Lecture 4c: Stolper-Samuelson Theorem

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IN THE SPECIFIC-FACTOR MODEL

Assume that the computer industry only use capital and that the shoe industry only use labor. If the price of computers increases with trade:

- a) Workers and capital owners all gains from trade but capital owners gain more
- b) Workers and capital owners all gains from trade but workers gain more
- c) Capital owners gain from trade and workers lose
- d) Workers gain from trade and capital owners lose

IN THE SPECIFIC-FACTOR MODEL

We have shown (see chapter 3):

c) Capital owners gain from trade and workers lose

Now, today the key question is:

Does the same result hold when both industries use K and L and factors are mobile? (=HO model)

(Continuation of chapter 4)

Stolper-Samuelson Theorem

Within the Heckscher-Ohlin framework:

(Continuation of chapter 4)

Stolper-Samuelson Theorem Within the Heckscher-Ohlin framework:

- What is the effect of trade on wages? (adjusting for prices, i.e. looking at welfare)

- What is the effect of trade on the rental rate?

(Continuation of chapter 4)

Stolper-Samuelson Theorem Within the Heckscher-Ohlin framework:

- What is the effect of trade on wages? (adjusting for prices, i.e. looking at welfare)

- What is the effect of trade on the rental rate?
- What is the effect of trade on the wage/rental rate ratio?
 → Focus first on wage/rental rate ratio
 → Focus first on relative demand & supply of labor/capital

Relative demand for Capital and Labor:

What is the relative *supply* of labor at Home?

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Relative demand for Capital and Labor:



Relative *demand* for labor determined by:

- Labor intensity in each industry: L_C/K_C and L_S/K_S
- Industry shares in capital use: K_C/K and K_S/K

 \rightarrow Relative demand for labor = Average of labor intensities, weighted by the share of each industry in capital use.

Relative demand for Capital and Labor:



- L_C/K_C and L_S/K_S : Labor intensity in each industry (correspond to each light-blue curve)
- K_C/K_{tot}: Share of Computer industry total K use = weight put on Computer industry
- K_S/K_{tot} : Share of Computer industry total K use = 1 - (K_C/K_{tot})

 \rightarrow Relative demand for labor = Average of labor intensities, weighted by the share of each industry in capital use.

Relative demand for Capital and Labor:



Relative supply of Capital and Labor:



Effect of trade (Effect of an increase in the Relative Price of Computers)



Relative demand for Capital and Labor:



A shift towards the computer industry leads to:

- An increase in computer industry capital share K_C/K
- An decrease in shoe industry capital share K_s/K
- Decrease in relative demand for labor

Effect of Trade (Effect of an increase in the Relative Price of Computers)



Effect of Trade (Effect of an increase in the Relative Price of Computers)



Labor/capital

Effect of trade

At Home, opening to trade induces:

- An increase in the relative price of computers
- An expansion of the computer industry
- A decrease of the demand for labor
- A decrease in the wage/rental-rate ratio

Examples:

Taking the production function from last lecture, with \bullet

$$\beta = 2/3 > \alpha = 1/3$$

• Shoe:
$$Y_s = a_s L_s^{2/3} K_s^{1/3}$$

• Shoe:
$$Y_{S} = a_{S} L_{S}^{2/3} K_{S}^{1/3} \implies \frac{L_{S}}{K_{S}} = 2 \left(\frac{w}{r}\right)^{-1}$$

• Computer: $Y_{C} = a_{C} L_{C}^{1/3} K_{C}^{2/3} \implies \frac{L_{C}}{K_{C}} = \frac{1}{2} \left(\frac{w}{r}\right)^{-1}$

• Shoe:
$$\frac{L_S}{K_S} = 2\left(\frac{w}{r}\right)^{-1}$$
 computer: $\frac{L_C}{K_C} = \frac{1}{2}\left(\frac{w}{r}\right)^{-1}$

Effect of trade on rental rate / w ratio:

• Equilibrium:
$$\frac{\overline{L}}{\overline{K}} = \frac{L_C}{K_C} \cdot \left(\frac{K_C}{\overline{K}}\right) + \frac{L_S}{K_S} \cdot \left(\frac{K_S}{\overline{K}}\right)$$

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 \Rightarrow And thus: $\frac{w}{r} = \frac{\overline{K}}{\overline{L}} \cdot \left(\frac{1}{2}\frac{K_C}{\overline{K}} + 2\frac{K_S}{\overline{K}}\right)$

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 $\frac{w}{r}$ decreases as K_C increases and K_S decreases

Clicker question

Assume that computers are more capital intensive than shoes. If the price of <u>shoes</u> increases with trade:

- a) Capital owners gain relatively more than workers
- b) Workers gain relatively more than capital owners

Clicker question

Assume that computers are more capital intensive than shoes. If the price of <u>shoes</u> increases with trade:

b) Workers gain relatively more than capital owners

Because in that case: W/R increases!

What's next?

- We have yet to examine whether workers actually gain or lose from trade.
- As for the Specific-Factor Model, we examine how MPK and MPL evolve.
- As for the Specific-Factor Model, this depends crucially on how L_C/K_C and L_S/K_S change in each industry.

Clicker question

Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

- a) Labor intensity increases in the Shoe industry and decreases in the Computer industry
- b) Labor intensity decreases in the Shoe industry and increases in the Computer industry
- c) Labor intensity increases in both industries
- d) Labor intensity decreases in both industries

Answer:

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Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

c) Labor intensity increases in both industries

Since the relative price of capital R/W increases, firms in ALL industries try to hire more workers relative to capital.

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On the graph:

- → Moving to the right for the demand curve in each industry (light-blue curves).
- Notice that the curves specific to each industry do not move, it's just a movement along these curves.



Effect of trade

At Home, opening to trade induces:

- An increase in the relative price of computers
- An expansion of the computer industry
- A decrease of the demand for labor
- A decrease in the wage/rental-rate ratio
- increase in labor intensity L_C/K_C and L_S/K_S in each industry

Effect of trade



- Shift of K towards computers implies a increase in labor intensity in each industry
- On aggregate, the relative demand remains unchanged

Effect of trade on MPK and MPL?

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 $MPK_C \uparrow because L_C/K_C$ increases (there are more workers to operate machines in the computer industry)

 $MPK_{S} \uparrow because L_{S}/K_{S}$ increases (there are also more workers to operate machines in the shoe industry)

Conversely, MPL decreases in both industries

We answered:

- What is the effect of trade on the wage/rental rate ratio?

Now:

- What is the effect of trade on the rental rate? (in real terms, i.e. in terms of welfare)

- What is the effect of trade on wages? (in real terms, i.e. in terms of welfare)

Effect on rental rate?

What about the rental rate? Welfare of K owners?

 $R = P_c \bullet MPK_c$ and $R = P_s \bullet MPK_s$

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 $R = P_c \bullet MPK_c$ and $R = P_s \bullet MPK_s$

Real rate (compared to each price):

 $R/P_C = MPK_C \uparrow$ because L_C/K_C increases (there are more workers to operate machines in the computer industry) Effect on rental rate?

What about the rental rate? Welfare of K owners?

$$R = P_c \bullet MPK_c$$
 and $R = P_s \bullet MPK_s$

Real rate (compared to each price):

 $R/P_C = MPK_C \uparrow$ because L_C/K_C increases

 $R/P_S = MPK_S \uparrow because L_S/K_S$ increases (there are also more workers to operate machines in the shoe industry) Effect on rental rate?

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$$R = P_c \bullet MPK_c$$
 and $R = P_s \bullet MPK_s$

Real rate (compared to each price):

 $R/P_C = MPK_C \uparrow$ because L_C/K_C increases

 $R/P_{S} = MPK_{S} \uparrow because L_{S}/K_{S}$ increases

The rental rate increases faster than any price in the Home country

Effect on wages?

What about wages? Welfare of workers?

$$W = P_C \bullet MPL_C$$
 and $W = P_S \bullet MPL_S$

"Real" wage (compared to each price):

$$W/P_C = MPL_C \downarrow$$
 because L_C/K_C increases

 $W/P_{S} = MPL_{S} \downarrow$ because L_{S}/K_{S} increases

Wages decreases faster than any price in the Home country

Determination of the Real Wage and Real Rental Stolper-Samuelson Theorem:

If the Home country opens to trade, the price of computers increases (compared to the price of shoes) and:

$$\frac{\Delta W}{W} < \frac{\Delta P_S}{P_S} < \frac{\Delta P_M}{P_M} < \frac{\Delta R}{R}$$

Determination of the Real Wage and Real Rental Stolper-Samuelson Theorem:

In the long run, when all factors are mobile, an increase in the relative price of a good will increase the real earnings of the factor used intensively in the production of that good and <u>decrease</u> the real earnings of the other factor.

PS: regardless of which industry employs this factor (HO model is about the long-run: factors are mobile)

Answer to initial clicker question for HO:

Assume that computers are more capital intensive than shoes. If the price of computers increases with trade:

c) Capital owners gain from trade and workers lose

Heckscher-Ohlin: Summary from Chapter 4

- We can generate trade by differences in endowments, even if technologies are the same
- Heckscher-Ohlin Theorem: if a country is abundant in a factor, it should exports in industries that are relatively intensive in this factor.
- The data support HO theorem only when also incorporate differences in productivity.
- Stolper-Samuelson theorem: An increase in the price of a good generates an increase in the real earning of the factor used intensively in the production of that good, and should <u>decrease</u> the real earning of the other factor

4- Trade and wage inequality

- Next parts:
 - A few words on wage inequality
 - FDI and migration (chapter 5)