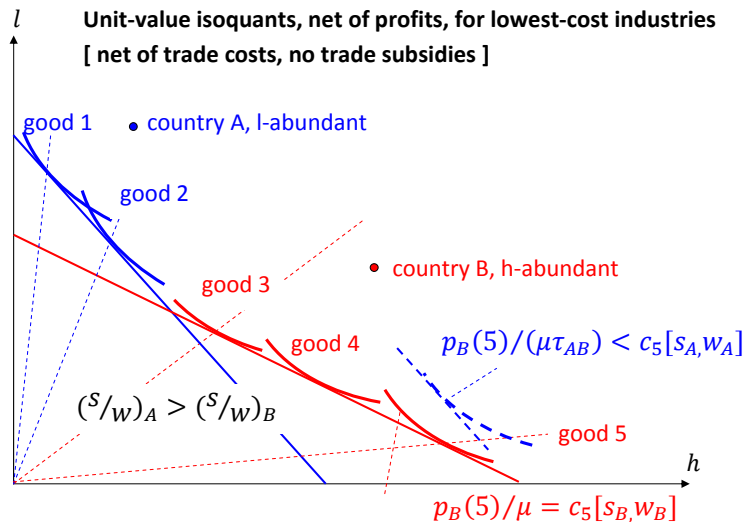
# Ricardian skill premium

- Effect of trade on skill premium
  - Increase in skill premium in A
  - Fall in skill premium in B
- **Trade liberalization:** losing/achieving lowest-cost-status of “extreme- $l$ -intensity-sectors”
  - ⇒ change in aggregate skill-intensity
  - ⇒ increase/fall in skill-premium

## Pure HO-type skill premium

- Common technology, but different endowments
  - Higher relative  $h$ -endowment in B requires relatively  $h$ -intensive “lowest-cost-in-B-sectors” on average across  $j$
  - With common technology this is possibly only with factor cost advantage through  $(s/w)_A > (s/w)_B$
- Characterization with unit cost isoquants as above, but looking at different  $j$ s explicitly

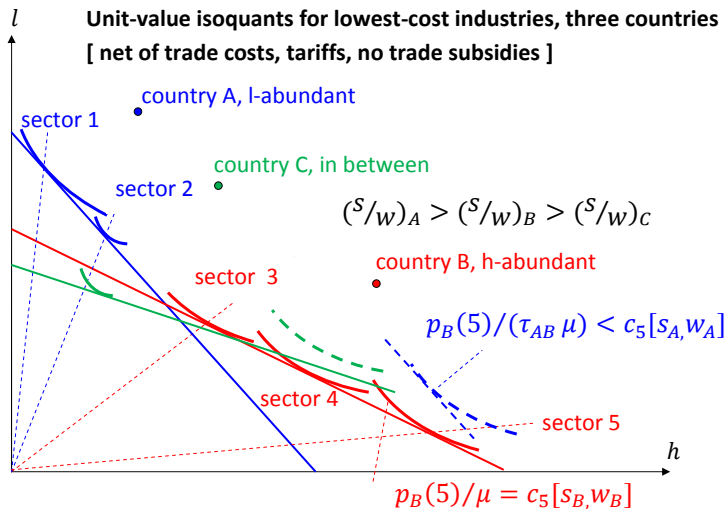
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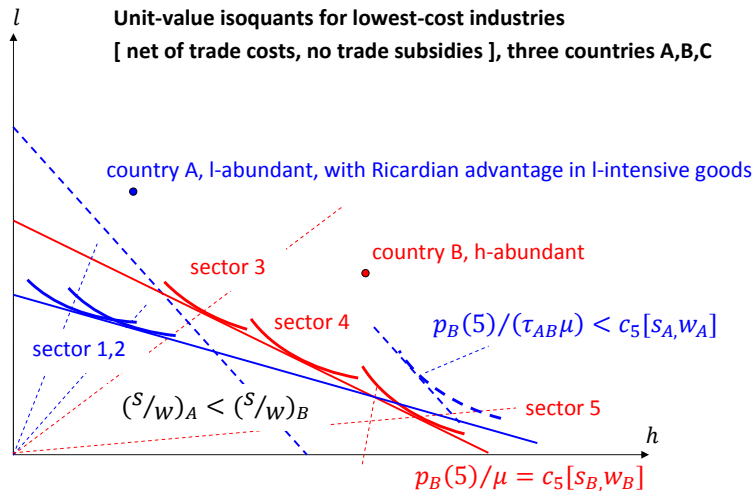
- Effect of trade on skill premium
  - Increase in skill premium in A
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- **Trade liberalization:** Losing/achieving lowest-cost status in “extreme-intensity sectors”  $\Rightarrow$  change in skill-premium (as above)
- Including more countries and allowing for artificial trade barriers weakens predictions:
  - Following figure: Country C with intermediate skill endowment, but high tariff on good 2 $\Rightarrow$  lowest skill premium of all

## HO-type skill premium: many countries, tariffs



## HO + Ricardo: skill-bias in technology - **type I**

- HO-type skill premium potentially reinforced (overturned) by Ricardian difference in technology
- **Type I skill-bias in technology:** Country-specific “correlation” between  $l$ -intensity of sectors and country-specific level of technology
- Following figure:
  - $l$ -abundant country A, but negative correlation between Ricardian advantage and skill-intensity
  - ⇒ lower skill premium than  $h$ -abundant country B

HO + Ricardo: skill-bias in technology - **type I**

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- Type I skill bias determines the skill premium effect of the trade scenario
- But: country-specific level of technology not affected by trade liberalization
- Hence, type I skill bias of minor importance for the trade liberalization scenario?
- Still: Presumably important for calibration



## Skill-bias in technology - **type II**: BEJK + Harrod

- Higher **firm-specific productivity level**  $z$ :
  - ⇒ higher efficiency of **both**  $l$  and  $h$ , hence lower unit cost
  - ⇒ higher/lower efficiency of  $h$  **relative** to  $l$
  - ⇒ higher/lower **firm-specific skill intensity**  $h(\omega)/l(\omega)$ , given  $w, s$
- Skill-bias jointly determined by parameters  $\phi$  and  $\rho$
- Skill-bias assumed uniform across firms, sectors, countries
- $h/l$ -intensity in previous diagrams: **averages across firms**  $\omega$  within sectors
- Average intensities determined by productivity **dispersion** parameter  $\theta$

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# The skill-biased technology mechanism

- Lower trade costs: Reallocation of labor towards exporting firms with higher productivity levels
  - Higher mandated real wages for both types of labor  
[ shift of **all** unit-value isoquants towards origin ]
  - At the same time: Change in aggregate skill-intensity for **all** sectors  $j$  in previous diagrams
- If positive skill-bias,  $\phi > 1/2$  and  $\rho > 1$ , then all sectors become more skill-intensive:
  - Labor market: excess demand for high-skill labor **everywhere**
  - Goods markets: excess supply of low  $l$ -intensive goods **everywhere**  
 ⇒ higher prices of high  $h$ -intensive sectors  
 ⇒ shift towards the origin of  $h$ -intensive unit-value isoquants
  - All of this must lead to higher skill premia **all over**

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## Summary - Take away

- Renaissance of trade-related determinants of skill premium [ tradability and geography **is** technology ]
  - ? Uniform parameters  $\phi$  and  $\rho$  driving technology mechanism on firm level
  - ? Linear relationship between Ricardian advantage and skill-intensity on country level
  - ? Role of firm-specific productivity dispersion
- Moves “new new” trade theory closer to
  - empirical regularities (skill-premium, intra-sectoral reallocation)
  - large scale numerical simulation of interesting scenarios
- ? Policy conclusion – difficult to derive without knowing about (distortions in) skill formation