

14.54 International Trade

— Lecture 13: Heckscher-Ohlin Model of Trade (I) —

Today's Plan

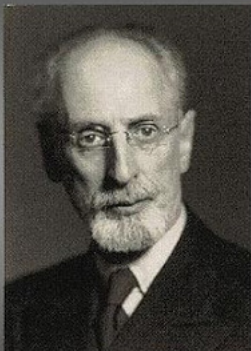
- 1 HO model: Main Assumptions
- 2 HO model: Production and Factor Prices in Equilibrium
- 3 Numerical Example

Graphs found on slides 8-13 and 18 are courtesy of Marc Melitz. Used with permission.

Main Assumptions

- We know study a model of trade where all factors of production are flexible in the long run
- The technologies used to produce different goods will use different factors relatively more intensively
- This model emphasizes differences across countries in aggregate factor abundance
- For simplicity, we will mostly abstract from differences in technologies across countries
- With more than one factor and differences in production technologies across sectors (different relative factor intensities), differences in factor abundance are enough to generate differences in country PPFs and relative supply curves –and hence a pattern of comparative advantage

Heckscher - Ohlin's Theory



Eli Heckscher



Bertil Ohlin

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Main Assumptions: Production

- The technologies for producing C and F are represented by the production functions $Q_C = F_C(K_C, L_C)$ and $Q_F = F_F(K_F, L_F)$
 - The production of C is labor intensive relative to the production of F (which is capital intensive relative to C)
- Both labor and capital can move across sectors
 - ... and hence must be paid same factor prices in both sectors (if both goods are produced)
- Subject to endowment constraints $L = L_C + L_F$, $K = K_C + K_F$
- Like in the specific factor model, for any labor allocation L_C , L_F , there is a relative price p_C/p_F s.t. $p_C MPL_C = p_F MPL_F$ (labor allocation is efficient)
 - ... but arbitrary capital allocations K_C , K_F will, in general, not be efficient at these prices: $p_C MPK_C \neq p_F MPK_F$
 - ... we need to determine jointly the efficient allocation of capital and labor, as well as the factor prices that sustain that allocation

Aggregate Production and Factor Prices (Cont.)

- Part 2 [Profit Maximization]: Factor prices and unit input req. determine goods prices

- Marginal cost pricing implies (recall that $MC = AC$)

$$p_C = wa_{LC} + ra_{KC}$$

$$p_F = wa_{LF} + ra_{KF}$$

- 1-1 relationship between factor prices (w, r) and goods prices (p_C, p_F)
- This can be inverted to determine (w, r) as a function of (p_C, p_F)
- Part 3 [Factor Market Clearing]: Unit input req. determine factor allocations and production

$$\begin{aligned} L_C + L_F &= L \\ K_C + K_F &= K \end{aligned} \Leftrightarrow \begin{aligned} Q_C a_{LC} + Q_F a_{LF} &= L \\ Q_C a_{KC} + Q_F a_{KF} &= K \end{aligned}$$

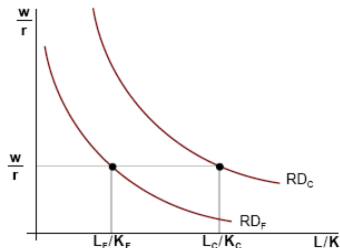
- Given ($a_{LC}, a_{LF}, a_{KC}, a_{KF}$), this can be solved for (Q_C, Q_F) and hence (L_C, L_F, K_C, K_F)
- This analysis assumes that both C and F are produced

Factor Price Equalization Theorem

- We just saw that there is a 1-1 relationship between goods prices and factor prices
- Changes in factor endowments have no effects on factor prices
 - This is referred to as 'factor price insensitivity'
- If countries produce both goods with the same technologies and face the same goods prices, then they will share the same factor prices
 - This is referred to as 'factor price equalization theorem'
- In these cases, trade in goods is a (perfect) substitute for trade in factors, which equalizes those returns across countries

Relative Factor Prices and Relative Factor Demands

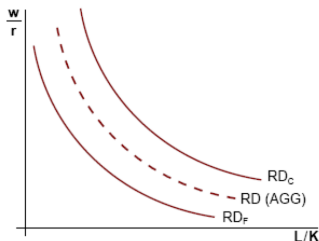
- Recall that the relative factor price will determine relative employment levels in both sectors:



- On the other hand, the aggregate relative supply of factors $L/K = (L_C + L_F)/(K_C + K_F)$ is fixed by the country's factor endowments
 - What happens if the economy is completely specialized in C or F ?
 - What can be said about the equilibrium range of w/r when both C and F are produced?

Relative Factor Prices and Relative Factor Demands (Ct.)

- Just like the case of relative demand curves for goods, the aggregate relative demand curve for factors is a weighted average of the relative demand for factors in each sector:

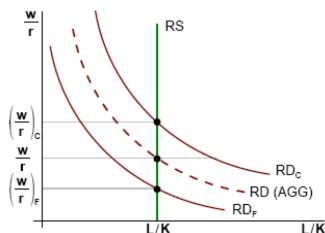


- One can write L/K as a weighted average of L_C/K_C and L_F/K_F

$$\frac{L}{K} = \frac{L_C}{K_C} \frac{K_C}{K} + \frac{L_F}{K_F} \frac{K_F}{K}$$

Relative Factor Prices and Relative Factor Demands (Ct.)

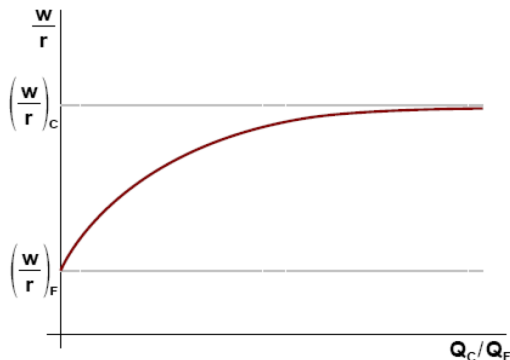
- The relative wage w/r is thus determined by the allocation of production between C and F



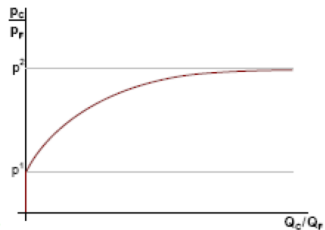
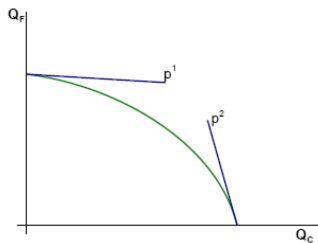
- What happens as economy produces relatively more C (and less F)?
 - The aggregate relative demand for L rises and w/r increases
 - w/r increase induces firms to substitute K for L : $L_C/K_C \searrow$ and $L_F/K_F \searrow$
 - How can aggregate L/K remain constant?

Relative Factor Prices and Relative Production

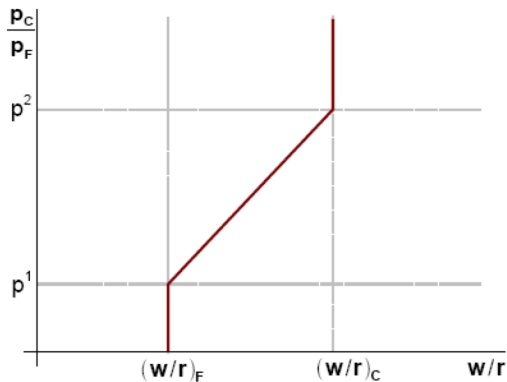
- One can graphically show the relationship between relative production Q_C/Q_F and the relative wage w/r :



Relative Good Prices and Relative Production



Relative Factor Prices and Relative Good Prices



- What happens as p_C/p_F increases between p^1 and p^2 ?
- What happens when $p_C/p_F < p^1$ or $p_C/p_F > p^2$?

Numerical Example: Mixing It All Up

Mixing It All Up: Martini Production

- A martini is produced with Gin (G) and Vermouth (V)
 - A regular martini is produced with 2 parts Gin for 1 part Vermouth
 - A dry martini is produced with 5 parts Gin and 1 part Vermouth
- The prices of a regular martini (p_M) and a dry martini (p_D) are fixed
- You have a given supply of both Gin (G) and Vermouth (V)
- Important questions:
 - What are the prices of Gin and Vermouth?
 - What is the output of regular and dry martinis?

- How much is an extra amount of either gin or Vermouth worth?
 - If the price of a dry martini rises, would you be willing to pay more or less for some extra Gin? For some extra Vermouth?
 - You unexpectedly break some of your bottles of Vermouth –is Vermouth now more or less valuable to you? How about Gin?
- Start with the opposite problem: you can purchase Gin and Vermouth at prices w_G and w_V –what is the competitive price for martinis?

$$p_M = \frac{1}{3}w_V + \frac{2}{3}w_G$$

$$p_D = \frac{1}{6}w_V + \frac{5}{6}w_G$$

- This can be inverted to obtain the value of Gin and Vermouth

$$w_V = 5p_M - 4p_D$$

$$w_G = 2p_D - p_M$$

- So when $p_D \nearrow$ then $w_G \nearrow$ and $w_V \searrow$

What to Produce?

- How should you split your gin and Vermouth supply between the production of dry and regular martinis?
- Recall part 3 (factor allocation and production determination from unit input requirements):

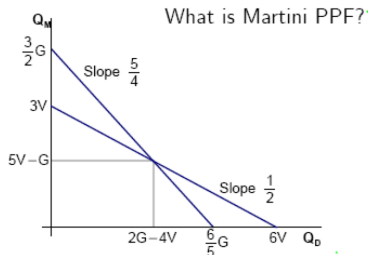
$$\begin{cases} \frac{1}{3}Q_M + \frac{1}{6}Q_D = V \\ \frac{2}{3}Q_M + \frac{5}{6}Q_D = G \end{cases} \implies \begin{cases} Q_M = 5V - G \\ Q_D = 2G - 4V \end{cases} \quad \text{if } Q_M > 0, Q_D > 0$$

- Why don't production levels depend on good prices?
- Would it ever make sense not to produce/sell one type of martini?

Martini Possibilities Frontier

- Recall

$$\begin{aligned} \frac{1}{3}Q_M + \frac{1}{6}Q_D &= V \\ \frac{1}{3}Q_M + \frac{1}{6}Q_D &= G \end{aligned} \implies \begin{aligned} Q_M &= 5V - G \\ Q_D &= 2G - 4V \end{aligned} \quad \text{if } Q_M > 0, Q_D > 0$$



- Why don't production levels depend on good prices?
- Would it ever make sense not to produce/sell one type of martini?
- What does RS curve look like?

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