1.9 — The Hecksher-Ohlin Model

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Outline

Motivations of the Hecksher-Ohlin Model

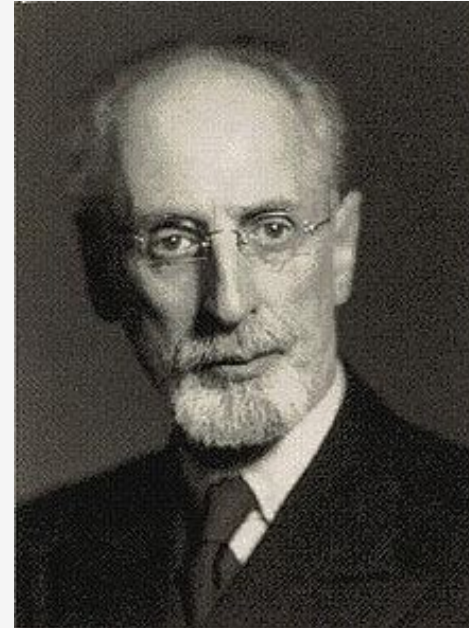# Extending/Applying the Standard Model

- Explore (some of) the **determinants of comparative advantage**

  - Standard model merely *assumed* comparative advantages via different relative prices across countries
  - What *causes* countrues to start with do those different relative prices?

- Explore effect that international trade has on earnings of factors in trading countries

  - We did that with specific factors model
 - Here we do that again with different assumptions

Motivations

- Eli Hecksher was a Swedish economist

- He & his student Bertil Ohlin developed a model to explain international trade

- They were writing during the late 1910s, during the "golden age of international trade" before WWI

- Wanted to explain the enormous burst of trade during their lifetimes

L: Eli Hecksher (1879-1952)
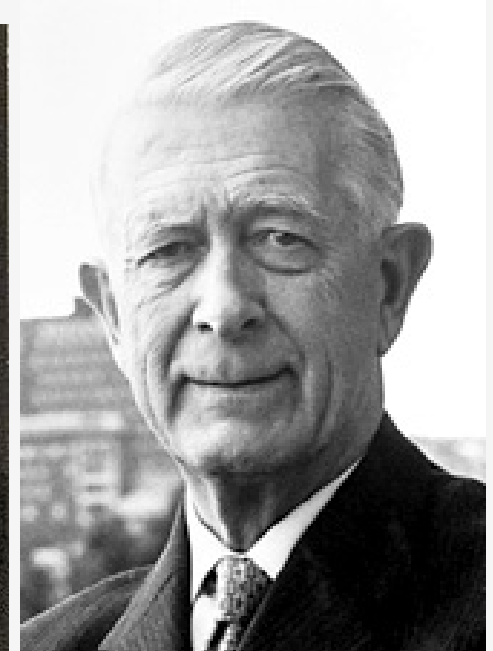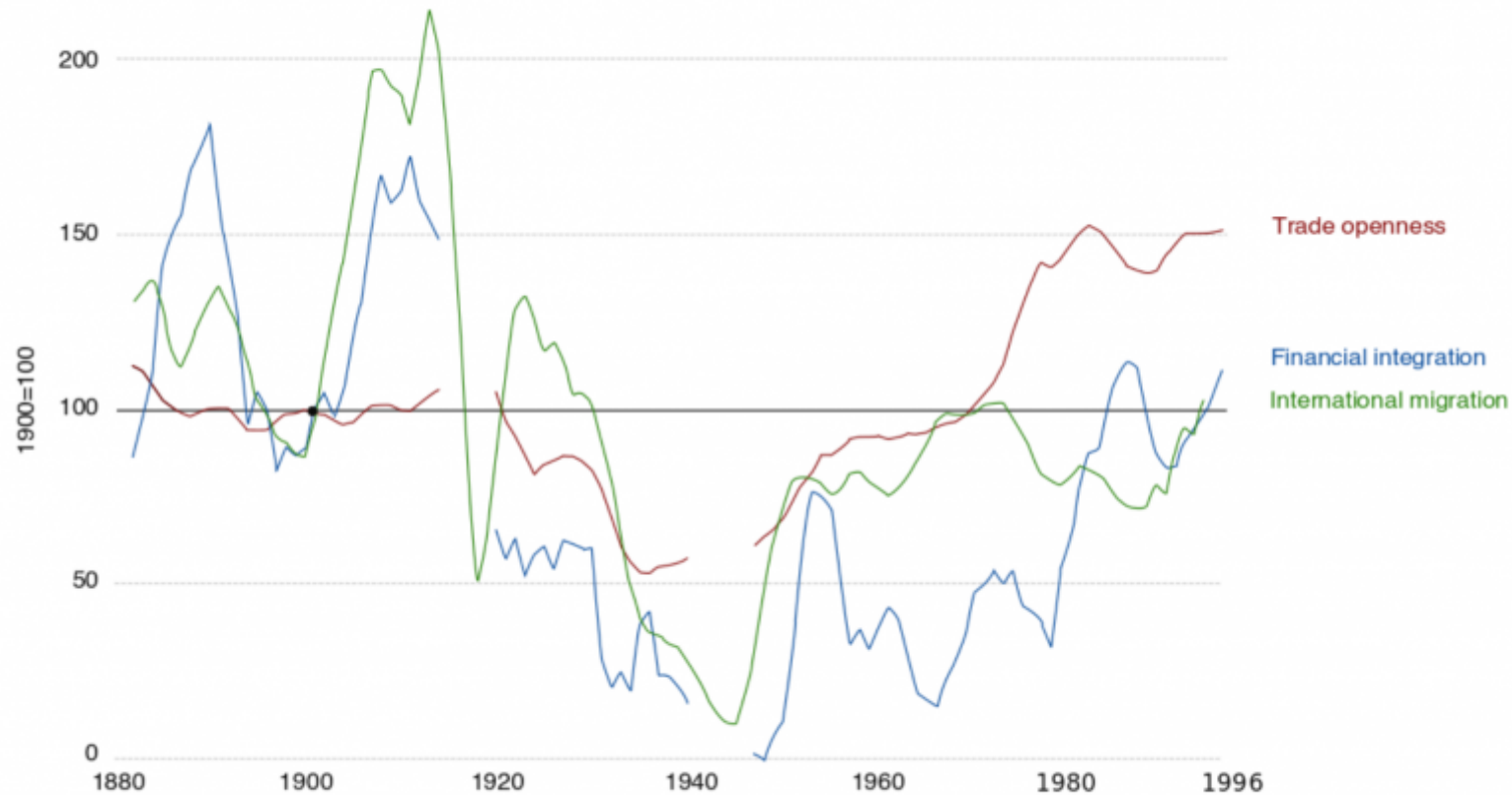
R: Bertil Ohlin (1899-1979)

The Golden Age of International Trade

Migration, financial integration and trade openness, World, 1880-1996

This chart shows the evolution of three indicators measuring integration in commodity, labor, and capital markets over the long run. All indicators are indexed, so that 1900 =100.

Note: Commodity market integration is measured by computing the ratio of goods exports to GDP. Labor market integration is measured by dividing the migratory turnover by population. Financial integration is measured using Feldstein–Horioka estimators of current account disconnectedness.

Source: Broadberry and O'Rouke (2010), The Cambridge Economic History of Modern Europe: Volume 2, 1870 to the Present. Cambridge University Press

This is a visualization from OurWorldinData.org, where you find data and research on how the world is changing. Licensed under CC-BY-SA by the authors Esteban Ortiz-Ospina and Diana Beltekian
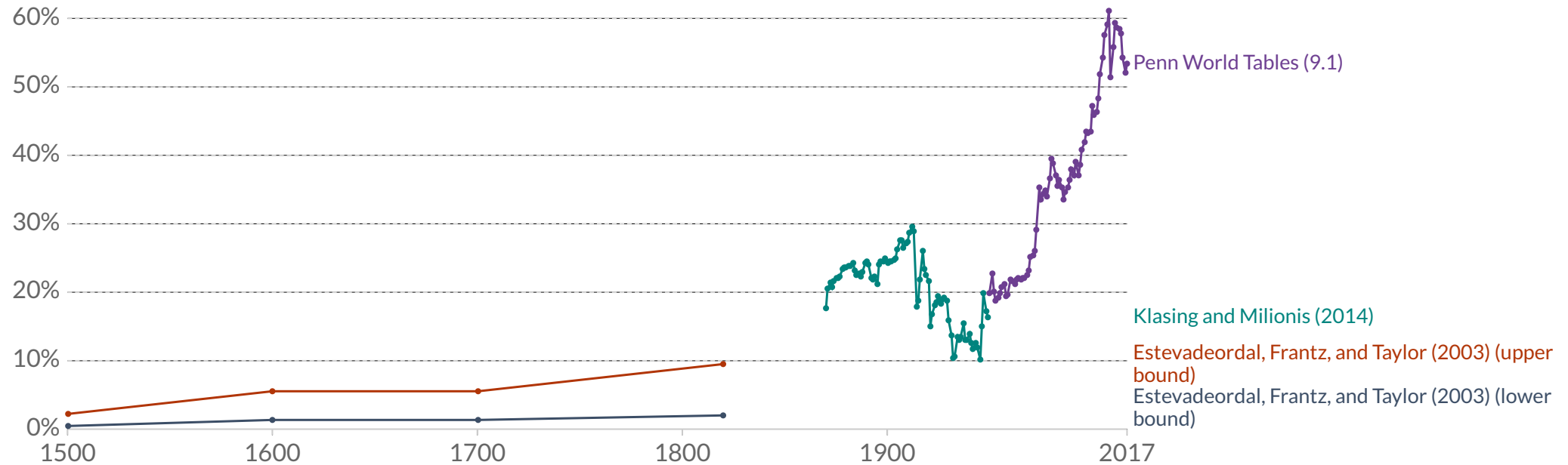
The Golden Age of International Trade


Globalization over 5 centuries

Shown is the "trade openness index". This index is defined as the sum of world exports and imports, divided by world GDP. Each series corresponds to a different source.

Penn World Tables (9.1)

Klasing and Milionis (2014)

Estevadeordal, Frantz, and Taylor (2003) (upper bound)

Estevadeordal, Frantz, and Taylor (2003) (lower bound)

Source: Estevadeordal, Frantz, and Taylor (2003), Klasing and Milionis (2014), Feenstra et al. (2015) Penn World Tables 9.1

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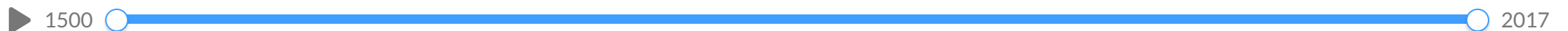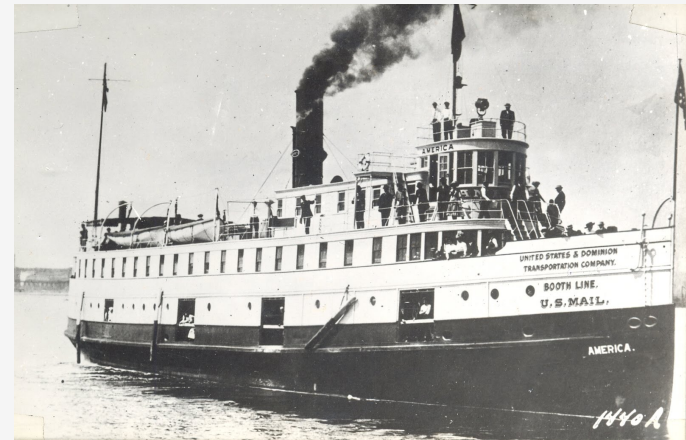
| CHART | TABLE | SOURCES | ⬇ DOWNLOAD | ⬚ |

The Second Industrial Revolution

- **"Second industrial revolution"** c.1890–1914, especially in United States

- Massive improvements & innovation in transportation & supply chains

  - railroads, steamships, automobiles, electrification, refrigeration

- Massive increase in international trade until WWI (1914)
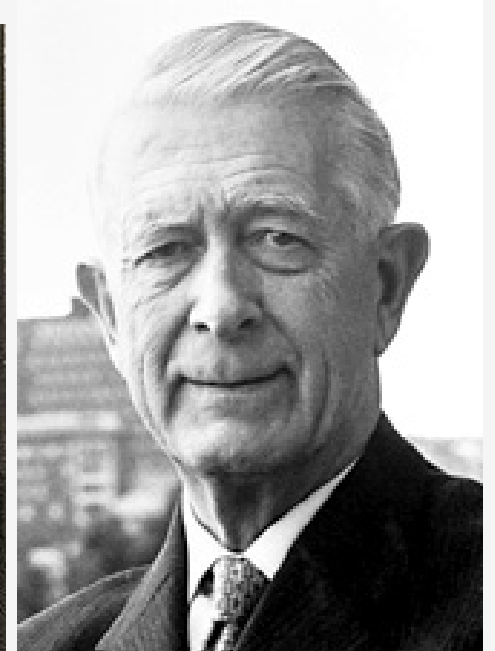
Motivations

- Unlike Ricardo: it's not differences in technology/productivity across countries that cause trade

    - can mimic and transfer!

- It's the uneven distribution of resources, the **factors of production**: land, labor, capital
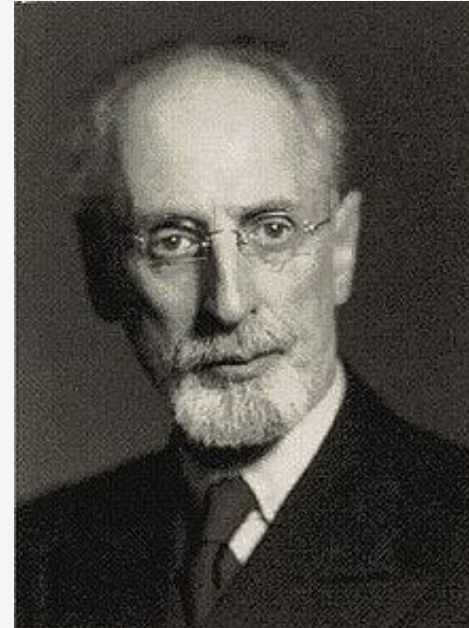
L: Eli Hecksher (1879-1952)

R: Bertil Ohlin (1899-1979)

Differences in Factor Endowments

Relatively **land** abundant

Exports timber, agricultural products

Relatively **capital** abundant

Exports services, sophisticated manuf.

Relatively **labor** abundant
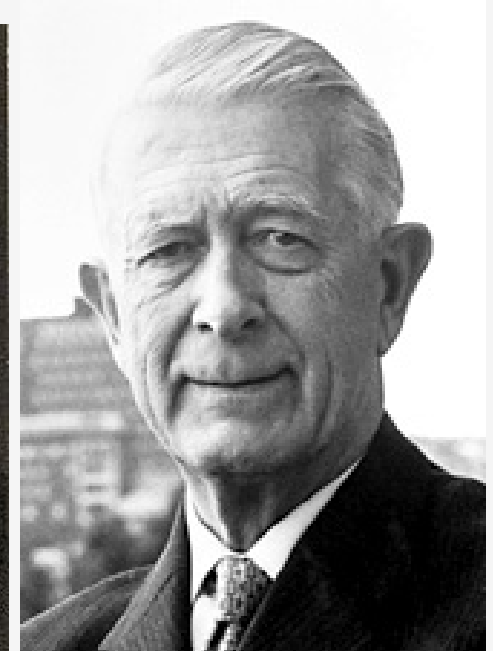
Exports basic manuf.

Hecksher-Ohlin Theory

- **Hecksher-Ohlin (H-O) Theory**: focus on differences in relative abundance of factors of production across countries

  - determines different relative prices and hence comparative advantage

- H-O Theory is often expressed as the combination of **several "theorems"**...
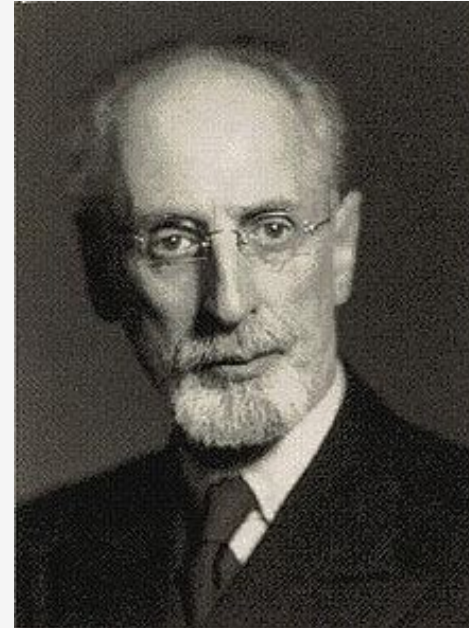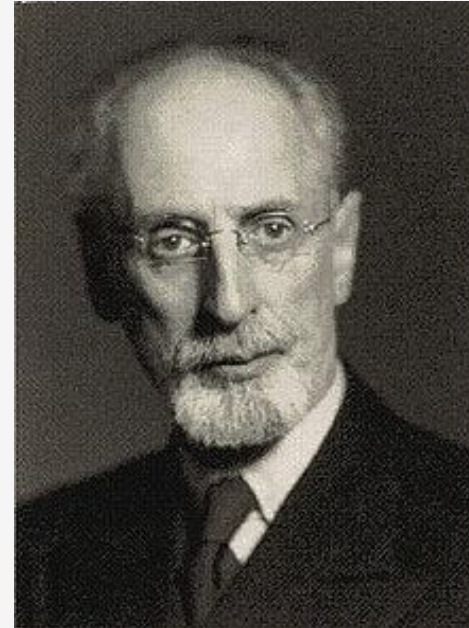

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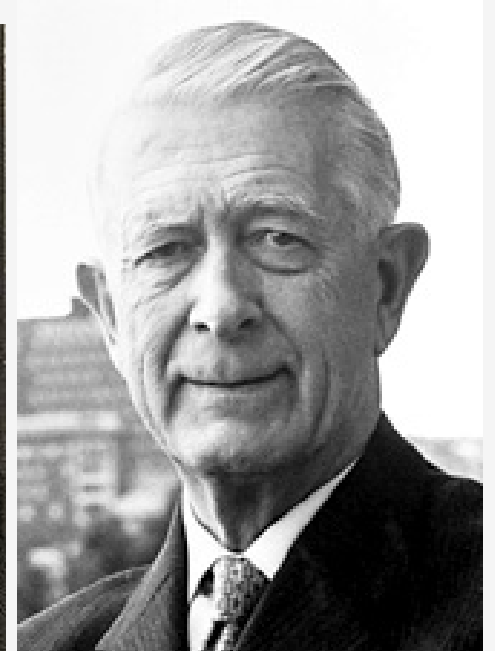
R: Bertil Ohlin (1899-1979)

Hecksher-Ohlin Theorem

1) **Hecksher-Ohlin (H-O) Theorem**: a nation will export the good whose production requires the intensive use of the nation's relatively abundant factor, and import the good whose production requires the intensive use of the nation's relatively scarce factor
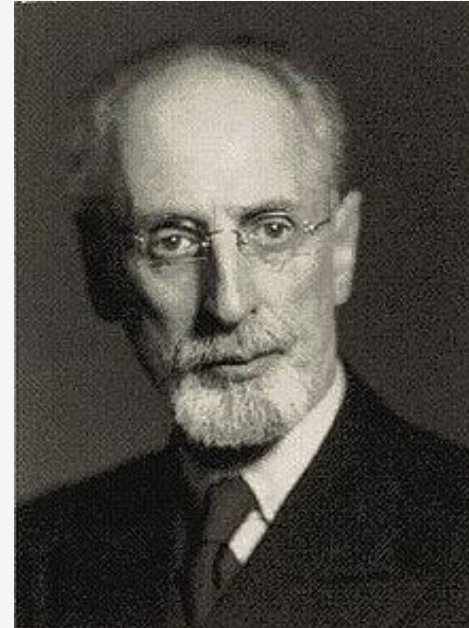

L: Eli Hecksher (1879-1952)

R: Bertil Ohlin (1899-1979)

Factor-Price Equalization Theorem

2) **Factor Price Equalization (FPE) Theorem**: under certain conditions, international trade tends to bring about equalization in relative and absolute returns to homogeneous factors across nations

3) **Stolper-Samuelson Theorem**: in the long run, an increase in the relative price of a good will increase the real earnings of the factor used intensively in that good's production and decrease the earnings of the other factor

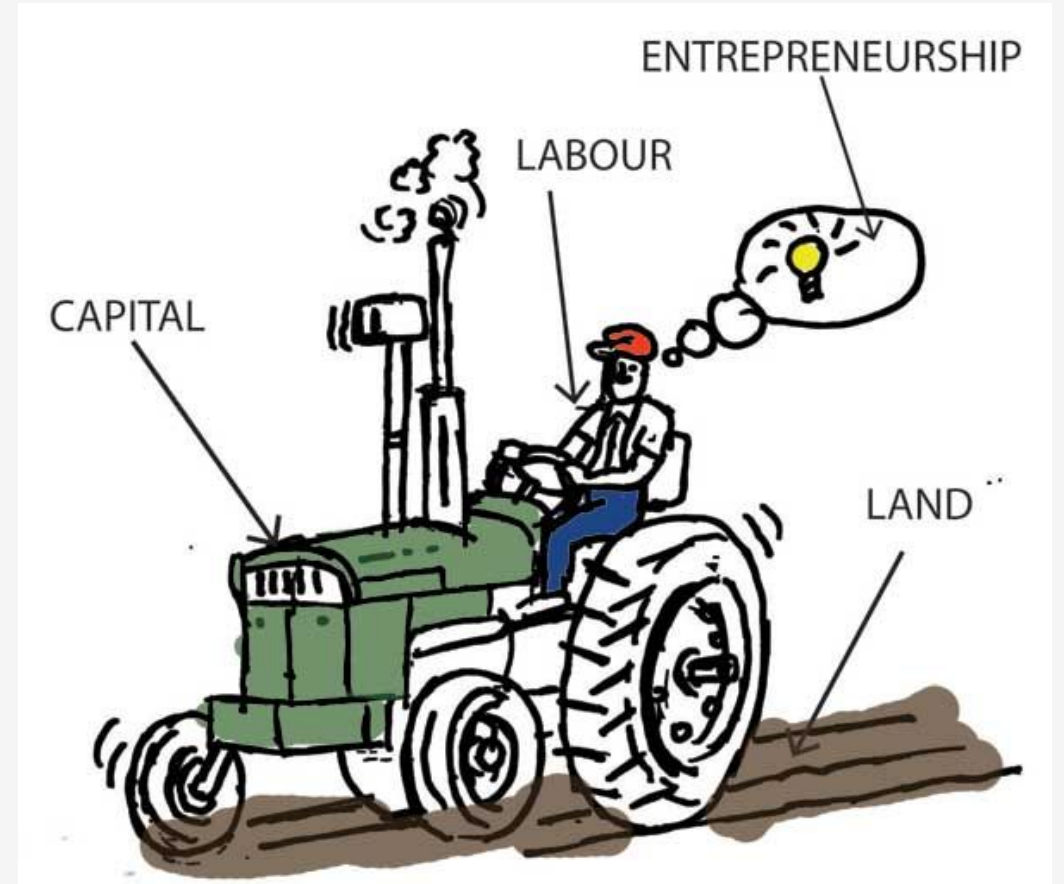L: Eli Hecksher (1879-1952)
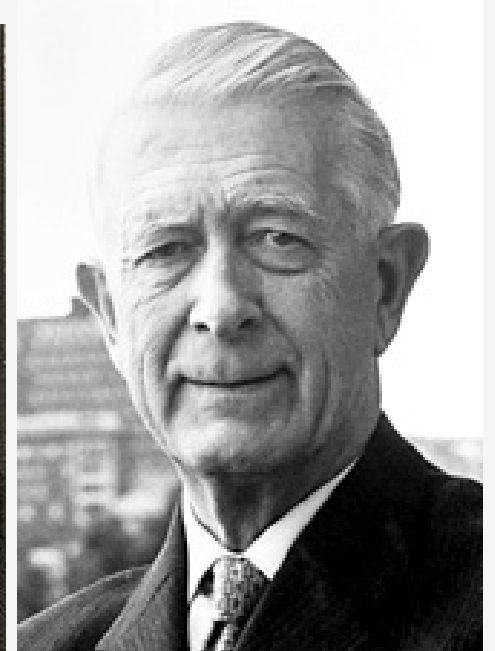
R: Bertil Ohlin (1899-1979)

Assumptions of the H-O Model

Assumptions of the H-O Model

- Imagine 2 countries, Home and Foreign

- Countries have two factors of production:

  - labor (L)
  - capital (K)

- All factors of production are **mobile** (non-specific) within a country, but *not internationally*

Setting up an H-O Model Example

- Each country has two industries, **computers (c)** and **shoes (s)**

- **Shoe** production (s) is **relatively labor-intensive**, requiring a *higher* **labor to capital ratio** $\frac{l}{k}$

- **Computer** production (c) is **relatively capital-intensive**, requiring a *lower* **labor to capital ratio** $\frac{l}{k}$

$$\frac{l_c}{k_c} < \frac{l_s}{k_s}$$

Setting up an H-O Model Example

- **Foreign** is **relatively labor-abundant**, with a high **labor to capital ratio**, $\frac{L}{K}$

- **Home** is **relatively capital-abundant**, with a low **labor to capital ratio**, $\frac{L}{K}$
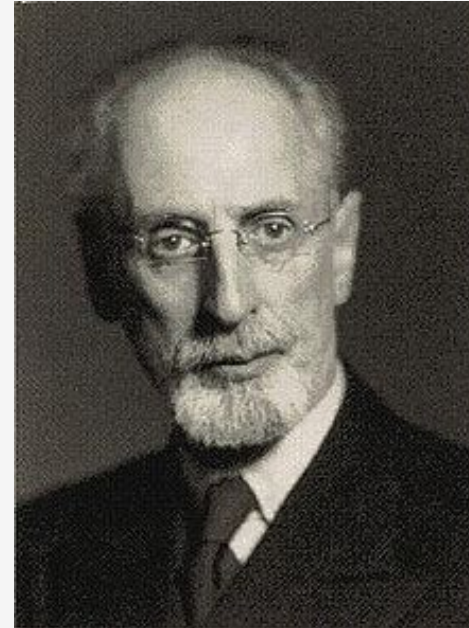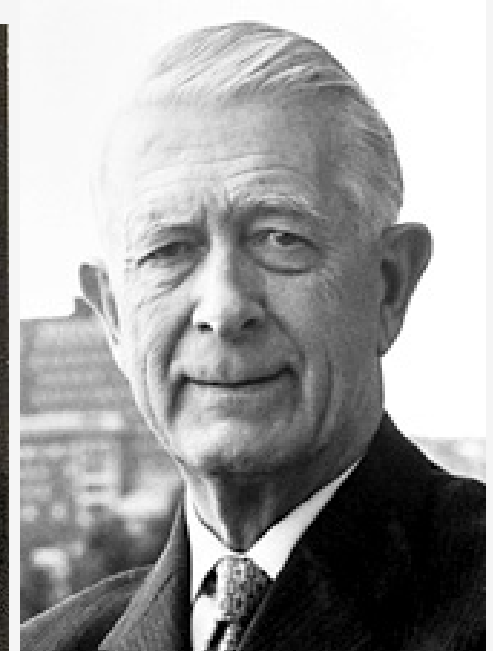
$$\frac{L}{K} < \frac{L'}{K'}$$

A Few Simplifying Assumptions

- Both factors are required to produce each good

- Final products are traded freely

- Technology is identical across countries

- Consumer preferences are identical across countries and do not vary with income

L: Eli Hecksher (1879-1952)

R: Bertil Ohlin (1899-1979)

The Two Industries

- **Shoe** production (s) is **relatively labor-intensive good**, requiring a *higher* labor to capital ratio $\frac{l_s}{k_s}$

- **Computer** production (c) is **relatively capital-intensive good**, requiring a *lower* labor to capital ratio $\frac{l_c}{k_c}$

- Key is *relative* **factor intensity**!

- In absolute terms, computers could need *more* labor to make than shoes, but if computers require more capital *per worker* than shoes, they are *relatively* more capital-intensive (and vice versa)!

The Two Countries

- **Foreign** is **relatively labor-abundant**, with a high labor to capital ratio, $\frac{L}{K}$

- **Home** is **relatively capital-abundant**, with a low labor to capital ratio, $\frac{L}{K}$

- Key is *relative* **factor abundance**!

- In absolute terms, Home could have *more* labor than Foreign, but if Foreign has more labor *per unit of capital* than Home, Foreign is *relatively* more labor-abundant (and vice versa)!
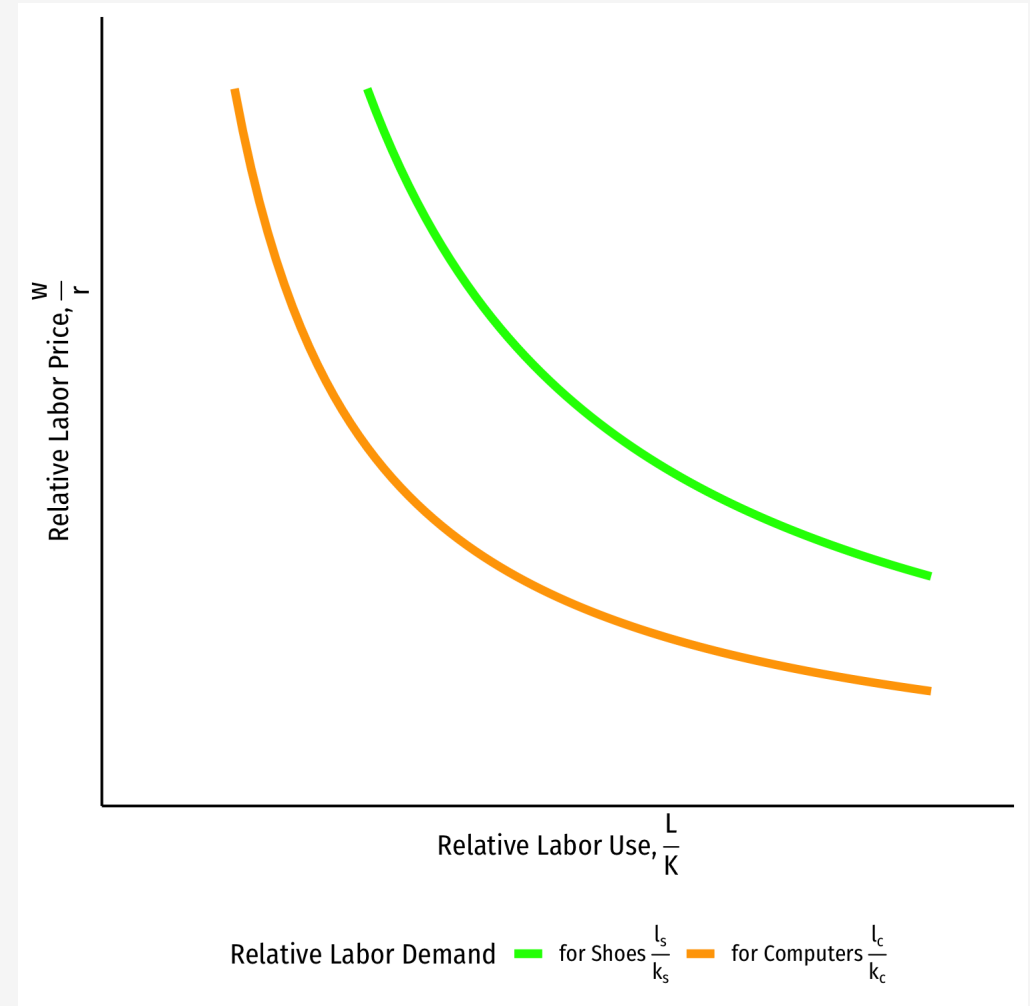
Relative Factor Uses and Relative Factor Prices

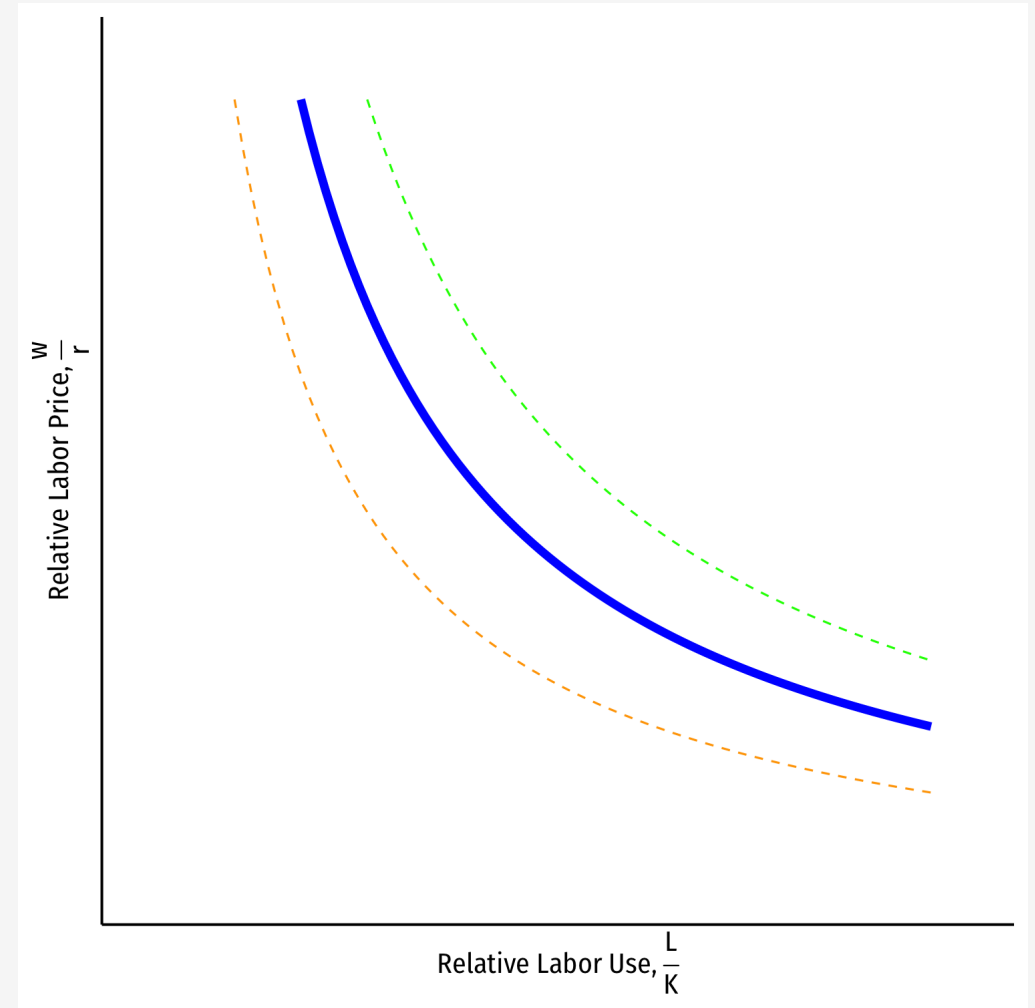# Relative Factor Uses and Relative Factor Prices

- Consider *relative* factor uses and *relative* factor prices

- Note: I'll always do everything in terms of labor (labor-to-capital ratio $\frac{l}{k}$ and labor-to-capital return $\frac{w}{r}$) for consistency

- How much $\frac{l}{k}$ a country uses depends on the relative price of labor $\frac{w}{r}$
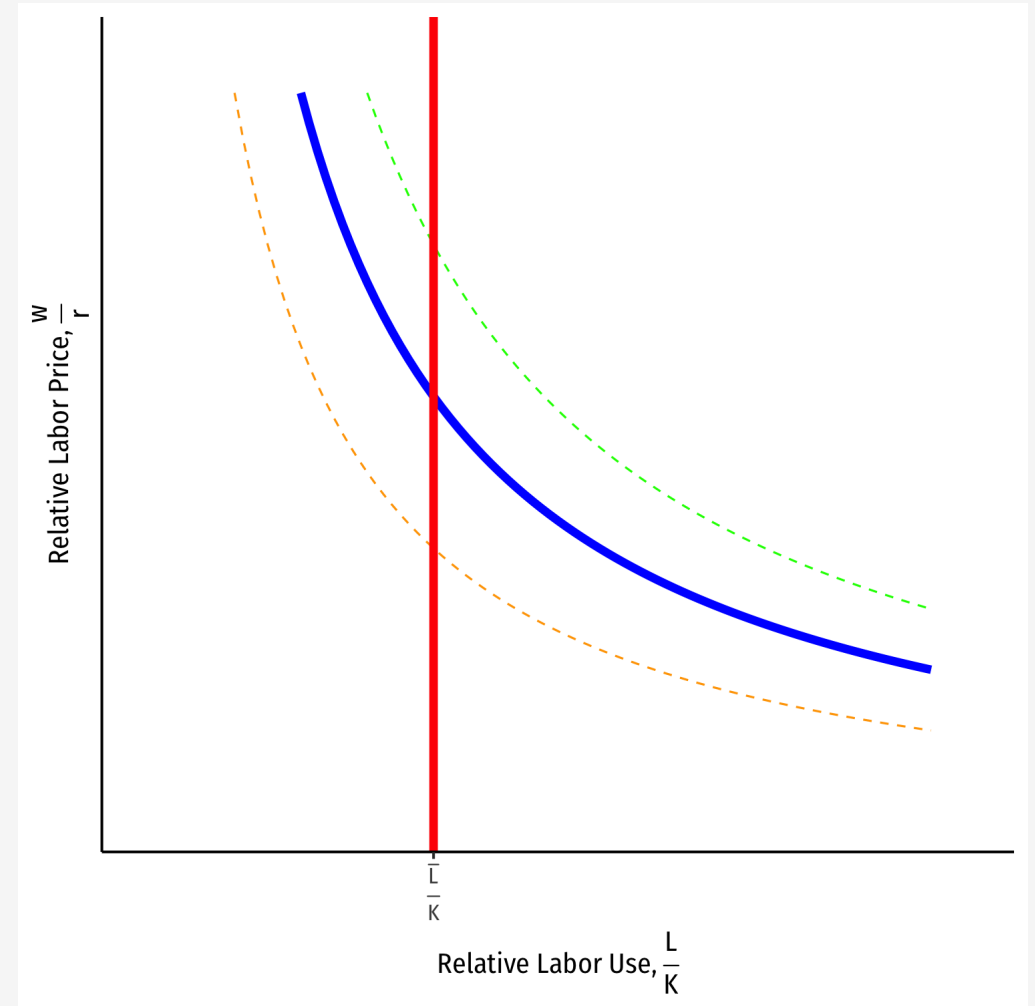

Relative Labor Price, $\frac{w}{r}$

Relative Labor Use, $\frac{L}{K}$

Relative Labor Demand — for Shoes $\frac{l_s}{k_s}$ — for Computers $\frac{l_c}{k_c}$

Factor Uses and Relative Factor Prices

- A country's *economy-wide* **relative demand for labor** is an average of the $\frac{l_s}{k_s}$ and $\frac{l_c}{k_c}$ relative labor demand curves

Factor Uses and Relative Factor Prices

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- A country is endowed with a fixed **relative supply of labor** $\frac{\bar{L}}{K}$

Relative Factor Uses and Relative Factor Prices

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- A country is endowed with a fixed **relative supply of labor** $\frac{\bar{L}}{K}$

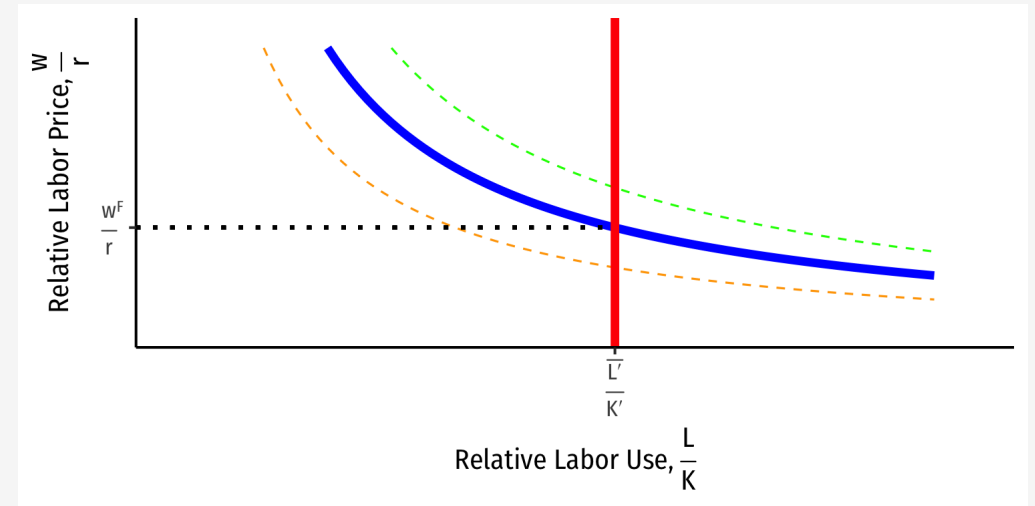- Intersection of relative supply and relative demand sets country's relative wage rate $\frac{w}{r}$
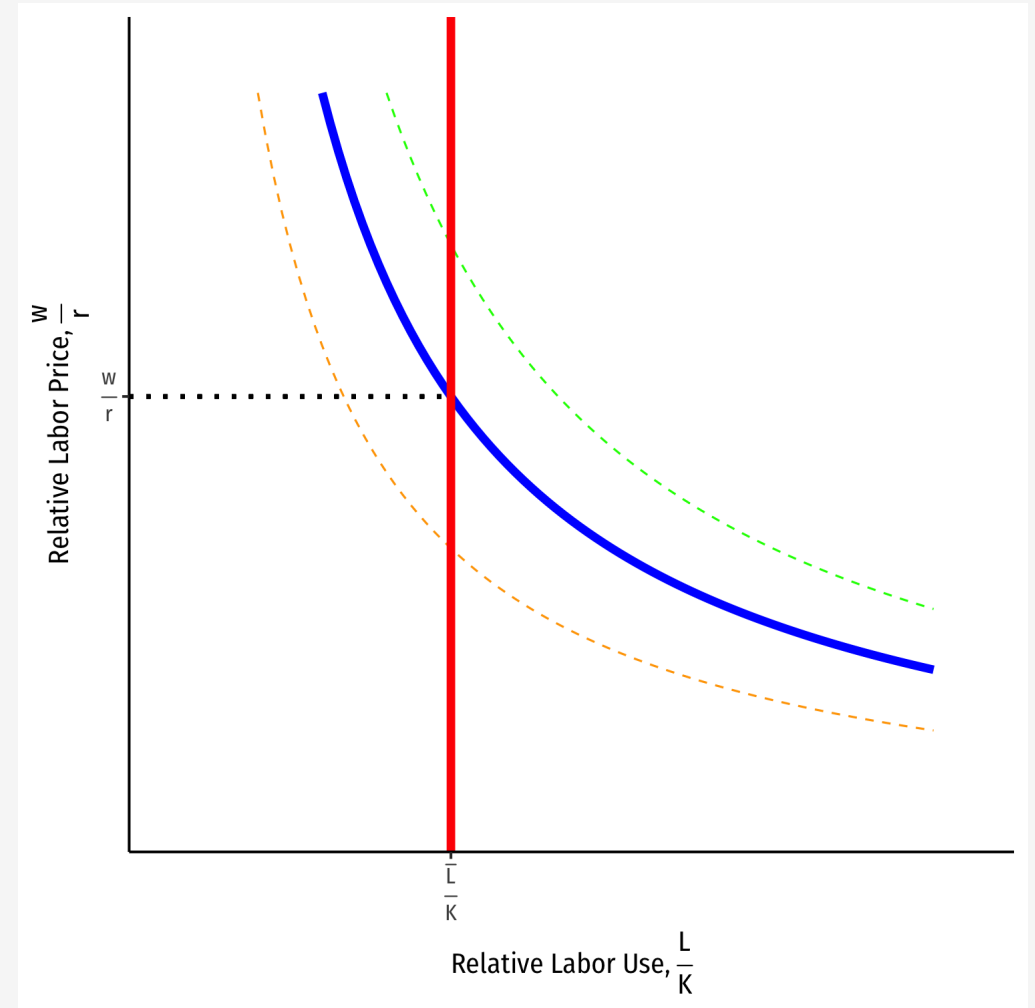
Different Relative Factor Endowments in Autarky

Home
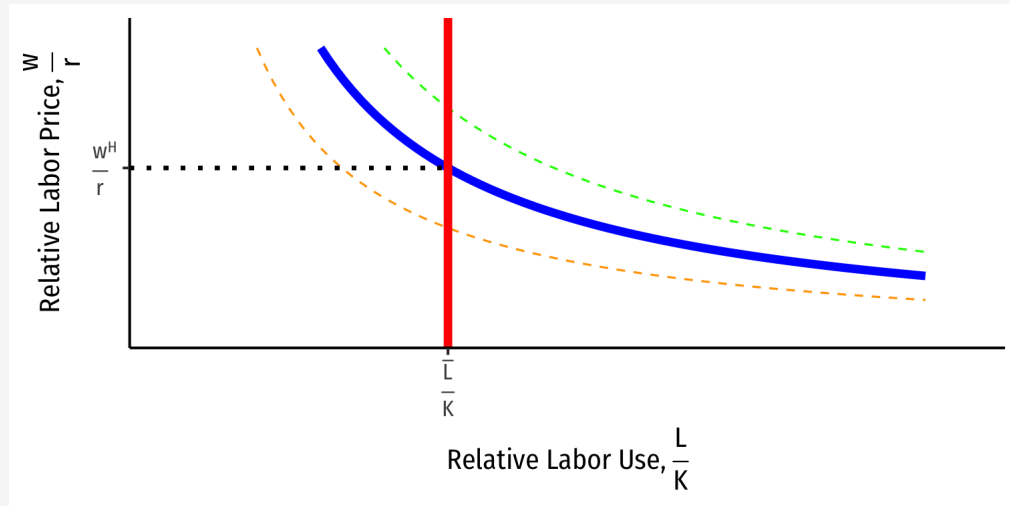
Foreign

- **Foreign** relatively more labor-abundant than **Home** $(\frac{\bar{L}}{\bar{K}})^H < (\frac{\bar{L}}{\bar{K}})^F$
- Thus, **Foreign** has a lower relative price of labor than Home $(\frac{w}{r})^H > (\frac{w}{r})^F$
  - Hence, **Foreign** has a comparative advantage in making **shoes**; **Home** in **computers**
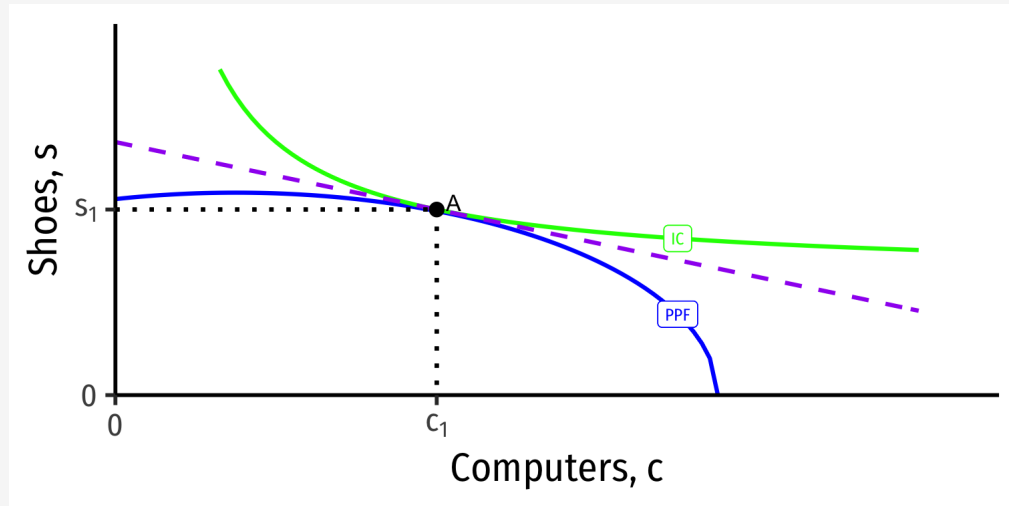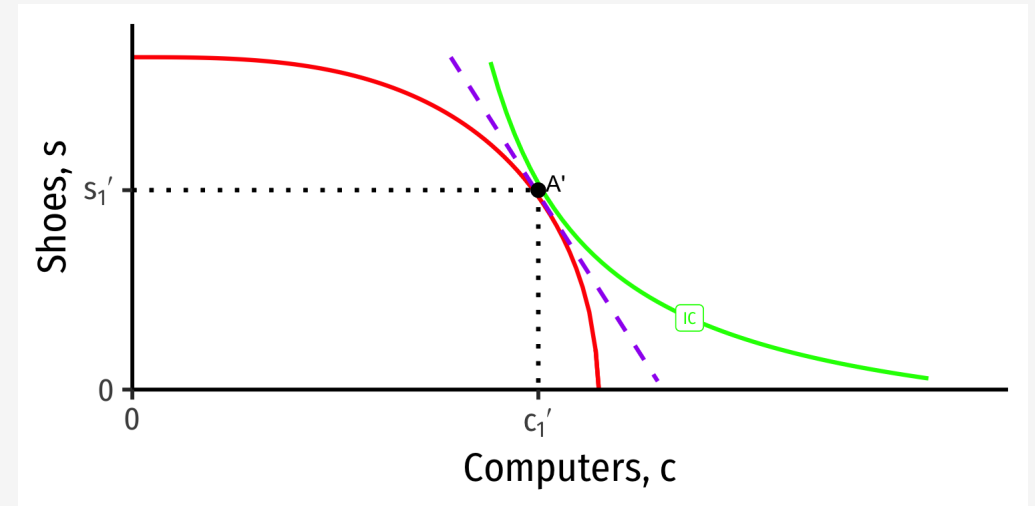
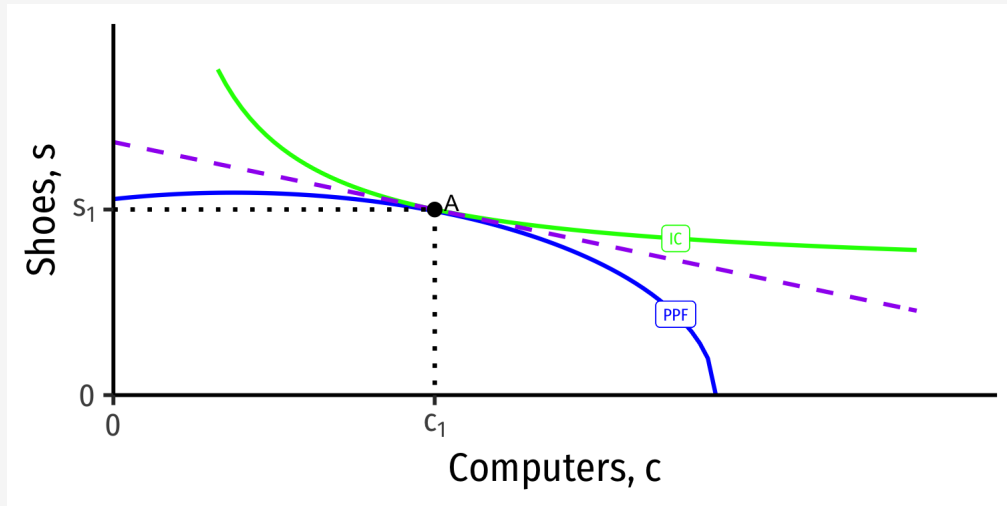# Running Our Two Country Example

Our Two Country Trade Example: Autarky

Home

Foreign

- Countries begin in **autarky** optimum with different relative prices
  - A is optimum for Home
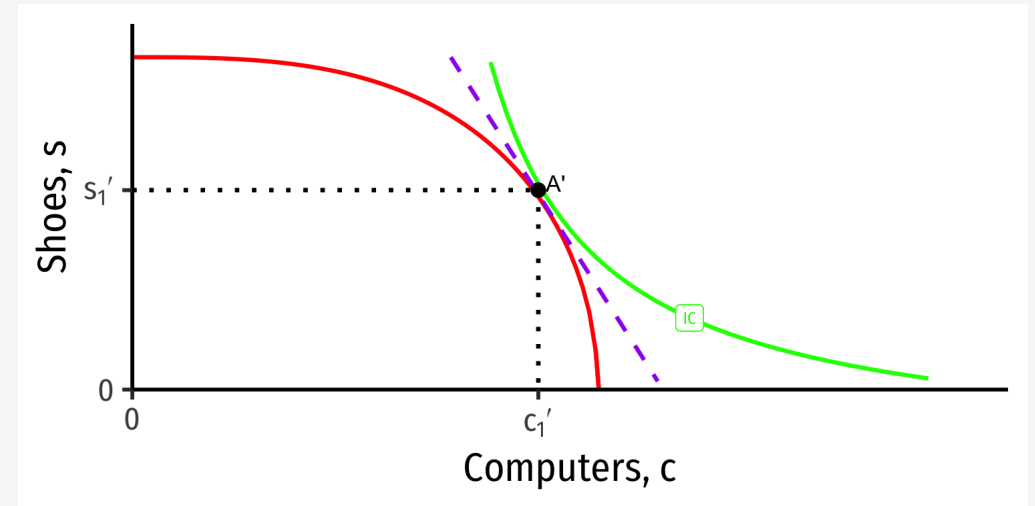 - A' is optimum for Foreign

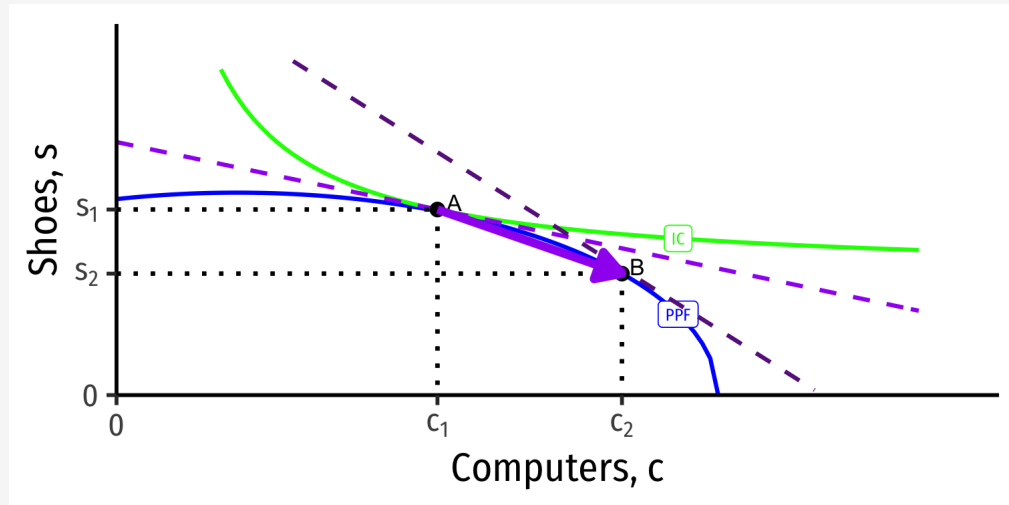# Our Two Country Trade Example: Specialization

Home

Foreign

- Home has comparative advantage in computers
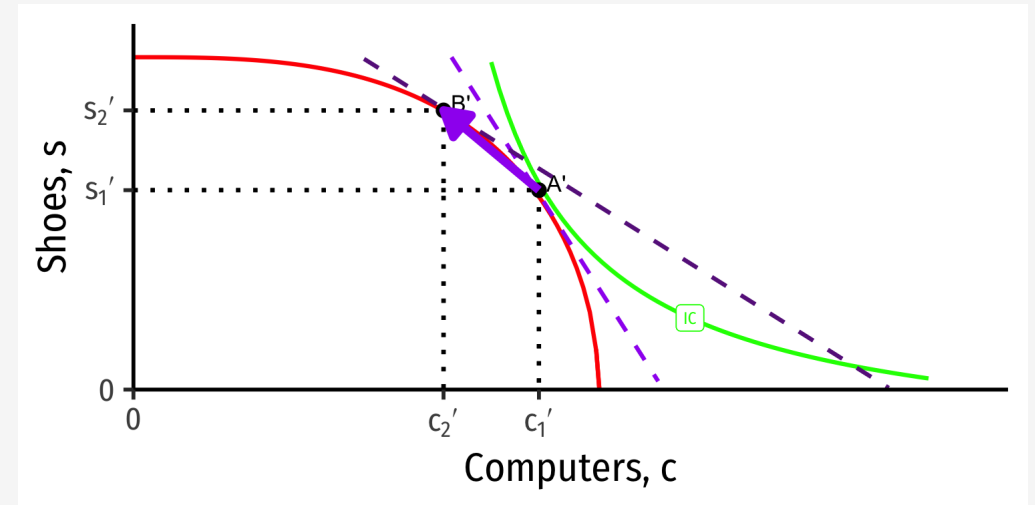- Foreign has comparative advantage in shoes

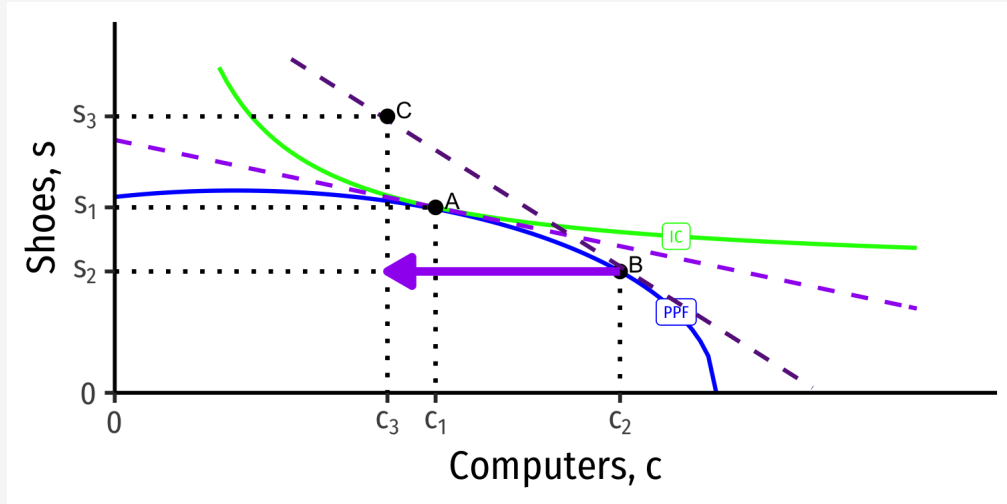# Our Two Country Trade Example: Specialization

Home

Foreign

- Countries **specialize**: produce *more* of comparative advantaged good, *less* of disadvantaged good
  - Home: A → B: produces more computers, fewer shoes
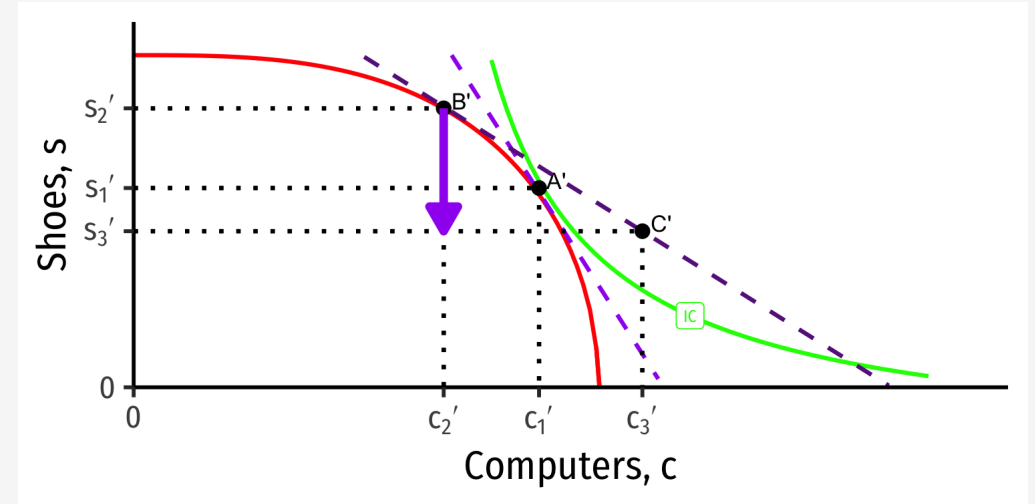 - Foreign: A' → B': produces fewer computers, more shoes

Our Two Country Trade Example: Exports
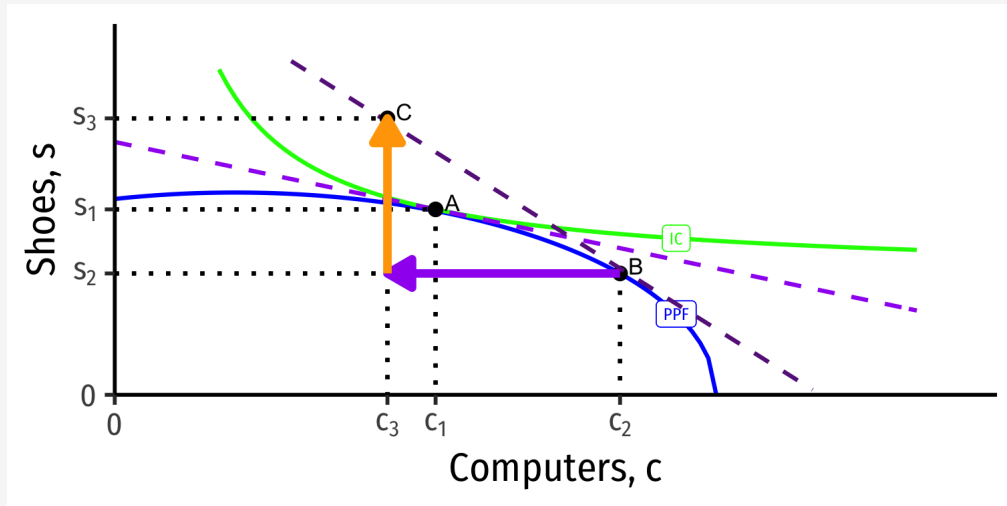
Home

Foreign

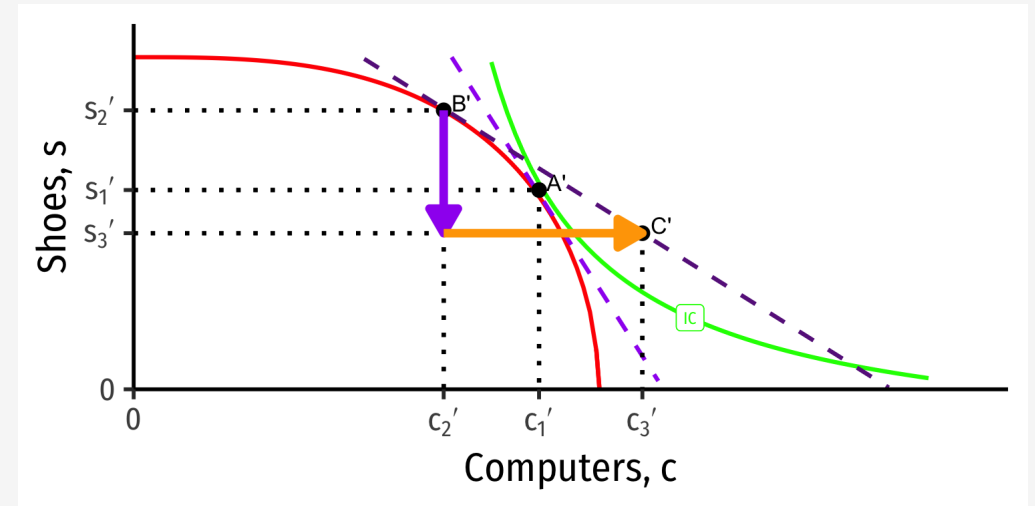- Home exports computers
- Foreign exports shoes

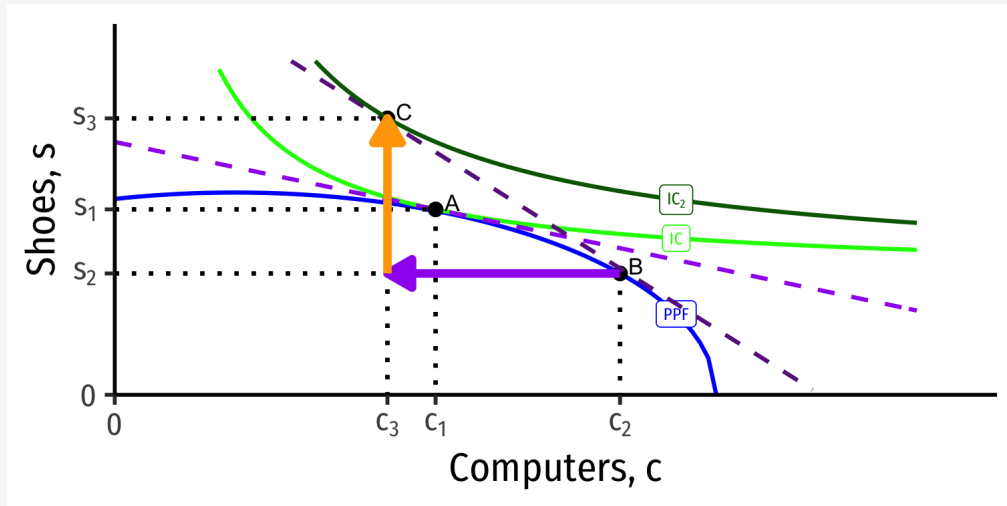# Our Two Country Trade Example: Imports

Home

Foreign

- Home imports shoes
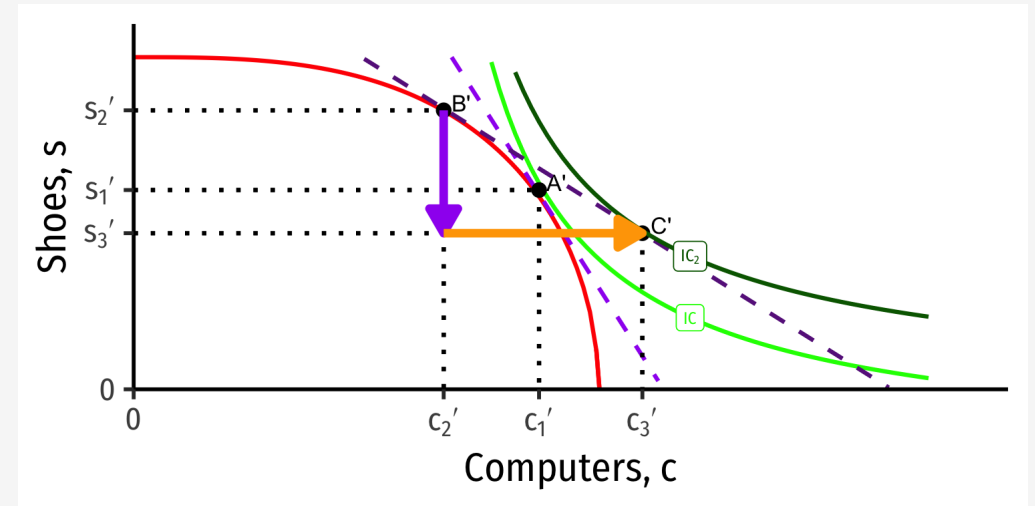- Foreign imports computers

Our Two Country Trade Example: Gains from Trade

Home

Foreign

- Both countries exchange their imports & exports and consume at C and C'

- Both reach a higher indifference curve with trade, well beyond their PPFs!
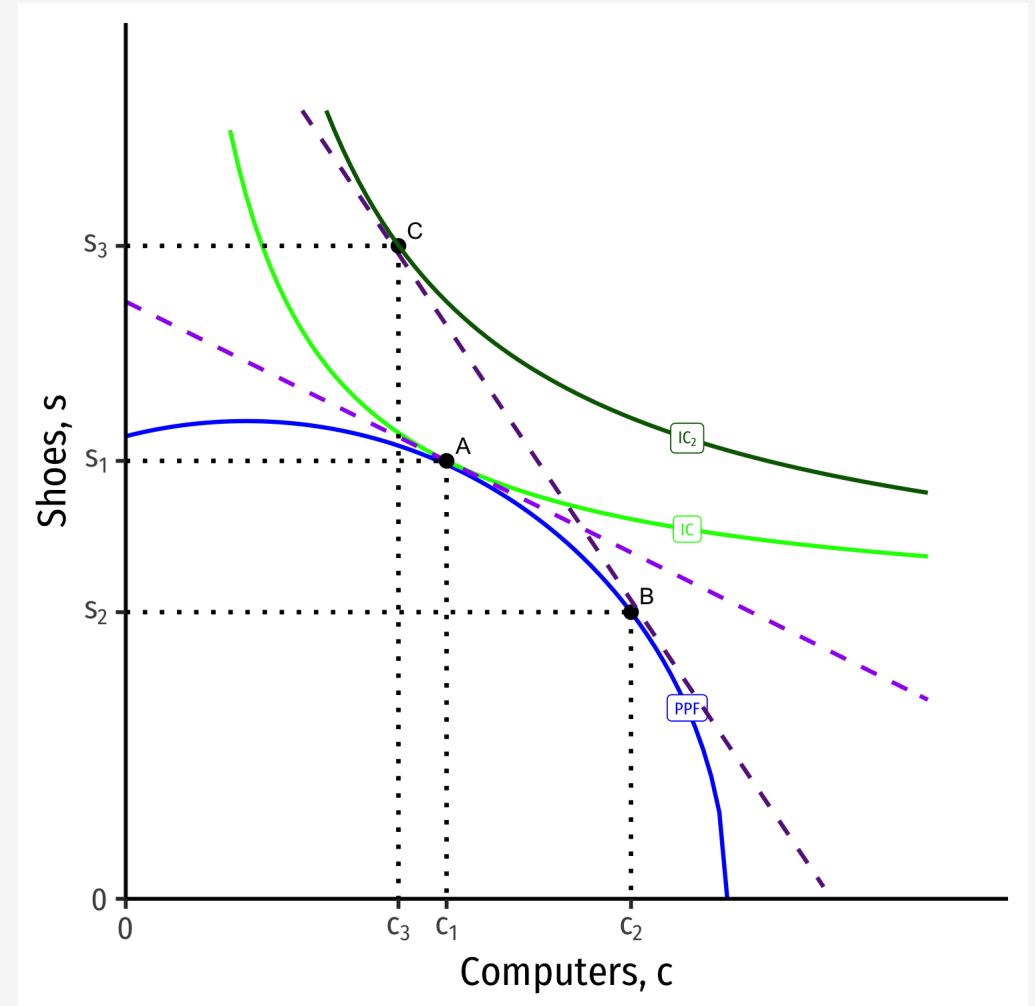
Factor Price Equalization
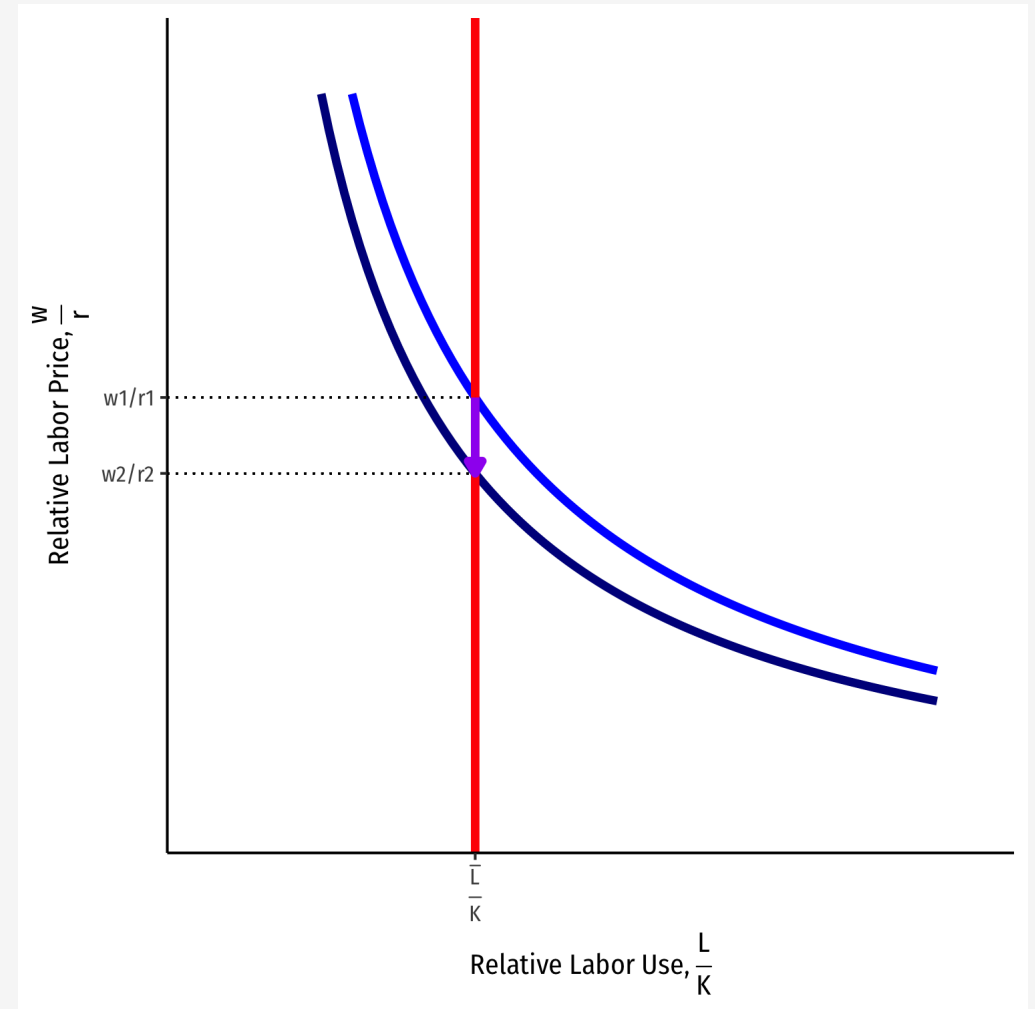
Relative Price Changes in Home

- Let's look at Home

- Increase in the relative price of computers from trade

  ○ decrease in relative price of shoes

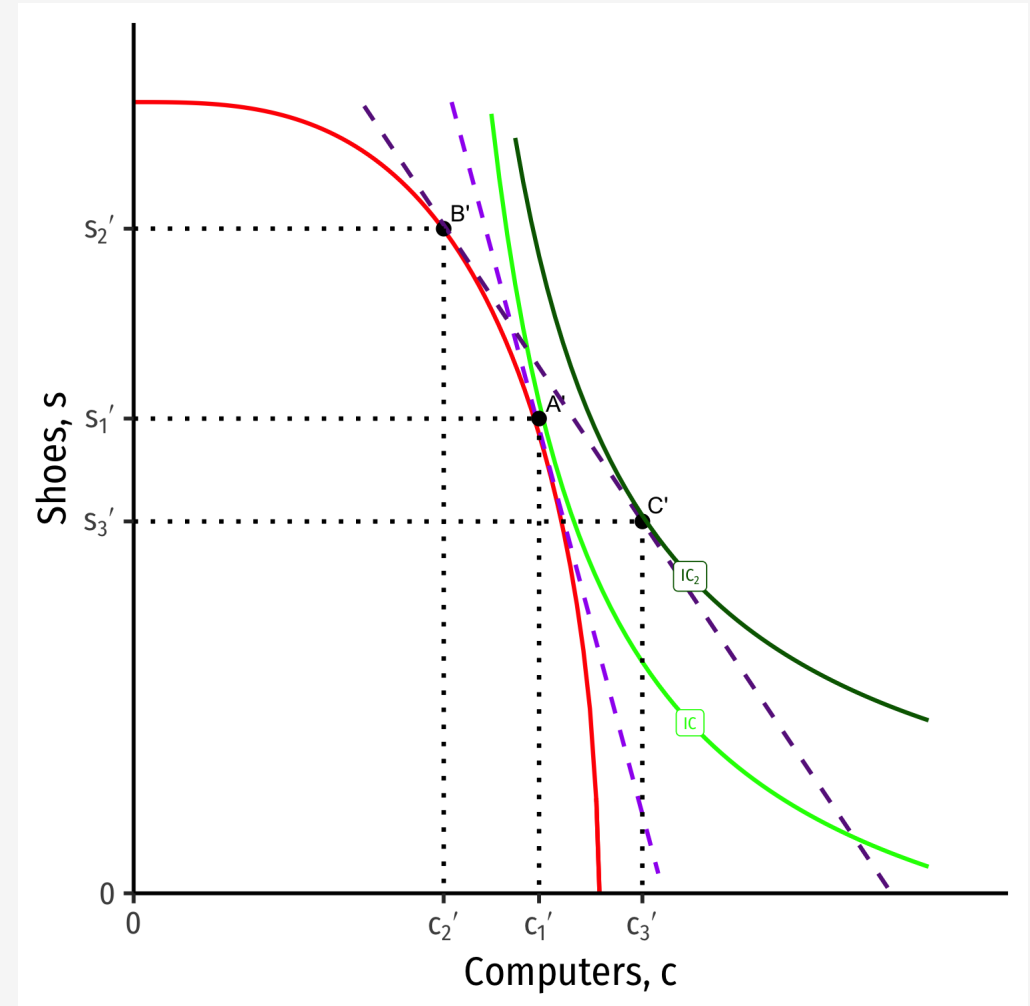# Relative *Factor* Price Changes in Home

- Fixed **relative labor supply** $\frac{\bar{L}}{K}$

- *Decrease* in **relative labor demand**

  - More demand for capital (for computers)
  - Less demand for labor (for shoes)

- *Lowers* relative wages $\frac{w}{r}$

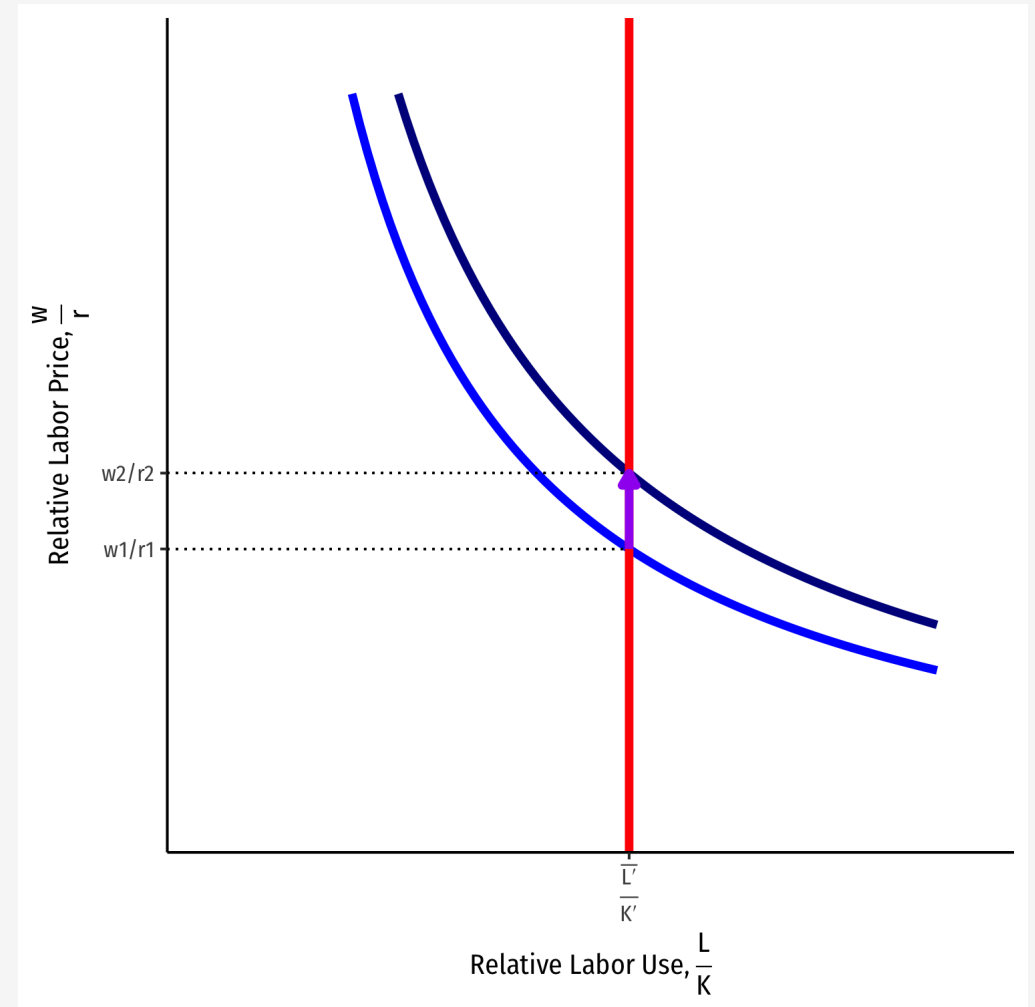# Relative Price Changes in Foreign

- Let's look at Foreign

- Increase in the relative price of shoes from trade

  - decrease in relative price of computers

Relative *Factor* Price Changes in Foreign
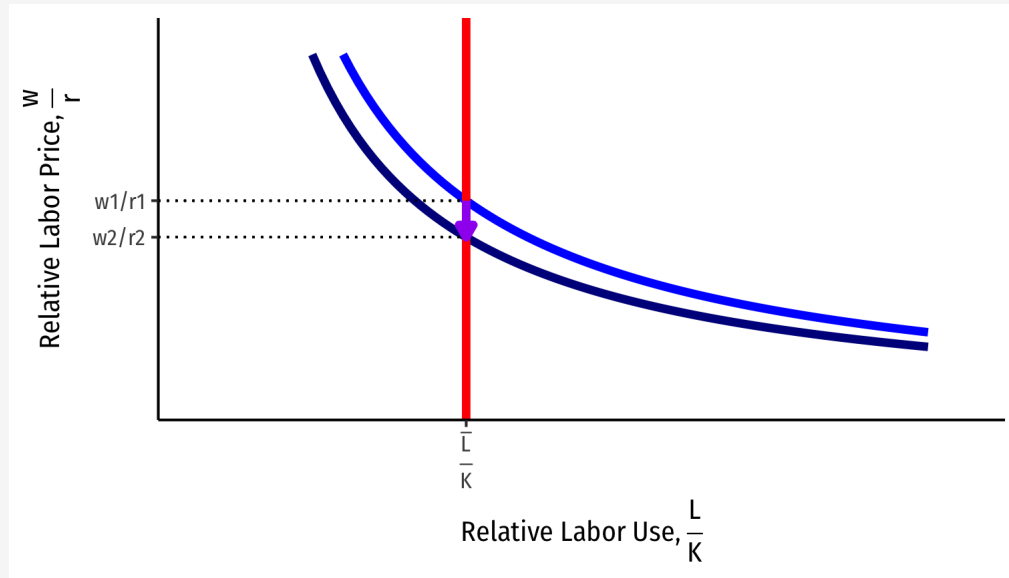
- Fixed **relative labor supply** ${\bar{L}' \over K}'$

- *Increase* in **relative labor demand**

  - More demand for labor (for shoes)
  - Less demand for capital (for computers)

- *Raises* relative wages ${w \over r}$
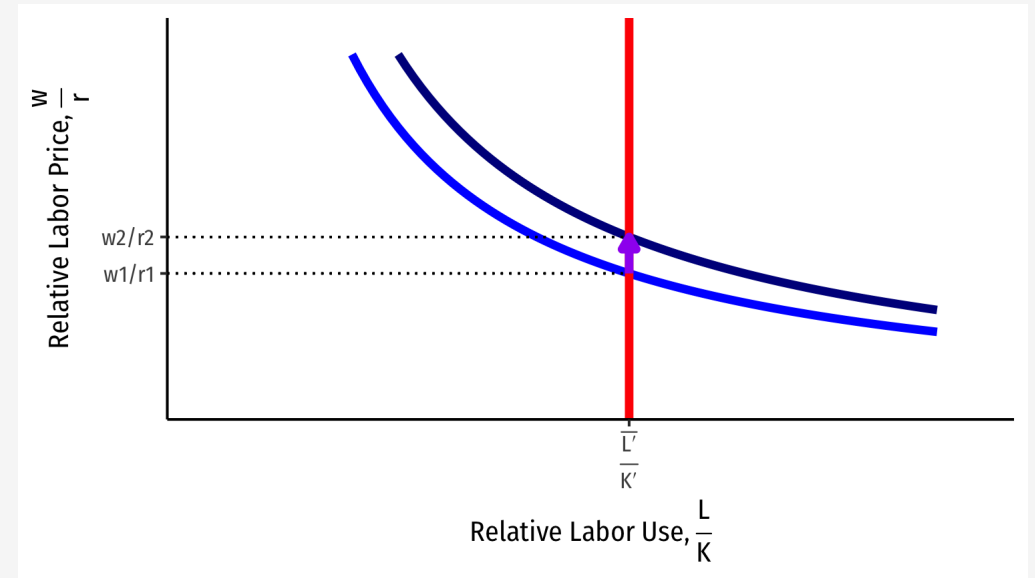
Factor Price Equalization

Home

Foreign

- **Relative factor prices equalize across both countries** (at w2/r2)
- Home: ↓ wages w, ↑ capital returns r
- Foreign: ↑ wages w, ↓ capital returns r

Factor Price Equalization Theorem

- **Factor Price Equalization (FPE) Theorem**: under certain conditions, international trade tends to bring about equalization in relative and absolute returns to homogeneous factors across nations
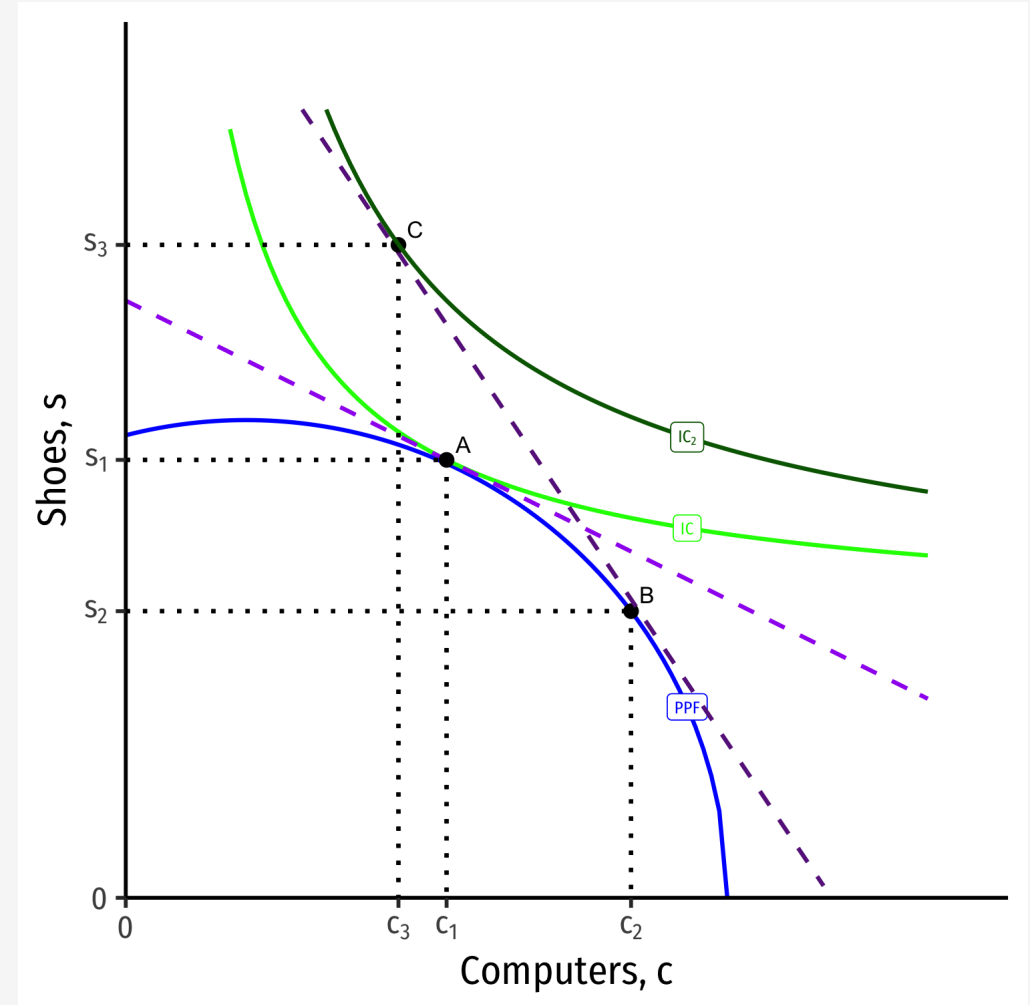
Long Run Real Income Changes (Stolper-Samuelson)

Long-Run Real Income Changes: Home

- Real income changes at Home in the **long-run**, when both L and K are mobile:

  - implies factor returns (w and r) must (each) equalize across industries (s and c)

- Increase in the relative price of computers (fall in relative price in shoes) $\implies$ fall in relative price of labor $\frac{w}{r}$ (rise in relative price of capital)

- This implies both industries will use relatively more labor (cheaper) and less capital (more expensive)

Long-Run Real Income Changes: Home

- Using more labor, less capital, in both industries:
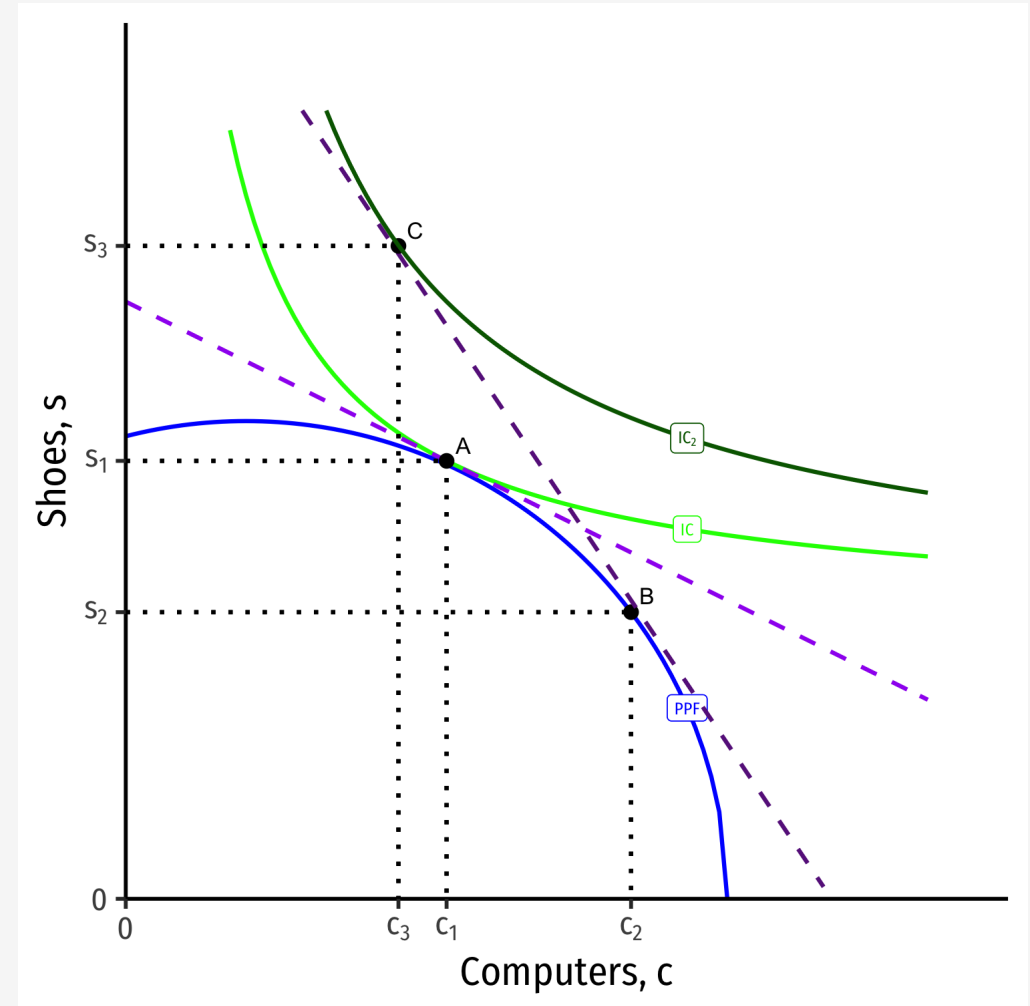
- Change in real wages:

$$p_c * MPL_c = w = p_s * MPL_s$$

  - $\downarrow MPL_c = \frac{w}{p_c}$ & $\downarrow MPL_s = \frac{w}{p_s}$
  - **Real wages fall**

- Change in real income to capital:
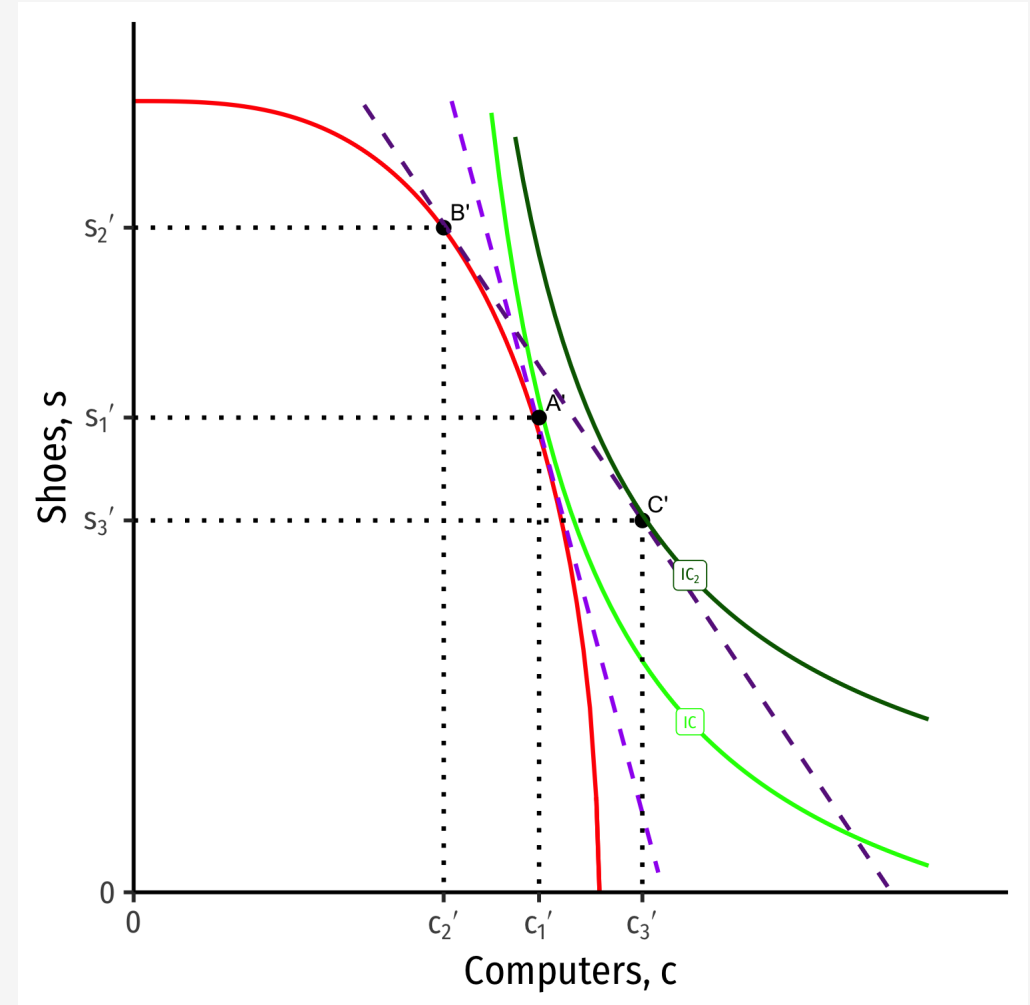
$$p_c * MPK_c = r = p_s * MPK_s$$

  - $\uparrow MPK_c = \frac{r}{p_c}$ & $\uparrow MPK_s = \frac{r}{p_s}$
  - **Real return to capital rises**

Long-Run Real Income Changes: Foreign

- Real income changes at Foreign in the **long-run**, when both L and K are mobile:

    - implies factor returns (w and r) must (each) equalize across industries (s and c)

- Increase in the relative price of shoes (fall in relative price in computers) $\implies$ rise in relative price of labor $\frac{w}{r}$ (fall in relative price of capital)

- This implies both industries will use relatively less labor (more expensive) and more capital (cheaper)

Long-Run Real Income Changes: Home

- Using less labor, more capital, in both industries:
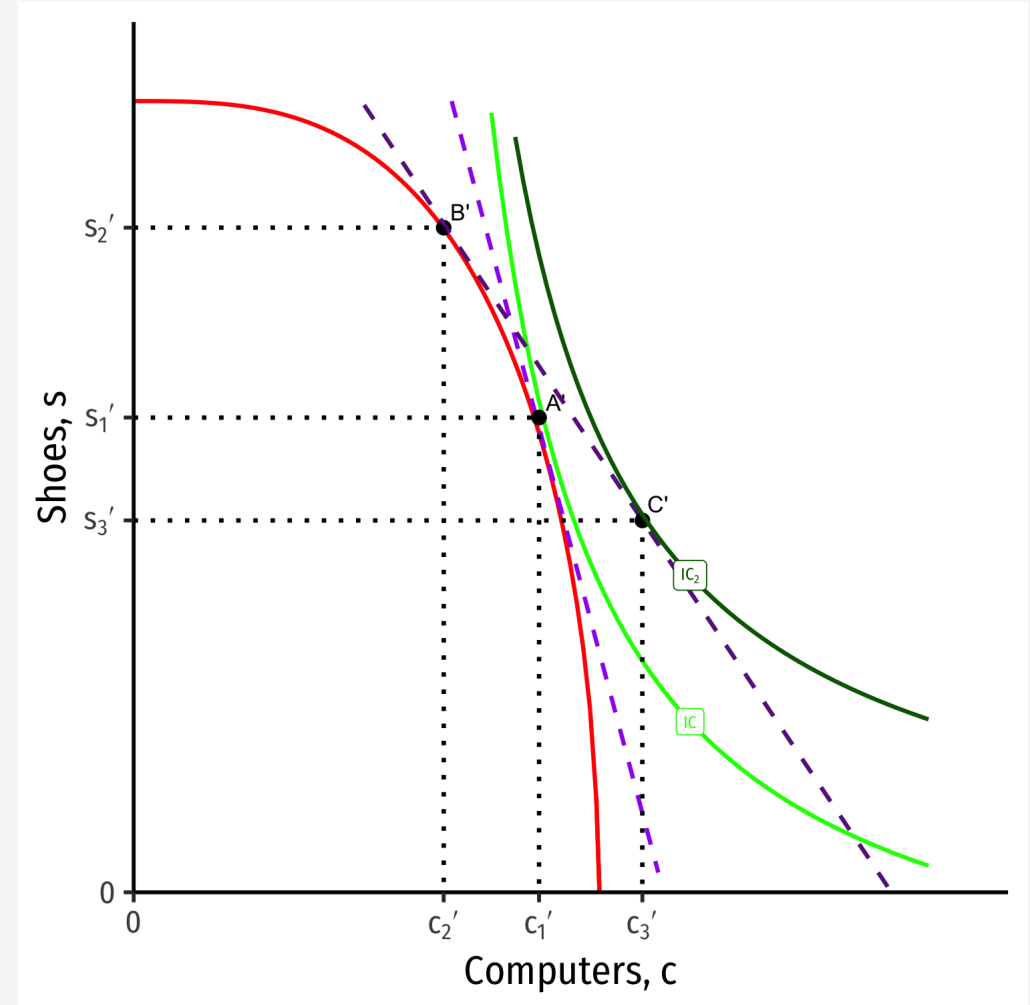
- Change in real wages:

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- Change in real income to capital:

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  - **Real return to capital falls**

Stolper-Samuelson Theorem

- **Stolper-Samuelson Theorem**: in the long run, an increase in the relative price of a good will increase the real earnings of the factor used intensively in that good's production and decrease the earnings of the other factor