International Economics I

Lecture Set 3: The HO model

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The Heckscher-Ohlin (H-O) Model

- in the classical frameworks, there is trade when there is *comparative advantage*
- in the Ricardian model, comparative advantage arises from technological differences across countries
- comparative advantage can also arise from differences in factor endowments (capital, labor, land,...)
  - e.g., the US import lumber from Canada since Canada has more land per capita than the US
- in the Heckscher-Ohlin model, a country's comparative advantage depends on:
  - its *relative factor abundance* combined with
  - the *relative intensity* in factor utilization for the production of different goods

Questions

- we'll consider 2 countries with the same technology and different factor endowments
  1. how does production change in the open economy?
  2. who exports/imports what?
  3. what are the welfare effects of trade?
  4. what happens if the endowment of a factor changes?
     - (e.g., due to immigration)
  5. what are the effects of trade on income distribution?
  6. what are the effects of trade on unemployment?
  7. is there empirical support to the theory?

The Heckscher-Ohlin Model: 2x2x2

- 2 countries: home and foreign (*)
  - same preferences
- 2 goods: textiles (T) and automobiles (A)
  - same technology to produce each good in both countries
  - T uses labor more intensively than A
- 2 factors of production: labor (L) and capital (K)
  - mobile between sectors, not between countries
  - different relative endowments of labor
    - e.g., home has relative abundance of L ($L/K > L^*/K^*$)

Relative Endowments (K/L) Across Countries

Capital and Labor endowments, 1996

Country	Labor force (mln)	Capital Stock ($bln)	Capital per worker ($)
India	369.50	2,080	5,629
China	735.10	5,450	7,414
Chile	5.57	204	36,653
Brazil	59.13	2,280	38,560
Mexico	31.67	1,400	44,211
Argentina	14.62	719	49,192
UK	29.05	2,550	87,778
Korea	18.97	1,860	98,055
Spain	15.63	1,720	110,024
Canada	15.12	1,850	122,326
US	135.40	17,000	125,554
Japan	79.73	10,600	132,953
Switzerland	3.92	621	158,504

Factor Intensities Across Sectors

Capital-Labor Ratio by Selected US Industries, 2005

INDUSTRY	Labor (th)	Capital Stock ($ mln)	Capital per worker ($ th)
APPAREL AND TEXTILES	262	15821	60.362
FURNITURE AND FIXTURES	324	20241	62.569
LUMBER AND WOOD PRODUCTS	535	35961	67.242
LEATHER AND LEATHER PRODUCTS	27	1944	71.482
PRINTING AND PUBLISHING	436	43529	99.953
FABRICATED METAL PRODUCTS	939	114058	121.520
RUBBER AND PLASTICS	673	91080	135.255
FOOD AND KINDRED PRODUCTS	1123	193020	171.848
TRANSPORTATION EQUIPMENT	881	185904	211.110
INSTRUMENTS AND RELATED PRODUCTS	320	67490	211.169
PRIMARY METAL INDUSTRIES	380	112946	297.304
PAPER AND ALLIED PRODUCTS	371	110728	298.297
ELECTRONIC AND ELECTRIC EQUIPMENT	591	199212	337.133
CHEMICALS	406	225141	554.261
PETROLEUM AND COAL PRODUCTS	64	91294	1424.242

Technology and Factor Intensities

- consider a production function with constant factor requirements:

$$\begin{aligned} a_{KT} &= \text{capital used for 1 unit of } T \\ a_{LT} &= \text{labor used for 1 unit of } T \\ a_{KA} &= \text{capital used for 1 unit of } A \\ a_{LA} &= \text{labor used for 1 unit of } A \end{aligned}$$

  - a_{Ki} and a_{Li} are *unit factor demands* and in general depend on factor prices:

    $$w = \text{wage}, \quad r = \text{rate of return on capital}$$

    but for now we consider them constant and exogenous

- A and T differ in their relative factor intensity:

$$\frac{a_{LT}}{a_{KT}} > \frac{a_{LA}}{a_{KA}}$$

  - T uses L relatively more intensively than A
  - T is relatively intensive in L (labor intensive)

Equilibrium in Closed Economy

- factor market clearing
  - production of A and T has to achieve full employment of L and K:

$$\begin{aligned} L &= a_{LT} \times Q_T + a_{LA} \times Q_A \\ K &= a_{KT} \times Q_T + a_{KA} \times Q_A \end{aligned}$$

- good market clearing
  - demand of T = fraction b of income $(rK + wL)$

$$P_T D_T = b(rK + wL) \quad \& \quad P_A D_A = (1-b)(rK + wL)$$

  - RD $(= D_T/D_A)$ = RS

$$\frac{D_T}{D_A} = \frac{b}{1-b}\frac{P_A}{P_T} = \frac{Q_T}{Q_A}$$

- perfect-competition pricing (price = marginal cost)

$$\begin{aligned} P_T &= a_{KT} \times r + a_{LT} \times w \\ P_A &= a_{KA} \times r + a_{LA} \times w \end{aligned}$$

- 5 equations in 5 unknowns

Equilibrium in Closed Economy: Production (RS)

- to obtain Q_A and Q_T
  - solve the 2×2 system for factor market clearing:

$$\begin{cases} Q_A = \frac{K - a_{KT} \times Q_T}{a_{KA}} \\ L = a_{LT} \times Q_T + a_{LA} \times Q_A \end{cases} \rightarrow \begin{cases} Q_A = \frac{K}{a_{KA}} - \frac{a_{KT}}{a_{KA}} \times Q_T \\ Q_T = \frac{L}{a_{LT}} - \frac{a_{LA}}{a_{LT}} \times Q_A \end{cases}$$

$$\begin{aligned} Q_A &= \frac{K}{a_{KA}} - \frac{a_{KT}}{a_{KA}} \frac{L}{a_{LT}} + \frac{a_{KT}}{a_{KA}} \frac{a_{LA}}{a_{LT}} Q_A \\ \frac{a_{KA} a_{LT} - a_{LA} a_{KT}}{a_{KA} a_{LT}} Q_A &= \frac{K}{a_{KA}} - \frac{a_{KT}}{a_{KA}} \frac{L}{a_{LT}} \end{aligned}$$

$$\begin{cases} Q_T = \frac{a_{KA} L - a_{LA} K}{a_{KA} a_{LT} - a_{LA} a_{KT}} \\ Q_A = \frac{a_{LT} K - a_{KT} L}{a_{KA} a_{LT} - a_{LA} a_{KT}} \end{cases}$$

  - which deliver the RS (independent of relative price):

$$\frac{Q_T}{Q_A} = \frac{a_{KA} L - a_{LA} K}{a_{LT} K - a_{KT} L}$$

Equilibrium Production: Diversification

$$Q_T = \frac{a_{KA}L - a_{LA}K}{a_{KA}a_{LT} - a_{LA}a_{KT}} \quad \text{and} \quad Q_A = \frac{a_{LT}K - a_{KT}L}{a_{KA}a_{LT} - a_{LA}a_{KT}}$$

- for home to produce both goods, two conditions are required:
  - different factor intensities across sectors

$$a_{KA}a_{LT} - a_{LA}a_{KT} > 0 \Leftrightarrow a_{LA}/a_{KA} < a_{LT}/a_{KT}$$

  - relative labor endowment within the "cone of diversification"

$$Q_A > 0 \Leftrightarrow a_{LT}K - a_{KT}L > 0 \Leftrightarrow L/K < a_{LT}/a_{KT}$$
$$Q_T > 0 \Leftrightarrow a_{KA}L - a_{LA}K > 0 \Leftrightarrow L/K > a_{LA}/a_{KA}$$

  i.e., lying between the relative labor intensities of both goods

Equilibrium Production: Properties

$$Q_T = \frac{a_{KA}L - a_{LA}K}{a_{KA}a_{LT} - a_{LA}a_{KT}} \quad \text{and} \quad Q_A = \frac{a_{LT}K - a_{KT}L}{a_{KA}a_{LT} - a_{LA}a_{KT}}$$

- production and factor endowments:
  - production of the L-intensive good (Q_T) is increasing in the relative endowment of L (increases with L falls with K)
  - production of the K-intensive good (Q_A) is increasing in the relative endowment of K (increases with K falls with L)
- *Rybczynski effect*:
  - *an increase in the endowment of a factor (e.g., L) raises disproportionately the production of the good intensive in that factor (Q_T)*

$$\%\Delta Q_T > \%\Delta L > 0 > \%\Delta Q_A$$

  - intuition: to absorb ΔL in the production of T, need to employ also more K → move some K and L away from A

Equilibrium in Closed Economy: Relative Price

- to obtain the relative price (P_T/P_A)
  - replace the RS into the good market clearing condition

$$\frac{1-b}{b}\frac{P_T}{P_A} = \frac{Q_A}{Q_T} = \frac{a_{LT}K - a_{KT}L}{a_{KA}L - a_{LA}K}$$

  - and simplify...

$$\frac{P_T}{P_A} = \frac{b}{1-b}\frac{a_{LT}K - a_{KT}L}{a_{KA}L - a_{LA}K} = \frac{b}{1-b}\frac{a_{LT}\frac{K}{K} - a_{KT}\frac{L}{K}}{a_{KA}\frac{L}{K} - a_{LA}\frac{K}{K}}$$

...to get

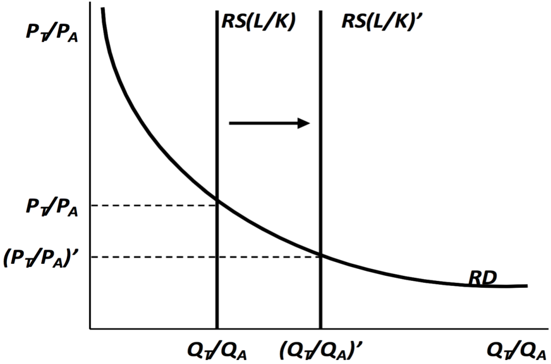
$$\frac{P_T}{P_A} = \frac{b}{1-b}\frac{a_{LT} - a_{KT}\frac{L}{K}}{a_{KA}\frac{L}{K} - a_{LA}}$$

Equilibrium Relative Price: Properties

$$\frac{P_T}{P_A} = \frac{b}{1-b}\frac{a_{LT} - a_{KT}\frac{L}{K}}{a_{KA}\frac{L}{K} - a_{LA}}$$

- P_T/P_A is a decreasing function of L/K
  - the relative price of a good is decreasing in the relative endowment of the factor it uses intensively
  - intuition: more L/K → more Q_T/Q_A (RS) → lower P_T/P_A
- relative endowments → relative price → comparative advantage
  - in K-abundant countries, the K-intensive good is cheaper
  - in L-abundant countries, the L-intensive good is cheaper

Equilibrium in Closed Economy: Graph



Equilibrium in Closed Economy: Factor Prices

- intuitively, if T becomes relatively more expensive,
  - firms value more L (intensively used by T)
  - and value less K (intensively used by A)
  - the price of L increases, the price of K drops
- analytically, to obtain factor prices (w and r)
  - solve, for given P_T and P_A, the system:

$$\begin{cases} P_T = a_{KT} \times r + a_{LT} \times w \\ P_A = a_{KA} \times r + a_{LA} \times w \end{cases} \rightarrow \begin{cases} w = \frac{1}{a_{LT}} P_T - \frac{a_{KT}}{a_{LT}} r \\ r = \frac{1}{a_{KA}} P_A - \frac{a_{LA}}{a_{KA}} w \end{cases}$$

$$r \left(\frac{a_{KA} a_{LT} - a_{LA} a_{KT}}{a_{KA} a_{LT}} \right) = \frac{1}{a_{KA}} P_A - \frac{a_{LA}}{a_{KA} a_{LT}} P_T$$

$$w = \frac{a_{KA} P_T - a_{KT} P_A}{a_{LT} a_{KA} - a_{KT} a_{LA}} \quad \text{and} \quad r = \frac{P_A a_{LT} - a_{LA} P_T}{a_{LT} a_{KA} - a_{KT} a_{LA}}$$

Relative Factor Prices: Properties

- the price of a factor:

$$w = \frac{a_{KA}P_T - a_{KT}P_A}{a_{LT}a_{KA} - a_{KT}a_{LA}} \quad \text{and} \quad r = \frac{P_A a_{LT} - a_{LA}P_T}{a_{LT}a_{KA} - a_{KT}a_{LA}}$$

  - is increasing in the price of the good intensive in that factor (w of P_T, r of P_A)
  - is decreasing in the price of the other good (w of P_A, r of P_T)

- the relative price of a factor

$$\frac{w}{r} = \frac{a_{KA}\frac{P_T}{P_A} - a_{KT}}{a_{LT} - a_{LA}\frac{P_T}{P_A}}$$

  - is increasing in the relative price of the good intensive in that factor

Relative Factor Prices: Properties

- *Stolper-Samuelson* effect:
  - *an increase in the price of a good (e.g., P_T) increases more than proportionally the price (w) of the factor it uses intensively (L)*

$$\%\Delta w > \%\Delta P_T > 0 > \%\Delta r$$

- if the relative endowment of a factor increases (e.g., L/K):
  - the relative price of the good that uses it intensively falls ($L/K \uparrow \rightarrow P_T/P_A \downarrow$)
  - the relative price of that factor fall ($P_T/P_A \downarrow \rightarrow w/r \downarrow$)

Equilibrium in Closed Economy: Summary

- supply

$$Q_T = \frac{a_{KA}L - a_{LA}K}{a_{KA}a_{LT} - a_{LA}a_{KT}} \quad Q_A = \frac{a_{LT}K - a_{KT}L}{a_{KA}a_{LT} - a_{LA}a_{KT}}$$

  - RS is

$$\frac{Q_T}{Q_A} = \frac{a_{KA}L - a_{LA}K}{a_{LT}K - a_{KT}L}$$

- relative price of goods

$$\frac{P_T}{P_A} = \frac{b}{1-b}\frac{a_{LT} - a_{KT}\frac{L}{K}}{a_{KA}\frac{L}{K} - a_{LA}}$$

- relative price of factors

$$\frac{w}{r} = \frac{a_{KA}\frac{P_T}{P_A} - a_{KT}}{a_{LT} - a_{LA}\frac{P_T}{P_A}}$$

2 Countries

- consider home and foreign
- same tastes → RD=RD*
- same technology + different relative endowments
  - suppose $a_{LT}/a_{KT} > L/K > L^*/K^* > a_{LA}/a_{KA}$
  - A and T produced in both countries
  - home is relatively L-abundant
- in closed economy:
  - RS>RS*: $L/K > L^*/K^* \rightarrow Q_T/Q_A > Q_T^*/Q_A^*$
  - $Q_T/Q_A > Q_T^*/Q_A^* \rightarrow P_T/P_A < P_T^*/P_A^*$

Equilibrium in Open Economy

- if both countries produce both goods:
  - the price of both goods has to be equal to the international (^{I}) price in both countries:

$$P_T = P_T^* = P_T^I \quad \text{and} \quad P_A = P_A^* = P_A^I$$

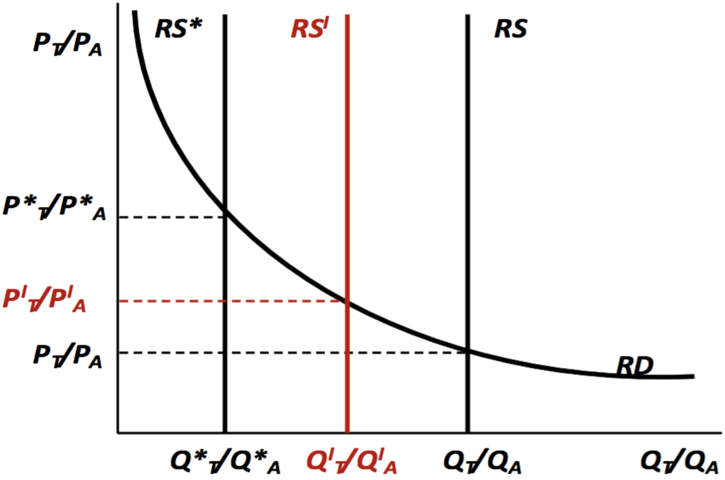
  - the international goods market has to clear

$$\frac{1-b}{b}\frac{P_T^I}{P_A^I} = \frac{Q_A + Q_A^*}{Q_T + Q_T^*}$$

  - given that $Q_T/Q_A > Q_T^*/Q_A^*$, the equilibrium relative price will lie between the closed-economy ones

$$P_T/P_A < P_T^I/P_A^I < P_T^*/P_A^*$$

Equilibrium in Open Economy: Graph



Equilibrium in Open Economy: Pattern of Trade

- the equilibrium relative price implies that:
  - for home, T becomes relatively more expensive → home comparative advantage
  - for foreign, A becomes relatively more expensive → foreign comparative advantage
- equilibrium relative demand implies that:
  - in both countries, relative demand of T is higher than RS* and lower than RS
  - home exports T and imports A, foreign the other way around
- *Heckscher-Ohlin* Theorem:
  - in open economy, provided that no perfect specialization occurs, a country exports the good intensive in its relatively abundant factor

Equilibrium in Open Economy: Factor Prices

- if both countries produce both goods:
  - in perfect competition, prices must equal marginal costs in both countries

$$\begin{cases} P_T^I = a_{KT} \times r + a_{LT} \times w = a_{KT} \times r^* + a_{LT} \times w^* \\ P_A^I = a_{KA} \times r + a_{LA} \times w = a_{KA} \times r^* + a_{LA} \times w^* \end{cases}$$

  - this requires that factor prices be equalized across countries

$$w = w^* = w^I \quad \text{and} \quad r = r^* = r^I$$

  - important result: *factor price equalization*

Factor Prices and Income Distribution

- consecuences for income distribution:
  - the increase in the relative price of T in home makes L gain relative to K

$$P_T^I/P_A^I > P_T/P_A \rightarrow w^I/r^I > w/r$$

  - the increase in the relative price of A in foreign makes K^* gain relative to L^*

$$P_T^I/P_A^I < P_T^*/P_A^* \rightarrow w^I/r^I < w/r$$

  - trade benefits the abundant factor and hurts the scarce factor

Application: Immigration to K-Abundant

- immigration from a third country into the foreign country:
  - $L^*/K^* \uparrow \longrightarrow Q_T^*/Q_A^* \uparrow \longrightarrow P_T^*/P_A^* \downarrow \rightarrow P_T^I/P_A^I \downarrow \rightarrow w^I/r^I \downarrow$
  - comparative advantage is weakened in both countries
  - less trade
  - lose part of the GFT
  - workers lose and capitalists gain

Application: Immigration to L-Abundant

- immigration from a third country into the home country
  - $L/K \uparrow \longrightarrow Q_T/Q_A \uparrow \longrightarrow P_T/P_A \downarrow \rightarrow P_T^I/P_A^I \downarrow \rightarrow w^I/r^I \downarrow$
  - comparative advantage is reinforced in both countries
  - more trade
  - larger GFT
  - workers lose relative to capitalists

Application: Migration from L to K-Abundant

- consider migration from the home to the foreign country
  - $L^*/K^* \uparrow \longrightarrow Q_T^*/Q_A^* \uparrow$ and $L/K \downarrow \longrightarrow Q_T/Q_A \downarrow$
  - $(L + L^*) / (K + K^*)$ unchanged $\longrightarrow Q_T^I/Q_A^I$ unchanged
  - comparative advantage is weakened in both countries
  - less trade
  - smaller GFT
  - no efect on P_T^I/P_A^I and w^I/r^I since RS^I unchanged

Application: Migration from K to L-Abundant

- consider migration from the foreign to the home country
  - $L^*/K^* \downarrow \longrightarrow Q_T^*/Q_A^* \downarrow$ y $L/K \uparrow \longrightarrow Q_T/Q_A \uparrow$
  - $(L + L^*) / (K + K^*)$ unchanged $\longrightarrow Q_T^I/Q_A^I$ unchanged
  - comparative advantage is reinforced in both countries ($\rightarrow$ more trade)
  - more trade
  - larger GFT
  - no efect on P_T^I/P_A^I and w^I/r^I since RS^I unchanged

Application: Trade and the Skill Premium

- focus on the wage gap within a country
  - difference between the wage of different types of workers
  - skill premium: wage gap between skilled and unskilled
- rise in wage inequality and skill premium world-wide in the las 40 years
- possible determinants:
  - drop in relative supply of skilled labor world-wide
  - trade
  - technological change

Application: Trade and the Skill Premium

- Let's focus on the US-Mexico case
  - Let's assume technology is the same in both countries
  - 2 factors: High-skilled labor (H) and low-skilled labor (L)
  - 2 goods: textiles (intensive in L) and PCs (intensive in H)
  - H relatively more abundant in the US:

$$\frac{H^{USA}}{L^{USA}} > \frac{H^{MEX}}{L^{MEX}} \tag{1}$$

  - Let's assume that $W_H > W_L$ in both countries

Application: Trade and the Skill Premium

Trade pattern

- Applying the theoretical results we have learned in class:
  - US exports PCs and imports textiles
  - Mexico exports textiles and imports PCs
- What happens when US and Mexico start increasing trade?
  - In the US:
    - The relative price of PCs goes up
    - The relative remuneration of H goes up $\frac{W_H}{W_L} \uparrow \Rightarrow$ skill-premium increases $\Rightarrow$ inequality increases
  - In Mexio
    - The relative price of PCs goes down
    - The relative remuneration of H goes down $\frac{W_H}{W_L} \downarrow \Rightarrow$ skill-premium decreases $\Rightarrow$ inequality decreases

Application: Trade and the Skill Premium

What do we see in the data?

- skill-premium has increased in the US
- skill-premium has ALSO increased in the Mexico
- The basic HO model fails for Mexico

Application: Trade and the Skill Premium

Possible explanations

- Skill-biased technological change
  - This means that H has become more and more productive over time in both countries
  - This would imply a higher demand for H relative to L
  - This means that the skill-premium increases because of changes in technology
- Evidence in favor of this argument: production in the US has become more intensive in H in ALL sectors

Many Goods, Factors and Countries: Factor Content of Trade

- if many goods, factors and countries:
  - difficulty: which good is intensive in which factor?
  - difficulty: factor abundance relative to which other factor?
- alternative version of the H-O Theorem (HO-Vanek):
  - net factor f content of c's trade = factor f endowment - factor f demand
  - define
    - V_c^f and V_w^f= country c and world (w) endowment of factor f
    - s_c = country c share in world income → demand of $f = s_c V_w^f$
    - F_c^f = net factor f content of c's trade

$$F_c^f = V_c^f - s_c V_w^f$$

  - provided that no perfect specialization occurs, a country is net exporter of the services of its abundant factor and net importer of its scarse factor

Empirical Evidence: Factor Content of Trade

- Bowen et al. (1987) consider 27 countries and their endowment of 12 factors
- suppose country c has
  - endowment of factor j equal to 10% of world endowment of j $(V_c^j / V_W^j = 0.1)$
  - endowment of factor h equal to 2% of world endowment of h $(V_c^h / V_W^h = 0.02)$
  - a GDP equal to 5% of world GDP $(s_c = 0.05)$
- HO-Vanek predicts
  -
$$F_c^f = V_c^f - s_c V_w^f$$
  - c net exporter of j (5% of world endowment of j)
  - c net importer of factor h (3% of world endowment of h)
- count for how many countries the net export of each factor follows the predicted pattern

Empirical Evidence: Factor Content of Trade (III)

- Trefler (1995) poited out that H-O also predict the volume of net factor export
- the US had
  - 23% of world GDP
  - 5% of world workers
  - should import 4 times as many workers (18% of the world)
- in general: there is very little factor trade compared to H-O predictions (the "missing trade")
- Davis and Weinstein (2001): H-O works if you add
  - different technology (factor productivity)
  - no factor price equalization across countries
  - non-traded goods + trade costs

Empirical Evidence: Patterns of Export to the US

- Romalis (2004) shows the validity of a "quasi-H-O" prediction:

  "countries abundant in skilled labor and capital capture a higher share of US imports in sectors intensive in those factors"

- intuition: given the set of exporters to a certain destination (the US),
  - skill-abuntant countries are "better" at exporting skill-intensive goods
  - hence capture a higher import share the higher the skill intensity of the good
- advantages:
  - no need to assume same technology and factor price equalization
  - use high-quality and homogeneous data
- this prediction is supported by data on:
  - US import and technology for 370 sectors
  - factor endowments of 123 exporting countries

Trade and Unemployment

- countries differ markedly in labor market institutions:
  - how does trade interact with (possibly different) labor market institutions?
- Davis (1998)
  - before the 70s, unemployment in Europe was $\sim 2-3\%$, now it's much higher
  - European labor markets are rigid
  - claim: globalization + rigidity → higher European unemployment
- trade model with two factors (H and L) and two countries:
  - US: flexible wages
  - Europe: binding minimum wage for unskilled workers
  - result: Europe-US trade can increase European unemployment

Wages and Unemployment

- flexible wages
  - recall: $\frac{w_H}{w_L} = \left(\frac{A_H}{A_L}\right)^{\frac{\epsilon-1}{\epsilon}} \left(\frac{L}{H}\right)^{\frac{1}{\epsilon}}$
  - normalize $w_H = 1$ and $(A_H/A_L)^{\frac{\epsilon-1}{\epsilon}} = a$

$$w_L^* = a^{-1} (H/L)^{1/\epsilon}$$

  w_L^* wage consistent with market clearing
- rigid wages
  - binding minimum wage, $\bar{w}_L > w_L$

$$\bar{w}_L = a^{-1} (H/L^e)^{1/\epsilon}$$

  where $L^e = L - U$ is employed unskilled workers
  - unemployment:

$$U = L - H (a\bar{w}_L)^{-\epsilon}$$

  - at $\bar{w}_L > w_L^*$ firms are not willing to employ all L

Unemployment and Comparative advantage

- consider Europe and the United States
  - same endowments: $L^{EU} = L^{US} = L,\ H^{EU} = H^{US} = H$
  - different labor markets: flex US vs rigid EU (binding $\bar{w}_L$)
  - autarky relative supply

$$\frac{Q_C^{US}}{Q_T^{US}} = \frac{A_H H}{A_L L} \;<\; \frac{A_H H}{A_L L^e} = \frac{Q_C^{EU}}{Q_T^{EU}}$$

  - autarky relative price

$$\frac{P_C^{US}}{P_T^{US}} = \left(\frac{A_H H}{A_L L}\right)^{-1/\epsilon} \;>\; \left(\frac{A_H H}{A_L L^e}\right)^{-1/\epsilon} = \frac{P_C^{EU}}{P_T^{EU}} = \frac{A_L}{A_H \bar{w}_L}$$

  - Europe has comparative advantage in C (skill-intensive good)!

Trade and European Unemployment

- if US and EU can trade
  - EU (US) consumers want to buy T (C) in the US (EU)
    - upward pressure on P_C^{EU}/P_T^{EU}
  - problem: P_C^{EU}/P_T^{EU} pinned down by $\bar{w}_L$
  - solution: EU keeps P_C^{EU}/P_T^{EU} by raising Q_C^{EU}/Q_T^{EU}
  - need to fire more L until

$$\bar{w}_L = \frac{1}{a}\left(\frac{2H}{L + (L^e)^I}\right)^{1/\epsilon}$$

  - free-trade unemployment:

$$U_{EU}^I = 2\left[L - \frac{H}{(a\bar{w}_L)^\epsilon}\right], \qquad U_{US} = 0$$

- other global events that can raise European unemployment:
  - immigration of L to the US can increase unemployment in Europe
  - SBTC ($a \uparrow$) can increase unemployment in Europe