14.662 Recitation 4

Canonical Models of Trade and Technology

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Why Study Trade?

- Trade patterns have changed drastically over the past 35 years
  - Increasing share of low income countries in world manufacturing
  - More trade between low- and middle-income countries
  - “Hyper-specialization” in many emerging economies
  - See Hanson (2012) (“The Rise of Middle Kingdoms”) for more

- Strong anecdotal links between trade and increased wage inequality

- Canonical intuition: opening of trade between developed (skill-endowed) and developing (unskill-endowed) economies analogous to decline in relative supply of skill in developed countries

- How can we formalize this story? What is the role of technology?
A Simple Model of Trade and Inequality

- Two tradable goods, $Y_h$ and $Y_l$; representative utility $(Y_l^\rho + Y_h^\rho)^{1/\rho}$
- Production: $Y_h = A_h H$ and $Y_l = A_l L$ for skilled/unskilled $H$ and $L$
- Without trade, relative price of skill-intensive goods is

\[
\frac{p_h}{p_l} = \frac{\partial U/\partial Y_h}{\partial U/\partial Y_l} = \frac{Y_h^{\rho-1}}{Y_l^{\rho-1}}
\]

\[
= \left( \frac{A_h H}{A_l L} \right)^{\rho-1} \equiv p^{US}
\]

- The skill premium is the ratio of the marginal value products:

\[
\omega^{US} = \frac{\partial Y_h/\partial H}{\partial Y_l/\partial L} p^{US} = (A_h/A_l)p^{US}
\]
A Simple Model of Trade and Inequality (cont.)

- Suppose U.S. starts trading with a LDC with same technology $A_h, A_l$
- LDC labor endowments: $\hat{H}$ and $\hat{L}$ with $\hat{H}/\hat{L} < H/L$
- Unique world relative price with trade:

$$ p_W = \left( \frac{A_h (H + \hat{H})}{A_l (L + \hat{L})} \right)^{\rho - 1} > p_{US} $$

Trade increases price of skill-intensive good. Why?

- Unique skill premium with trade:

$$ \omega_W = (A_h/A_l) p_W > p_W $$

Trade with developing countries increases wage inequality

- Opposite effect on prices and wages for the LDC
A One-Good Model

- The above model easily generalizes to a workhorse Heckscher-Ohlin
  - Central notion: differences in factor endowments drive trade patterns

- Can work through the math, but graphical intuition (via Lerner diagrams) often sufficient

- Warm-up: one sector and (as above) two factors.

- Basic H-O assumptions: CRTS and quasi-concave production function, perfect competition, homothetic representative preferences (i.e. no income effects)

- Production function gives isoquants in factor space, wage ratio gives slope of isocost curve (and intersections give inverse wage)

- How to graph skill-biased (e.g. factor-biased) technical change?
Excess demand for skilled labor at pre-SBTC prices: $w'_s/w'_u > w_s/w_u$
Trade in a Two-Good, Two-Factor Economy

Now suppose two goods, with one skill-intensive and the other unskill-intensive

- E.g. \( Y_s = \alpha_s H^\beta_s L^{1-\beta_s} \) and \( Y_u = \alpha_u H^\beta_u L^{1-\beta_u} \) with \( \beta_s > \beta_u \)

Isocosts as before; isoquants become iso\textit{value} curves (include prices)

Consider small skill-intensive economy that opens to trade

- Assume both goods produced in equilibrium (i.e. equilibrium lies in “the cone of diversification”)
- Assume prices are parametric (because the country is small)

As above, trade raises relative price of skill-intensive good; isovalue curve shifts towards the origin. Relative wage of skilled labor rises

New insight: relative use of skilled labor within each sector \textit{falls}
A Skill-Intensive Economy Opens to Trade

- Higher price of skill-intensive good: \( \frac{w_s'}{w_u'} > \frac{w_s}{w_u} \)

Image by MIT OpenCourseWare.
Factor-biased Technical Change in a Small Open Economy

- Consider technical change biased towards the skilled factor, saving in equal proportion in each sector
  - Value isoquants shift equally towards the origin
  - Corresponds to $\beta_s$ and $\beta_u$ rising proportionately in earlier model

- Because the economy is small, no effect on world prices; no change in relative wages (though all workers are better off)

- Compare to earlier SBTC example with one good; economy accommodates change in effective factor supply by shifting production across goods, so demand for factors is in effect perfectly elastic
  - This is the basis for Leamer’s (1994) criticism of the SBTC explanation for falling relative unskilled wages

- But what if the economy is large, or if technical change is pervasive (Krugman, 1995)?
Factor-biased Technical Change

- Skilled sector relatively contracts to clear labor mkt.: $w_s'/w_u' = w_s/w_u$
Pervasive Factor-biased Technical Change

- What if the technical change affects many countries at once? The world market reacts much like a single country experiencing SBTC.

- As unskilled sector relatively grows, global price of unskilled-intensive good declines.

- Isovalue curve shifts relatively out, decreasing relative unskilled wages.

- Consistent with simultaneous substitution towards skilled labor in most sectors of many developed countries since the 1980s (Berman, Bound, and Machin 1998).
Pervasive Factor-biased Technical Change

- Fall in price of unskill-intensive good: $w'_s/w'_u > w_s/w_u$
How does H-O Fall Short?

- Predictions hard to map to / routinely refuted by data
  - Ex.: Leontief 'paradox' (1954): U.S. the most capital-abundant country, yet exports labor-intensive commodities and imports capital-intensive commodities

- Not just about endowments: within-industry productivity varies widely

- Factor Price Equalization does not hold empirically

- Country size and distance appear important
  - Trade between countries diminishes with distance
  - Large countries trade less relative to GDP
  - Countries import more from larger countries
  - Prices more different for countries that are further apart

- Trade flow data more abundant than trade price data (H-O makes no real predictions about trade volumes)

- All of these issues better understood with gravity