Lecture 4a:

Heckscher-Ohlin Model

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C181 – International Trade

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Introduction

In the specific-factors model:

- Aggregate gains from trade, as in Ricardo
- Some factors are specific to a sector
- Those who lose the most are those who are trapped in the comparative-disadvantage sector.

Introduction

Limits of the **specific-factors model?**

Things to keep:

- Different factors of production
- Sectors use factors in different proportions

Things to change?

Introduction

Limits of the **specific-factors model?**

Things to keep:

- Different factors of production
- Sectors use factors in different proportions

Things to change:

- Mobility of each factor across sectors

→ **Q:** What happens to each factor when they are mobile across sectors?

Introduction

CHAPTER 4: Heckscher-Ohlin model

- Two factors of production, K and L, that are mobile across sectors
- *But sectors use K and L in different proportions.*
- Other assumptions remain the same:
  - Perfect competition
  - Constant returns to scale
  - Common prices under free trade

Introduction

CHAPTER 4: Heckscher-Ohlin model

Raises several questions:

- What determines trade flows in this model?
- Are there aggregate gains from trade?
- Who gains the most from trade?
- Who gains the least from trade?
- How do gains/losses relate to world prices?

Introduction

Interpretations

Short-run vs. long-run:

- Short-run: factors are stuck: use specific factor model
- Long-run: factors can adjust: → HO model

Introduction

Interpretations

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About capital and labor?

- We can use “skilled labor” instead of K
- We can use “unskilled labor” instead of L

Introduction

Interpretations

Short-run vs. long-run:

- Short-run: factors are stuck: use specific factor model
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About capital and labor?

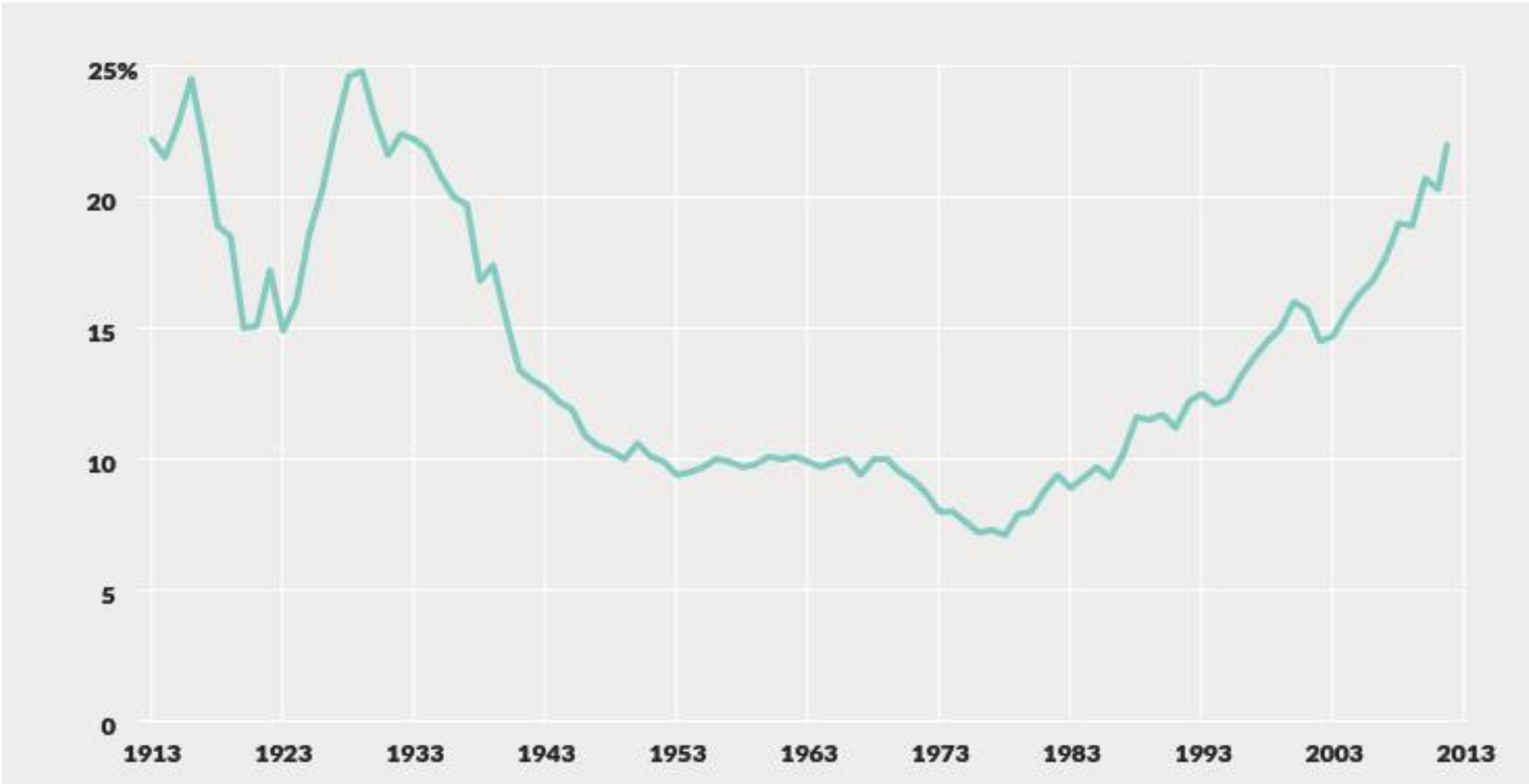
- We can use "skilled labor" instead of K
- We can use "unskilled labor" instead of L

Hence we can use the model to talk about **inequality in the long term:** Payments to K vs. L can be reinterpreted as payments to skilled vs. unskilled labor

Top-income inequality in the US

The Return of the Roaring Twenties

The share of total U.S. wealth owned by the top 0.1 percent of families, 1913-2012



Notes: Wealth is total assets (including real estate and funded pension wealth) net of all debts. Wealth excludes the present value of future government transfers (such as Social Security or Medicare benefits).

Source: Saez, Emmanuel and Gabriel Zucman "Wealth Inequality in the United States since 1913: Evidence from Capitalized Income Tax Data", NBER Working Paper, October 2014, online at http://gabriel-zucman.eu/uswealth/

Washington Center for Equitable Growth

Introduction

Plan of lecture on Heckscher-Ohlin model (ch 4):

- Introduction
- Model: who trade what?
- Trade and factors of production in data
- Payments to K and L

1- Heckscher-Ohlin Model

Assumptions of the Heckscher-Ohlin Model

Assumption 1: Two factors of production, L and K, can move freely between the industries.

Assumption 2: Two sectors: Shoes” and Computers production of shoes is “labor-intensive”.

1- Heckscher-Ohlin Model

Some definitions:

Definition: We say that shoe production is "labor-intensive" if it requires more labor per unit of capital to produce shoes than computers, so that $L_S / K_S > L_C / K_C$.

Wage: payment to Labor

Rental rate: payment to K

What determines the use of K vs. L in a sector?

1- Heckscher-Ohlin Model

Some definitions:

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Wage: payment to Labor

Rental rate: payment to K

What determines the use of K vs. L in a sector?

Ratio of rental rate / wage:

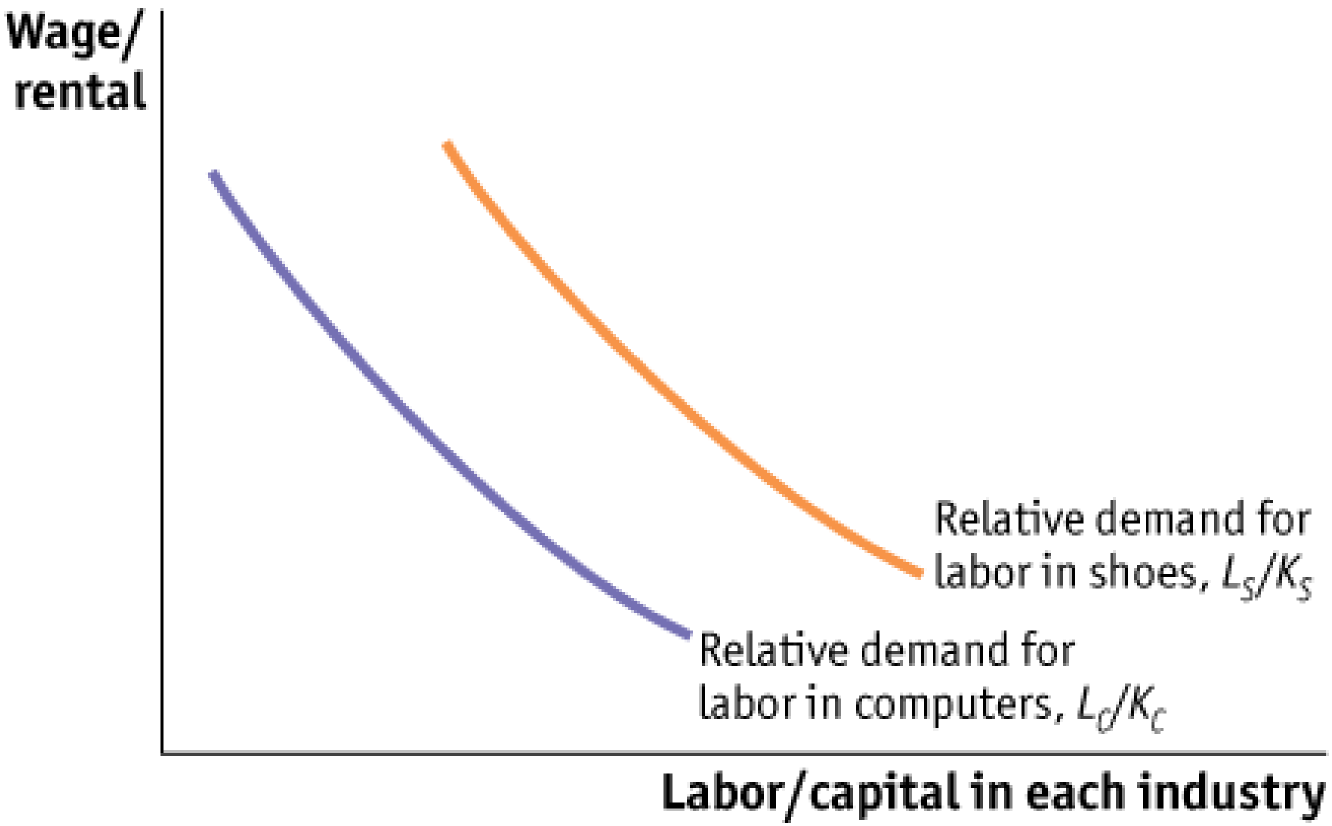
Higher relative price of K ➔ More intensive use of L vs. K

1- Heckscher-Ohlin Model

Labor Intensity of Each Industry

The demand for labor relative to capital is assumed to be higher in shoes than in computers: $L_S/K_S > L_C/K_C$.

***Assumption 2:* the two curves never intersect**



1- Heckscher-Ohlin Model

Optimal use of L and K in the Shoe industry?

1- Heckscher-Ohlin Model

Optimal use of L and K in the Shoe industry?

- At optimum:

$$w = P_S \,.\, MPL_S \quad \text{and} \quad r = P_S \,.\, MPK_S$$

- This implies:

$$w \,/\, r = MPL_S \,/\, MPK_S$$

where MP$L_S \,/\, MPK_S$ depends primarily on $K_S \,/\, L_S$

→ This provides a relationship between $K_S \,/\, L_S$ and w/r (like the one provided in the previous graph)

1- Heckscher-Ohlin Model

Examples of production functions:

- Shoe: $Y_S = a_S L_S^{1-\alpha} K_S^{\alpha}$ with $\alpha > 0$

Optimal use of L and K in the Shoe industry:

- MPL in Shoes: $MPL_S = (1-\alpha)\, a_S \left(K_S / L_S\right)^{\alpha}$
- MPK in Shoes: $MPK_S = \alpha\, a_S \left(L_S / K_S\right)^{1-\alpha}$
- $w = P_S \,.\, MPL_S$ and $r = P_S \,.\, MPK_S$ implies:

$$\frac{r}{w} = \frac{MPK_S}{MPL_S} = \frac{\alpha}{1-\alpha} \frac{L_S}{K_S} \quad \Rightarrow \quad \frac{K_S}{L_S} = \frac{\alpha}{1-\alpha}\left(\frac{r}{w}\right)^{-1}$$

1- Heckscher-Ohlin Model

Examples of production functions:

- Computer: $Y_C = a_C L_C^{1-\beta} K_C^{\beta}$ with $\beta > \alpha$

Optimal use of L and K in the Computer industry:

- MPK in Computers: $MPK_C = \beta\, a_C \left(L_C / K_C\right)^{1-\beta}$

- $w = P_C \,.\, MPL_C$ and $r = P_C \,.\, MPK_C$ implies:

$$\frac{r}{w} = \frac{MPK_C}{MPL_C} = \frac{\beta}{1-\beta} \frac{L_C}{K_C}$$

- $\beta > \alpha \quad \Rightarrow \quad \dfrac{K_C}{L_C} = \dfrac{\beta}{1-\beta} \left(\dfrac{r}{w}\right)^{-1} > \dfrac{K_S}{L_S}$ for all r/w

1- Heckscher-Ohlin Model

Other assumptions of the Heckscher-Ohlin Model

Assumption 3: Foreign is "Labor abundant", Home is Capital abundant.

Notation: $\bar{K}$ and $\bar{L}$: supply of K and L in Home country

$\bar{K}^*$ and $\bar{L}^*$: supply of K and L in Foreign country

Definition: Foreign is "labor-abundant" means that the labor-capital ratio in Foreign exceeds that in Home:

$$\bar{L}^*/\bar{K}^* > \bar{L}/\bar{K}$$

Assumption 4: Goods can be traded freely, but labor and capital do not move between countries.

1- Heckscher-Ohlin Model

Other assumptions of the Heckscher-Ohlin Model

Assumption 5: The technologies used to produce the two goods are identical across the countries.

Assumption 6: Consumer tastes are the same across countries, and preferences for computers and shoes do not vary with a country’s level of income.

1- Heckscher-Ohlin Model

Production functions:

- Shoe: $Y_S = a_S L_S^{1-\alpha} K_S^{\alpha}$
- Computer: $Y_C = a_C L_C^{1-\beta} K_C^{\beta}$ $\quad \beta > \alpha$

→ Production possibility frontier for Home?

1- Heckscher-Ohlin Model

Production functions:

- Shoe: $Y_S = a_S L_S^{1-\alpha} K_S^{\alpha}$
- Computer: $Y_C = a_C L_C^{1-\beta} K_C^{\beta}$ $\beta > \alpha$

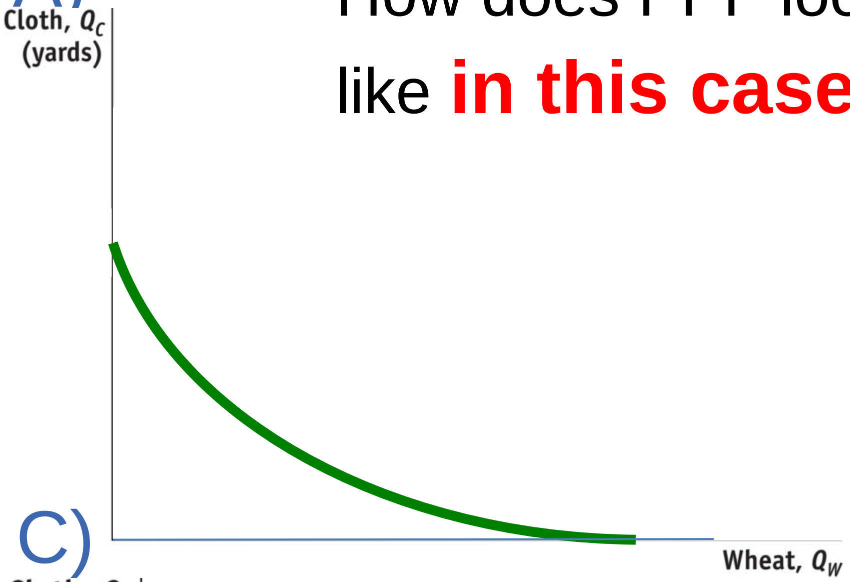
- Resource constraints:

$K_C + K_S = \overline{K}$ and $L_C + L_S = \overline{L}$

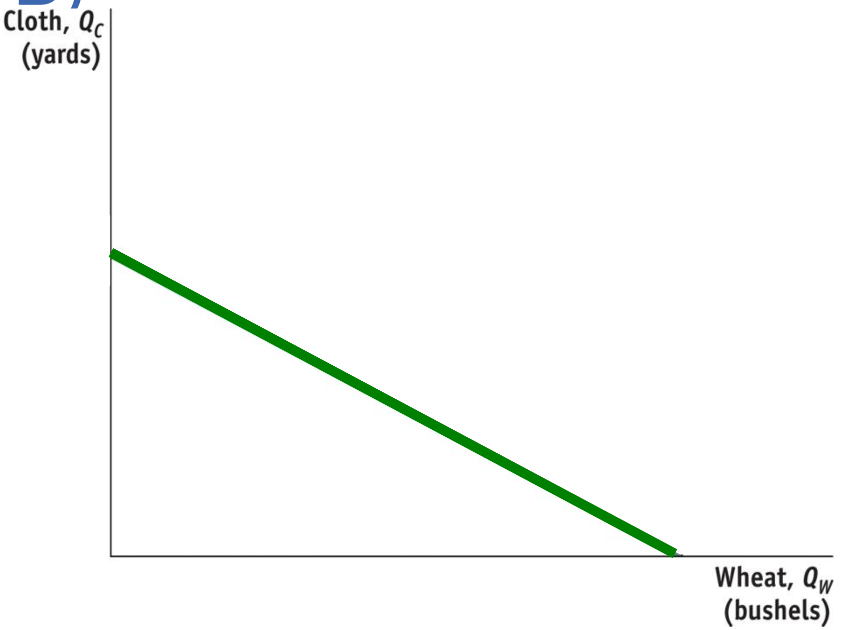
→ Production possibility frontier for Home?

How does PPF look like **in this case?**

A)

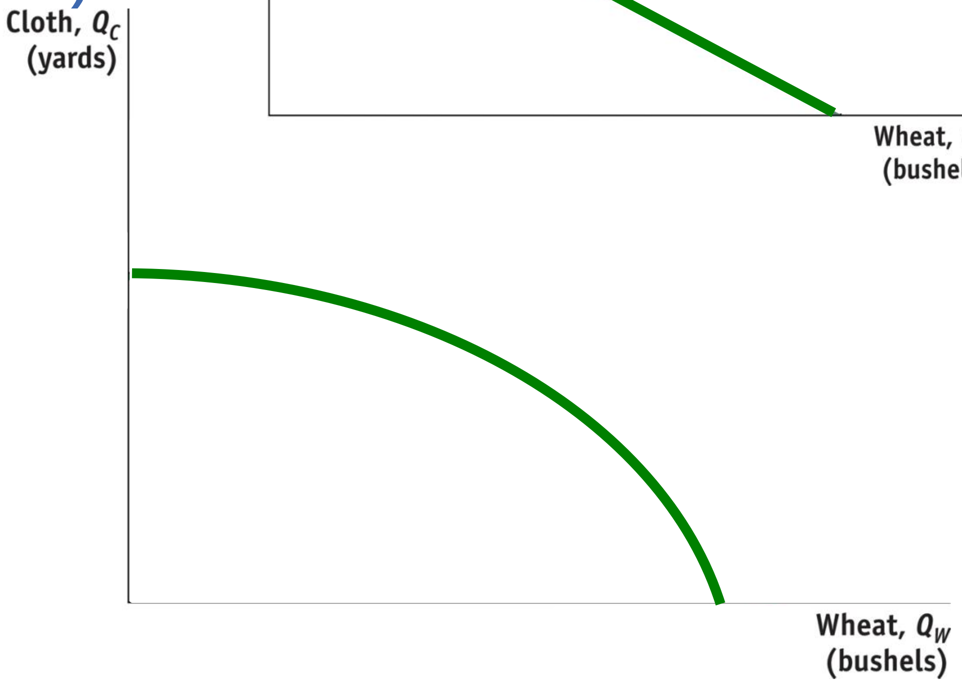


B)



C)

D)



1- Heckscher-Ohlin Model

Same production functions for Foreign:

- Shoe: $Y'_S = a_S L'_S{}^{\alpha} K'_S{}^{1-\alpha}$
- Computer: $Y'_C = a_C L'_C{}^{1-\beta} K'_C{}^{\beta}$

- Resource constraints:

$K'_C + K'_S = \overline{K}^*$ and $L'_C + L'_S = \overline{L}^*$

→ Production possibility frontier for Foreign?

→ How does it compare to Home?

1- Heckscher-Ohlin Model

Same production functions for Foreign:

- Shoe: $Y'_S = a_S L'^{\alpha}_S K'^{1-\alpha}_S$
- Computer: $Y'_C = a_C L'^{1-\beta}_C K'^{\beta}_C$

- Resource constraints:

$K'_C + K'_S = \overline{K}^*$ and $L'_C + L'_S = \overline{L}^*$

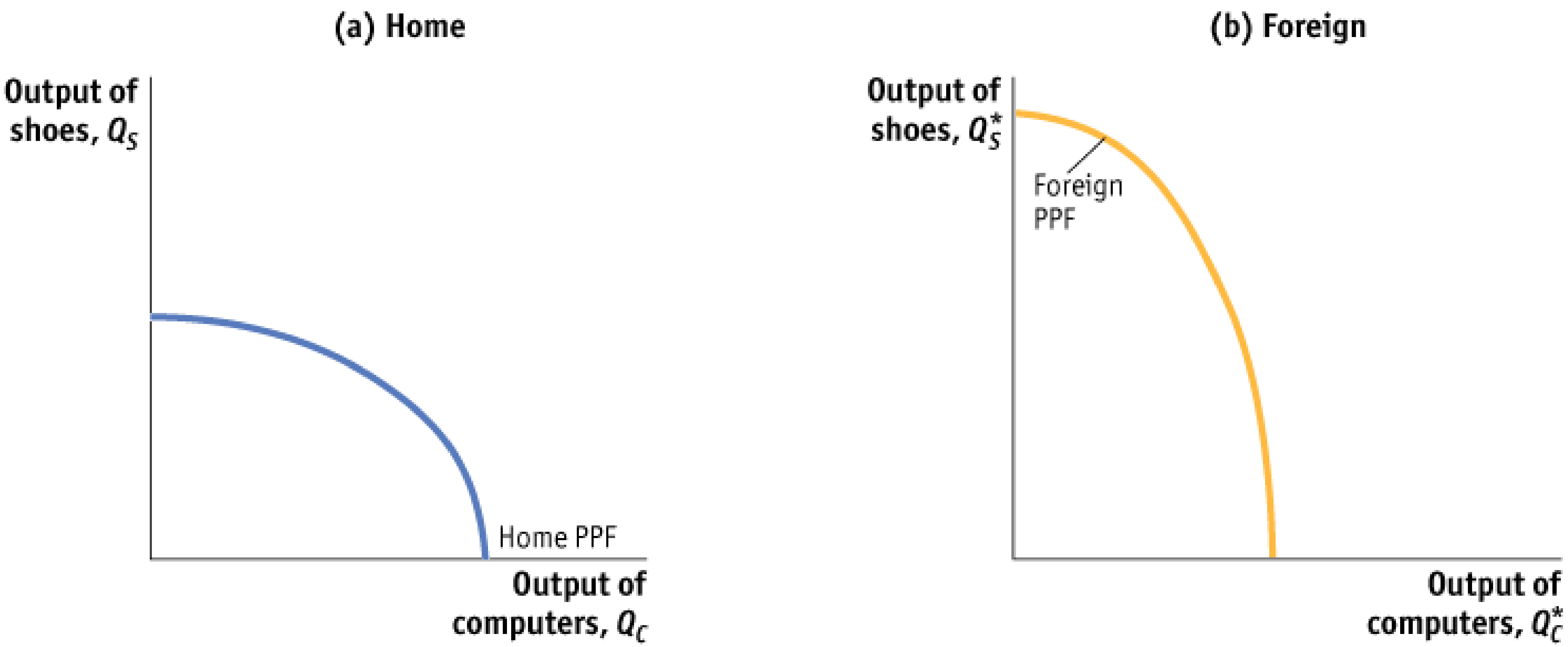
→ Production possibility frontier for Foreign?

Reminder: Home is K-abundant: $\overline{K}/\overline{L} > \overline{K}^*/\overline{L}^*$

No-Trade Equilibrium

PPF, Indifference Curves, and Autarky Price

Autarky Equilibria in Home and Foreign



Home vs Foreign PPF:

Because Home is **capital abundant**, the Home PPF is skewed toward computers.

1- Heckscher-Ohlin Model

Clicker question:

Is the slope of the PPF equal to…?

a) MPK_S/MPK_C

b) MPL_S/MPL_C

c) Both: slope = $MPK_S/MPK_C = MPL_S/MPL_C$

d) slope = $MPL_S/MPL_C + MPK_S/MPK_C$

e) None of the above

1- Heckscher-Ohlin Model

Answer:

Note also: slope = relative price P_C/P_S

1- Heckscher-Ohlin Model

Labor market equilibrium:

$$W = P_S \cdot MPL_S$$
$$W = P_C \cdot MPL_C \quad \Rightarrow \quad \frac{P_C}{P_S} = \frac{MPL_S}{MPL_C}$$

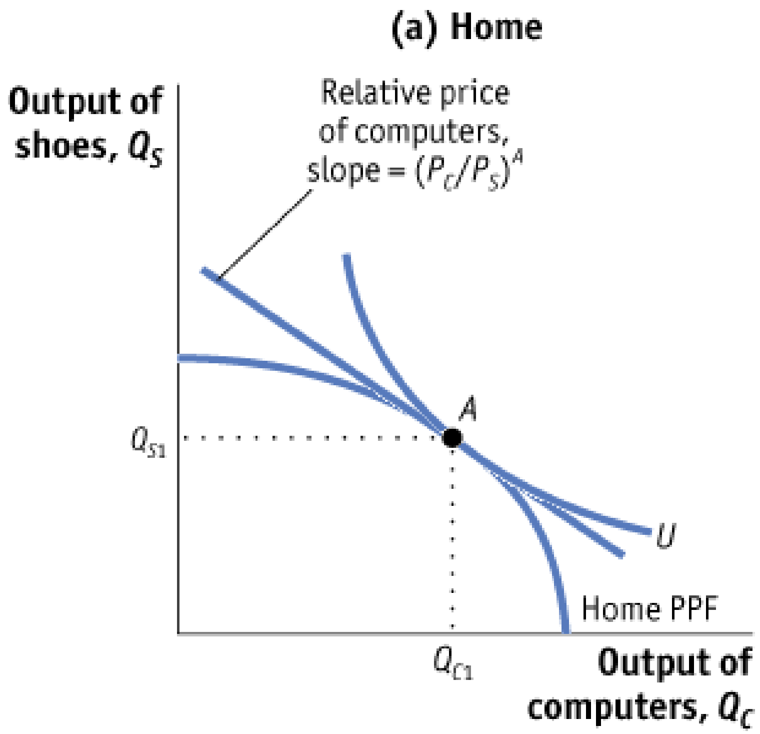
Capital market equilibrium:

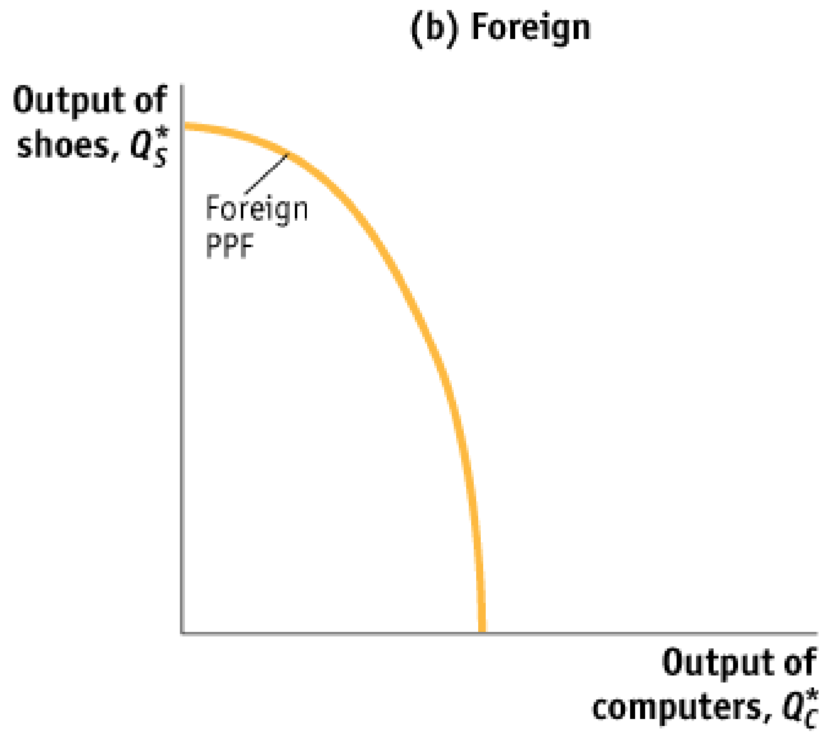
$$R = P_S \cdot MPK_S$$
$$R = P_C \cdot MPK_C \quad \Rightarrow \quad \frac{P_C}{P_S} = \frac{MPK_S}{MPK_C}$$

No-Trade Equilibrium

PPF, Indifference Curves, and Autarky Price

Autarky Equilibria in Home and Foreign (continued)

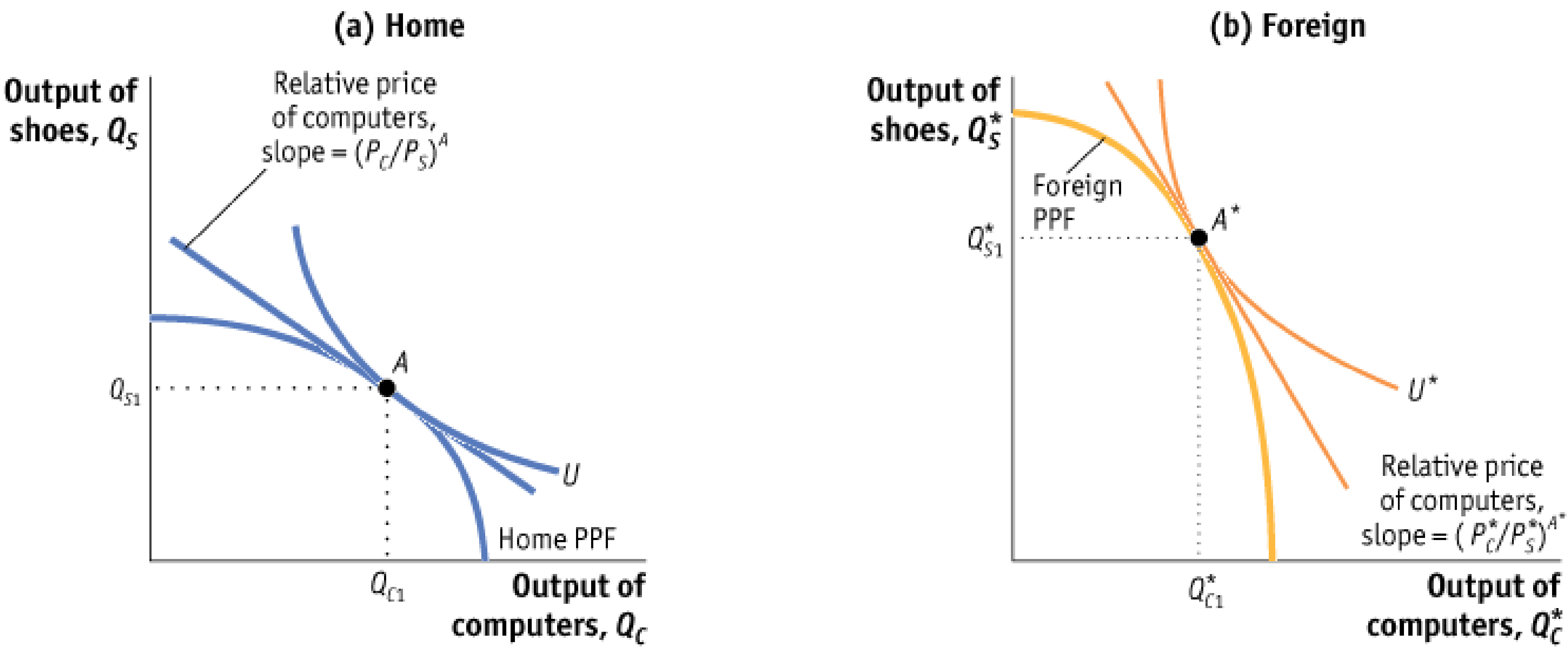




The flat slope indicates a low relative price of computers at Home in Autarky: $(P_C/P_S)^A$

No-Trade Equilibrium
PPF, Indifference Curves, and Autarky Price

Autarky Equilibria in Home and Foreign (continued)



The Foreign Autarky equilibrium has higher relative price of computers, as indicated by the steeper slope of $(P^*_C / P^*_S)^{A*}$

1- Heckscher-Ohlin Model

Relative price with free trade:

In autarky: $(P_C / P_S)^A < (P^*_C / P^*_S)^{A^*}$

Home has a "comparative advantage" in computers

With trade: $(P_C / P_S)^W$ such that:

$(P_C / P_S)^A < (P_C / P_S)^W < (P^*_C / P^*_S)^{A^*}$

1- Heckscher-Ohlin Model

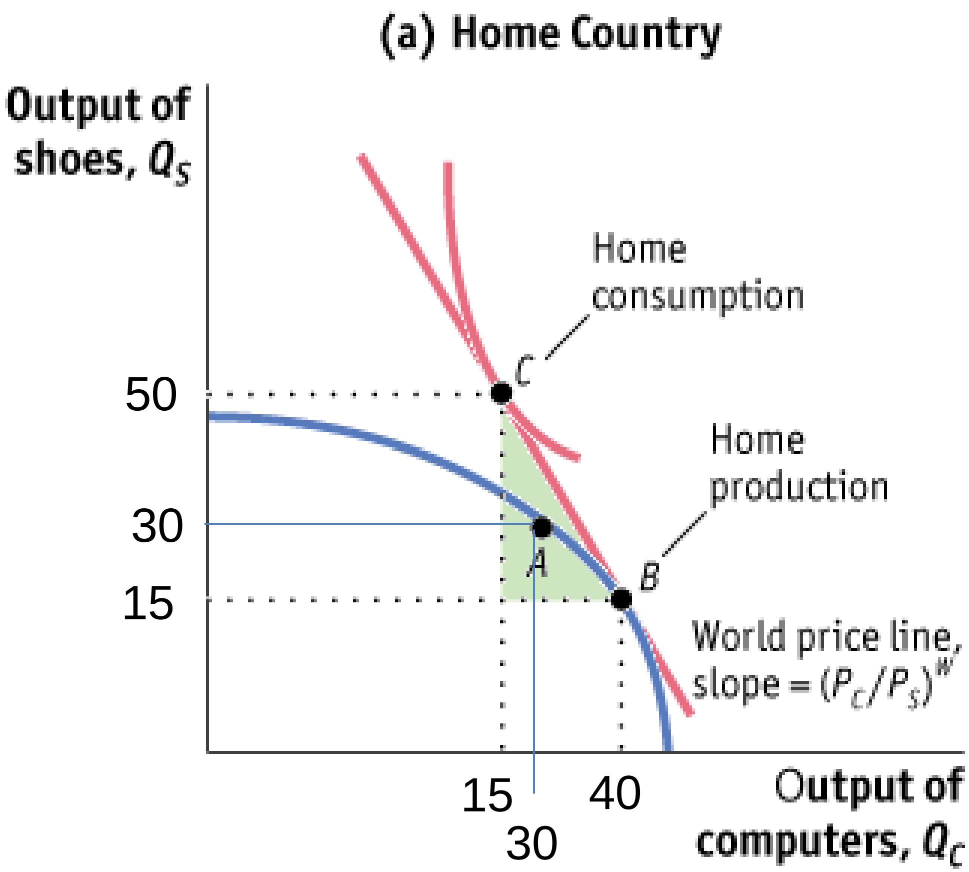
Relative price with free trade:

- Home export supply curve of computers?
- Foreign import demand curve of computers?

→ Intersection determines equilibrium price

(Simple) clicker question

Home:



1) In the figure, trade for the Home country is:

a. X_C = 20, M_S = 20;

b. X_C = 25, M_S = 35;

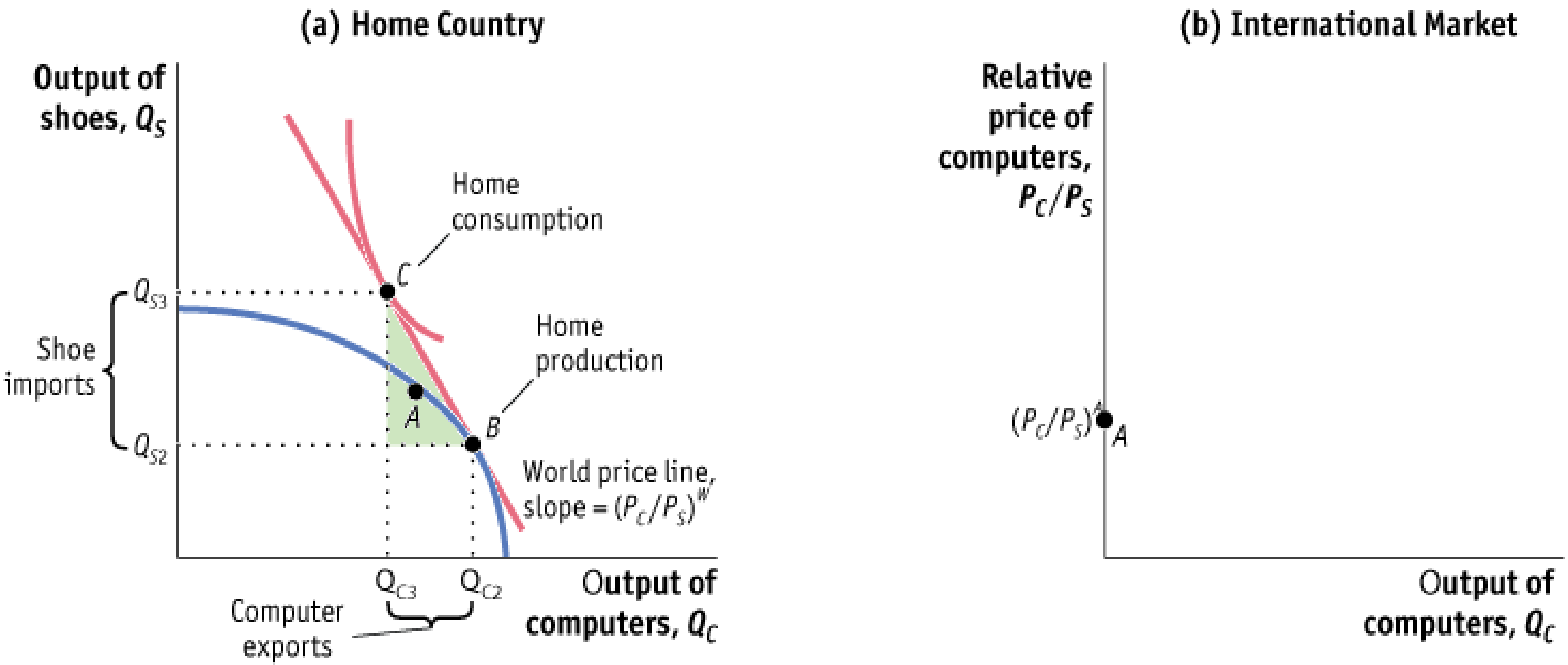
c. X_C = 25, M_S = 15;

d. X_C = 5, M_S = 20;

e. X_C = 35, M_S = 25;

Free-Trade Equilibrium

Home:

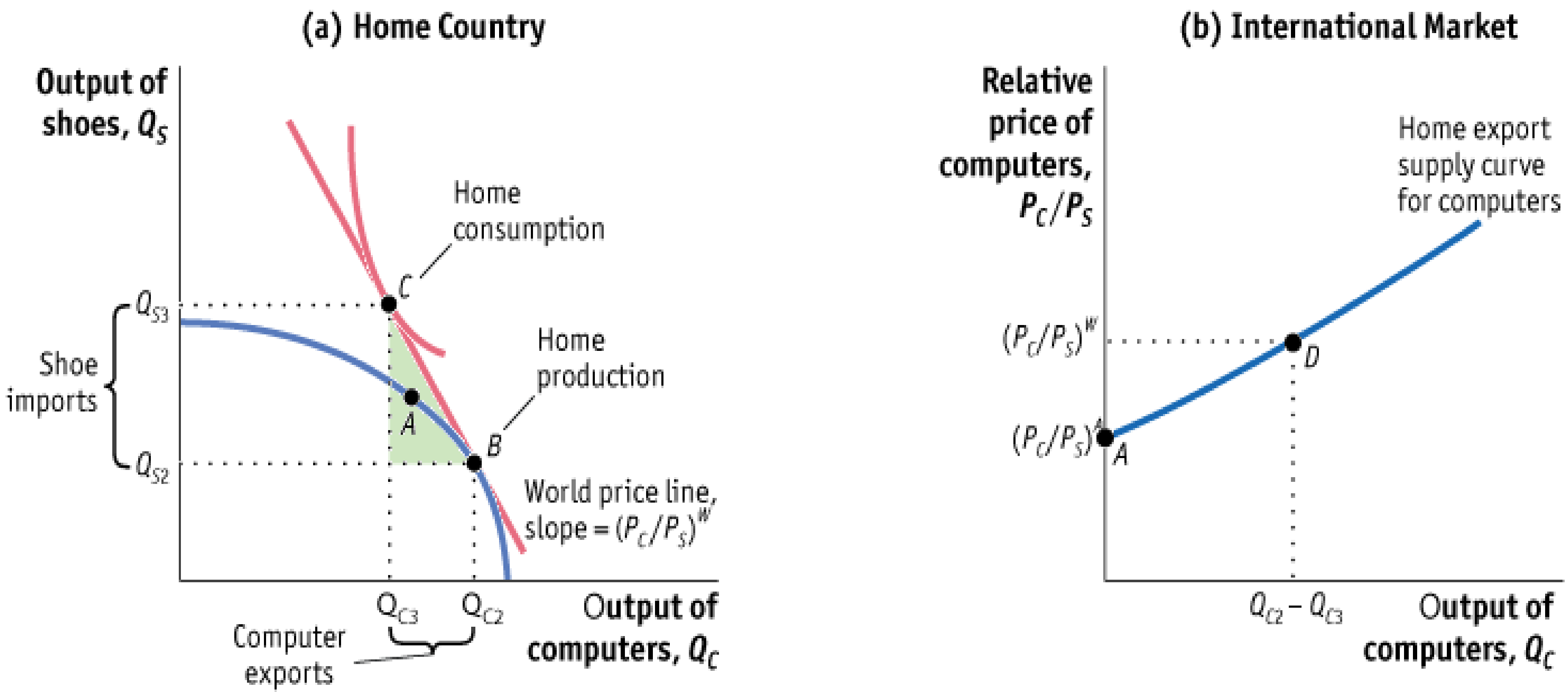


At the free-trade world relative price of computers, $(P_C /P_S)^W$, Home produces at point *B* in panel (a) and consumes at point *C:*

Exporting computers and importing shoes.

Free-Trade Equilibrium

Home:



In panel (b):

- **Home exports of computers** equal to zero at the autarky price, $(P_C/P_S)^A$,
- equal to $(Q_{C2} - Q_{C3})$ at free-trade relative price $(P_C/P_S)^W$

1- Heckscher-Ohlin Model

Steps to draw the export supply curve:

For ***each*** relative price P_C / P_S:

- Determine the optimal production point on the PPF (where the slope of the PPF equals P_C / P_S)

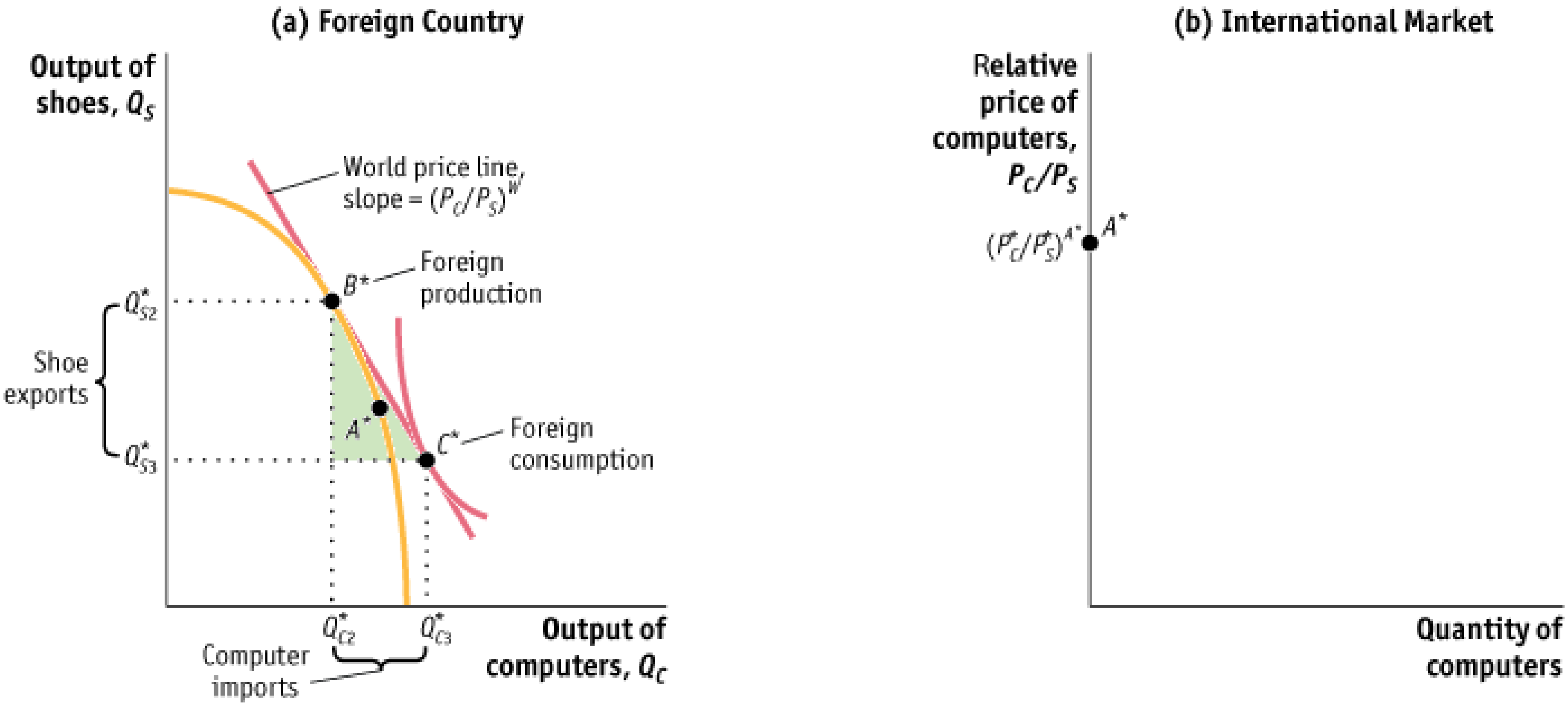
- Draw the new budget line (slope given by P_C / P_S)

- Determine the new consumption basket on the budget line (tangency to an indifference curve)

→ **Exports** (depending on P_C / P_S) correspond to the difference between production and consumption

Free-Trade Equilibrium

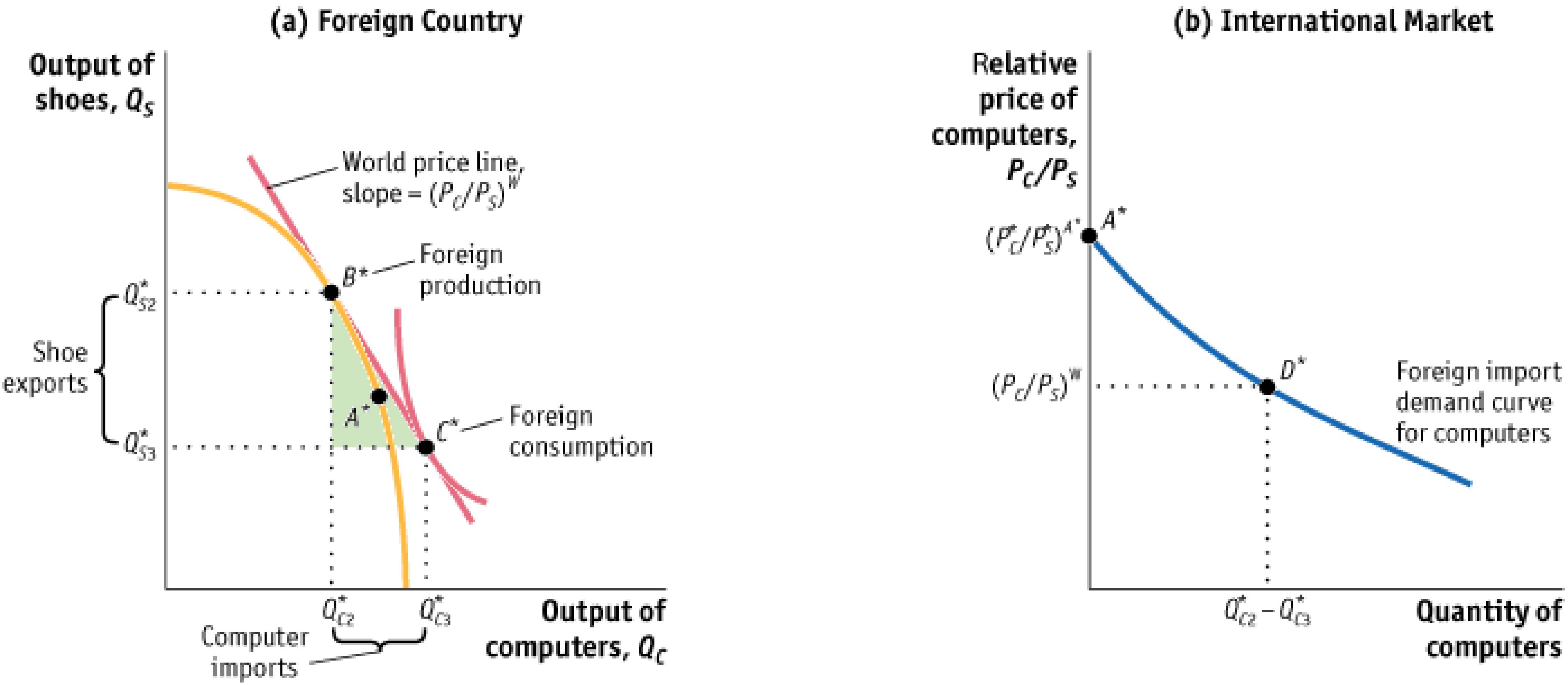
Foreign:



At the free-trade world relative price *$(P_C/P_S)^W$*, Foreign produces at point *B^** in panel (a) and consumes at point *C^**, **importing computers and exporting shoes.**

Free-Trade Equilibrium

Foreign:



In panel (b):

- Foreign imports no computers at autarky price $(P^*_C / P^*_S)^{A*}$
- imports equal to $Q^*_{C3}-Q^*_{C2}$ at the free-trade price $(P_C / P_S)^W$

1- Heckscher-Ohlin Model

Same steps to draw the import demand curve:

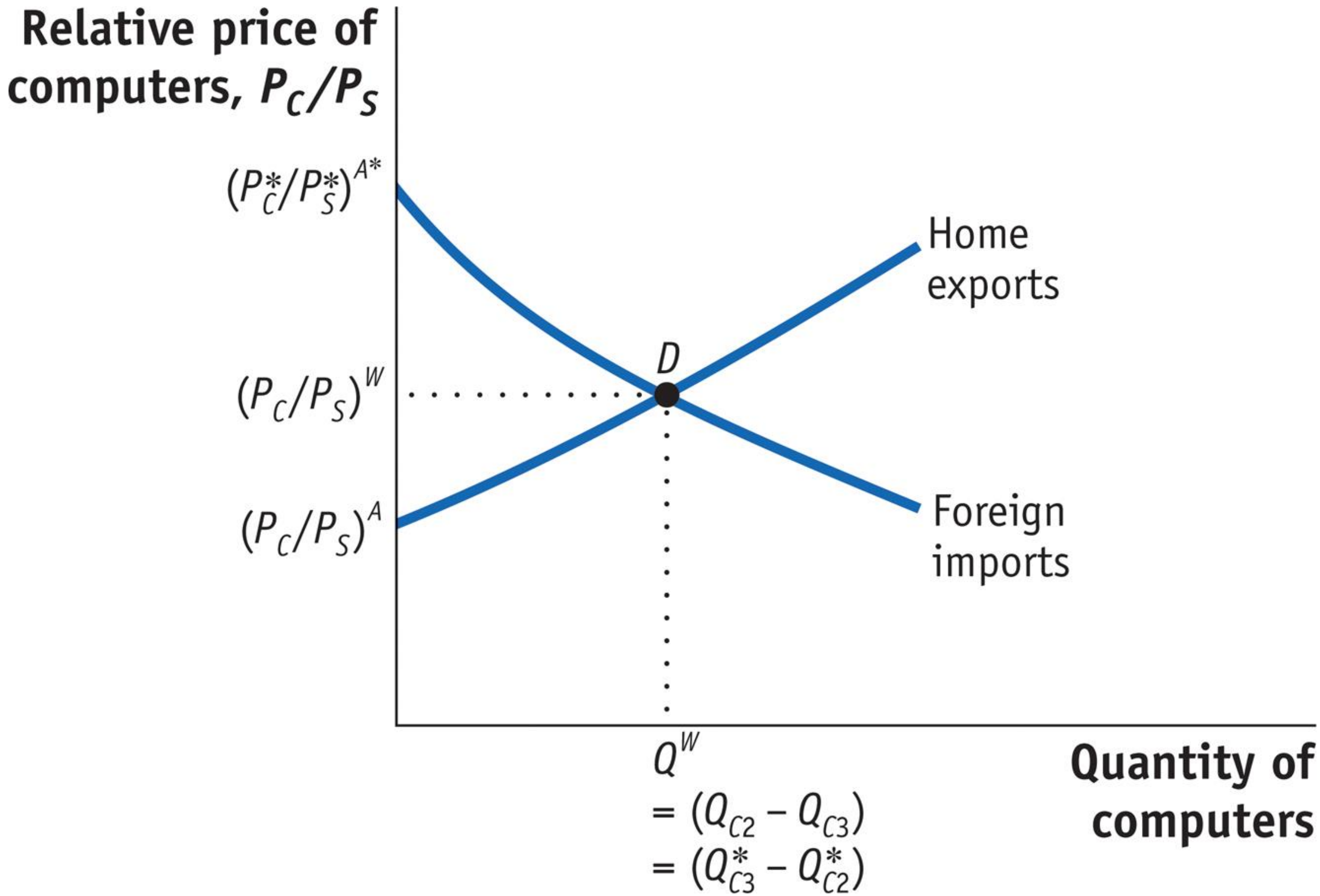
For ***each*** relative price P_C / P_S:

- Determine the optimal production point on the PPF (where the slope of the PPF equals P_C / P_S)
- Draw the new budget line (slope given by P_C / P_S)
- Determine the new consumption basket on the budget line (tangency to an indifference curve)

→ **Imports** (depending on P_C / P_S) correspond to the difference between consumption and production

Free-Trade Equilibrium

Home Exports of computers equal Foreign Imports of computers:



1- Heckscher-Ohlin Model

Free-Trade Equilibrium

Pattern of Trade

- Home exports computers, the good that uses intensively the factor of production (K) found in relative abundance at Home.

- Foreign exports shoes, the good that uses intensively the factor of production (L) found in relative abundance there.

This result is called the Heckscher-Ohlin theorem.

1- Heckscher-Ohlin Model

Heckscher-Ohlin Theorem: <u>a lot of assumptions:</u>

Assumption 1: L and K are mobile between the industries.

Assumption 2: The production of shoes is labor <u>intensive</u> as compared with computer production (K intensive).

Assumption 3: The amounts of labor and capital found in the two countries differ, with Foreign <u>abundant</u> in labor and Home <u>abundant</u> in capital.

Assumption 4: There is free international trade in goods.

Assumption 5: The technologies for producing shoes and computers are the same across countries.

Assumption 6: Tastes are the same across countries.