

# The Ricardian Model

## International Trade

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Lecture Slides

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# Outline

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- 3 Gains from trade
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What have we learned so far?

In the previous section we saw that countries benefit from trade if the relative prices of goods differ across countries in the absence of trade.

Open questions:

- What characteristics matter for trade patterns?
- How does trade affect income levels in different countries?
- What consequences does international trade have for the distribution of income within a country?

# Outlook

- In order to address these questions, we will look at three different models:
  - ▶ Ricardian model
  - ▶ Specific factors model
  - ▶ Heckscher-Ohlin model
- Although different in their assumptions, all three models emphasize differences on the supply side as the underlying source of differences in relative prices and thus as the reason for trade.
- In all these models, differences on the supply side induce differences in comparative advantage (CA). But the models differ in their specific source of CA.



Figure : David Ricardo, 200-years-of-Ricardian-trade-theory

- Comparative vs. absolute advantage

	Home	Foreign
X	4	5
Y	2	3

- The numbers in the table represent productivity: how much output of the good can be produced in one unit of time (hour).
- The foreign country is more productive in both sectors, so it is said to have an absolute advantage in both goods.
- Production inputs (labor, capital, land,..) are limited in the real world. So if a country wants to produce more of X it will have to sacrifice production of Y. By opportunity cost we mean refer to how much of Y must be sacrificed in order to produce one more unit of X (or equivalently, how much extra X can be produced if one were to sacrifice one unit of Y).
- This opportunity cost differs across countries.

- The determination of comparative advantage is based on opportunity costs: When giving up the production of one unit of Y, the home country can produce 2 additional units of food, whereas the foreign country only produces  $5/3$  additional units.
- We say that the home country has a comparative advantage in the production of X when it can get more X when it sacrifices one unit of Y than the foreign country.
- In a two country-two good world, if one country has a CA in X the other country must have a CA in Y (verify this using the table above)
- If the opportunity cost is constant (independent of the scale of production) then the two countries will specialize in the production of the good in which they have CA.

For the pattern of trade, **only comparative advantage matters!**  
Absolute advantage is irrelevant.

# Assumptions

1. Countries are endowed with a single, homogeneous factor, i.e. labor.  
(*Weakness: cannot address the effect of trade on income distribution*).

There is full employment and wages are determined in each country's labor market:

$$L = L_X + L_Y$$



2. Constant unit cost of production  $\alpha_{LX}$ ,  $\alpha_{LY}$  (amount of  $L$  needed to produce one unit of  $X$ ,  $Y$ )

The amount of labor needed to produce amounts  $X$  and  $Y$  respectively

$$L_X = \alpha_{LX} \cdot X, \quad L_Y = \alpha_{LY} \cdot Y$$

$$\Rightarrow L = L_X + L_Y = \alpha_{LX} \cdot X + \alpha_{LY} \cdot Y$$

The last equation gives the Production Possibility Frontier (PPF) of this economy.

The slope of the PPF schedule describes the opportunity cost of producing  $X$  and is given by the ratio  $\left(\frac{\alpha_{LY}}{\alpha_{LX}}\right)$ .

The intercepts show the maximum amount of each good that can be produced if all labor were used in the respective sector.

Remark: the inverse of the labor unit requirement is labor productivity (e.g.  $\beta_{LX} = \frac{1}{\alpha_{LX}}$ ). For instance, the value of a labor productivity of 4 (home, X) means a labor requirement of 1/4.

3. There is perfect competition in all markets.

In the absence of trade, the relative prices of goods are equal to their relative unit labor requirements:

$$\left(\frac{p_X}{p_Y}\right) = \frac{\alpha_{LX}}{\alpha_{LY}} \quad \text{and} \quad \left(\frac{p_X}{p_Y}\right)^* = \frac{\alpha_{LX}^*}{\alpha_{LY}^*}$$

A \* signifies foreign

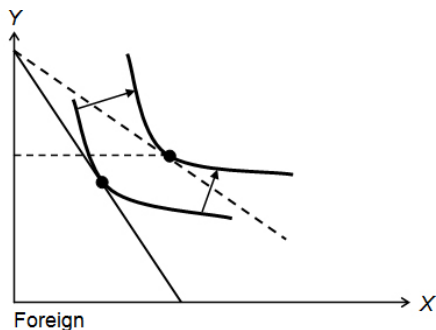
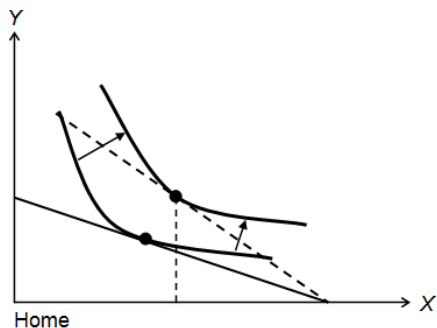
Reminder: Source of comparative advantage:

CA arises from differences in relative productivity (across industries across countries).

We say that Home has CA in X (and Foreign in Y) iff:  $\frac{\alpha_{LX}}{\alpha_{LY}} < \frac{\alpha_{LX}^*}{\alpha_{LY}^*}$   
(flatter PPF)

# Gains from trade

National gains: (Let Home have a CA in  $X$ )



Main result: Complete specialization

# International trade and wages

The price of labor services is determined on the labor market ( $D^L = S^L$ ). The supply of labor is fixed. The demand for labor comes from the firms.

They maximize their profits:

$$\max_L \pi = p_X \cdot X - w \cdot L$$

$$\frac{d\pi}{dL} = p_X \cdot \underbrace{\left( \frac{\partial X}{\partial L} \right)}_{=1/\alpha_{LX}} - w = 0$$

$$\Rightarrow p_X = w \cdot \alpha_{LX}$$

$$\Rightarrow p_Y = w^* \cdot \alpha_{LY}^*$$

Case 1: Perfect specialization  $\left( \frac{\alpha_{LX}}{\alpha_{LY}} < \frac{\alpha_{LX}^*}{\alpha_{LY}^*} \Rightarrow \text{Home specializes in } X \right)$

$$\left. \begin{array}{l} \text{H: } w = \frac{p_X}{\alpha_{LX}} \\ \text{F: } w^* = \frac{p_Y}{\alpha_{LY}^*} \end{array} \right\} \Rightarrow \frac{w}{w^*} = \frac{p_X}{p_Y} \cdot \frac{1}{\frac{\alpha_{LX}}{\alpha_{LY}^*}} = \frac{p_X}{p_Y} \cdot \frac{\beta_{LX}}{\beta_{LY}^*}$$

Case 2: Imperfect specialization (let Home be imperfectly specialized; F specializes in Y)

$$\begin{aligned}
 \text{H: } \left\{ \begin{array}{l} w = \frac{p_X}{\alpha_{LX}} \\ w = \frac{p_Y}{\alpha_{LY}} \end{array} \right\} &\Rightarrow \frac{p_X}{p_Y} = \frac{\alpha_{LX}}{\alpha_{LY}} \\
 &\Rightarrow \frac{w}{w^*} = \frac{\alpha_{LX}}{\alpha_{LY}} \cdot \frac{1}{\frac{1}{\alpha_{LY}^*}} = \frac{\alpha_{LY}^*}{\alpha_{LY}} = \frac{\beta_{LY}}{\beta_{LY}^*}
 \end{aligned}$$

Main result: Differences in wages reflect differences in productivity (as well as in the prices of the goods produced by a country).

The case of Switzerland: Terms of trade, productivity

# Further topics

## Myths:

- (a) Productivity and competitiveness
  - Productivity refers to absolute advantage. Relevant for determining living standards in an economy but not relevant for the pattern of trade and the size of the gains from trade.
- (b) Unfair competition (based on low wages)
  - Productivity advantage can overcome wage disadvantage.
- (c) Unequal exchange (fair trade)

	US	MEX
T-shirt	1	2
PC	10	100
$(P_{PC}/P_{TS})_{Aut}$	10	50
$(P_{PC}/P_{TS})_{Trad}$	30	30

Note: The numbers give unit labor requirements (hours needed to produce one unit of the good)

"Unequal" exchange: MEX uses 60 work hours to get a US product that uses 10 hours

Silly: It would have costed MEX 100 hours to get this PC. Think also of heart surgery



## An interesting question:

Implications of foreign productivity growth for domestic welfare?

- ⇒ The effect of fast productivity growth in the LDCs on the welfare of the developed countries is ambiguous. It depends on the sector(s) it takes place.

An example: Country A produces goods 1, 2. B produces goods 2, 3.  
Both consume 1, 2, 3

$$p_1 = w_A \alpha_{A1}, p_2 = w_A \alpha_{A2} = w_B \alpha_{B2}, p_3 = w_B \alpha_{B3}$$

- Productivity growth in B's exportable ( $a_{B3} \downarrow$ ):  $WELF^A \uparrow$
- Productivity growth in the common good ( $a_{B2} \downarrow$ ):  $WELF^A \downarrow$
- Uniform productivity growth in B ( $\{a_{B2}, a_{B3}\} \downarrow$ ):  $WELF^A \rightarrow$

## Multiple goods:

Rank industries in relative productivity vs. relative wages.

$$\frac{\alpha_{L1}}{\alpha_{L1}^*} < \frac{\alpha_{L2}}{\alpha_{L2}^*} < \frac{\alpha_{LN}}{\alpha_{LN}^*}$$

(Home has the greatest productivity advantage in good 1)

Criterion for where production takes place: Produce where it's cheapest!

Cost of good = (unit labor requirement) · (wage)

Produce good  $i$  at Home if:

$$w \cdot \alpha_{Li} \leq w^* \cdot \alpha_{Li}^*$$

(relative wage < relative productivity)

## Empirical tests of the Ricardian theory

Examine how unit labor costs (or productivity) in various industries is related to the trade pattern.

⇒ Mixed results

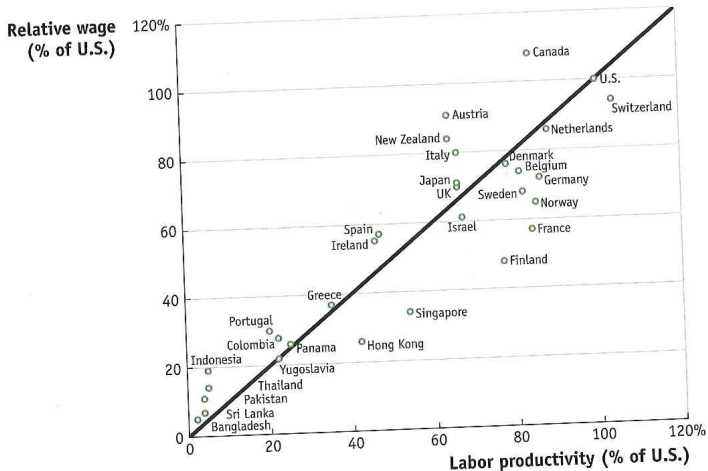


Figure : Wages and productivity

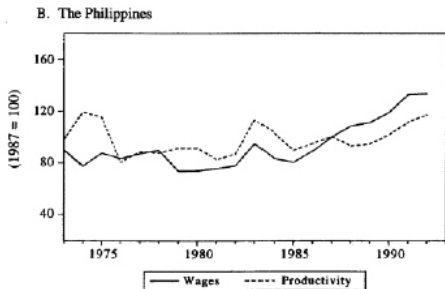
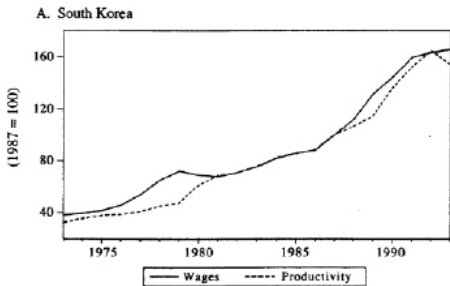
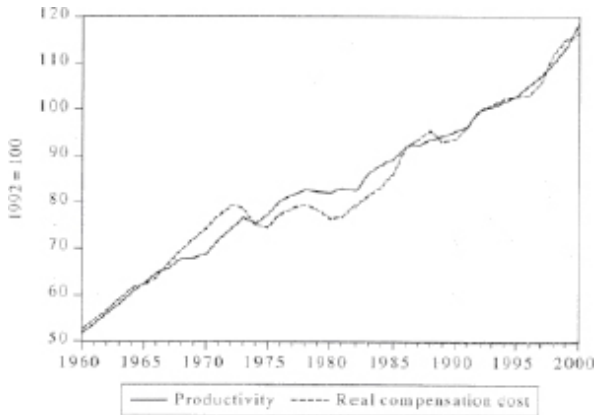


Figure : Real wages and labor productivity in manufacturing, South Korea and the Philippines, 1972-93 (1987=100). (Data from World Bank World Tables.)



**Figure :** Labor productivity and labor compensation costs in the United States, 1960-2000. Productivity is output per hour of all the persons in the business sector. Real compensation is compensation per hour divided by the producer price index of total finished goods. (Data from Council of Economic Advisors, 2001, tables B-49, B-65.)

## Summary: The key concept of relative productivities

- Wage differences across countries reflect primarily differences in labor productivity and also terms of trade effects
- Levels of productivity determine living standards but not the gains from trade
- Relative productivities determine the pattern of international trade specialization
- International trade does not affect the internal distribution of income