

Chapter 3 : The Ricardian Model of International Trade

Farid Toubal

ENS de Cachan

Introduction

Why do countries open to international trade?

Which countries benefit from international trade?

What is the nature of the gain? And how do gains are shared?

Traditional theories of international trade provide some answers to these questions

Models based on differences between countries

2 main models with different assumptions

- ▶ Ricardian model of trade (David Ricardo) : countries have different technologies
- ▶ Heckscher Ohlin Samuelson (HOS) : countries have different factor endowments (labor, capital, human capital...)

All these differences result in **different terms of trade** (relative prices) in autarky

⇒ **These differences motivate international trade**

Terms of trade drives international exchange

Terms of trade = price of exports relative to price of imports

Variations of terms of trade affect welfare in Home country :
⇒ ↑ terms of trade enables ↑ imports for a given amount of products exported

Free trade will be preferred if it improves the terms of trade & (economic) welfare

Example : 2 countries (A and B) and 2 goods (Computers and T-shirts)

Prices of these goods in autarky, in the two countries :

	Computer	T-shirt
A	1,000	10
B	1,500	10

Relative price of the two goods in the two countries :

- ▶ $P_A = \frac{P_{C,A}}{P_{T,A}} = 100$ in country A
- ▶ $P_B = \frac{P_{C,B}}{P_{T,B}} = 150$ in country B

$P_A < P_B$: in autarky, the relative price of computers is higher in country B than in country A

- ▶ Producers of computers in A : selling goods in B enables to get more t-shirts
- ▶ Producers of t-shirts in B : selling goods in A enables to get more computers

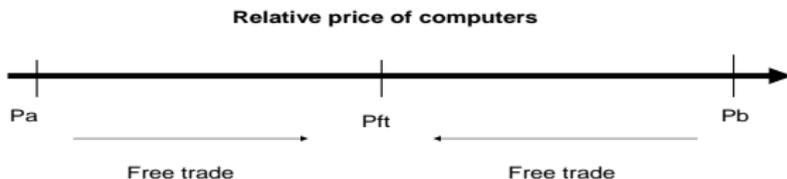
In trade models : specialization and free trade allows each country to improve its terms of trade

⇒ Free trade increases welfare **for each country**

Terms of trade in free trade :

Terms of trade in each country converge to terms of trade in free trade, common to both countries :

$$P_A < P_{FT} < P_B$$



⇒ No trade is possible if this is not the case

Summary :

Motivation for free trade in trade models

- ▶ Differences between autarky prices across countries
- ▶ Specialization and free trade increases welfare
- ▶ The larger the difference between autarky price and free trade price, the larger the gain
⇒ Think of small countries opening up to trade
- ▶ Traditional trade theories predict that smaller countries gain more from the free trade
- ▶ Similar countries do not gain from free trade
⇒ Ex. Does not explain trade between European countries

I. Ricardo : origins of comparative advantage

In the Ricardian model of trade

- ▶ Trade is based on differences (as in HOS)
- ▶ These differences arise because countries have different production technologies
- ▶ Production costs differ across countries... and therefore prices
- ▶ As compared to Smith, countries with an absolute disadvantage in the production of all goods will gain in free trade
- ▶ **Specialization and trade will result from international differences in opportunity costs for the production of the two goods.**

Relative productions and opportunity cost

Example : Country in the North imports flowers from the South

The North can produce 10 million flowers a year

- ▶ Resources used for this production could be used to produce 100,000 computers
- ▶ **The opportunity cost of producing 10 million roses is 100,000 computers.**

If the South can only produce 30,000 computers with these resources

- ▶ The opportunity cost of producing computers is lower in the North
- ▶ The opportunity cost of producing flowers is lower in the South

If North stops the production of roses and specializes in the production of computers, production changes :

	Millions of roses	Thousands of computers
North	-10	+100
South	+10	-30
Total	0	+70

⇒ **Specialization on most efficient productions can increase the availability of goods at the world level**

The gains of free trade have two components :

- ▶ **The gains of specialization** : Scarce resources are used in the production of the good for which countries are the most efficient
⇒ World production increases
- ▶ **Gains from trade** : The separation of production and consumption structures enables to increase the welfare
⇒ Consumers can buy more goods

Relative production costs and opportunity cost

Example : 2 countries (France and Tunisia), 2 goods (oranges and cars).

The table gives the monthly productions of workers in both sectors/countries (productivity)

	Oranges	Cars
France	50	15
Tunisia	150	5

- ▷ Tunisia has an **absolute advantage** in the production of oranges, with respect to France
- ▷ France has an **absolute advantage** in the production of cars

Absolute advantage (Adam Smith).

Definition : *A country has an absolute advantage in the production of a good, if its productivity is larger than the productivity of the other country*

France should specialize in the production of cars, and Tunisia in the production of oranges

Is free trade possible when one country has an absolute disadvantage in both industries ?

Ex. France is more efficient in the production of the two goods

	Textile	Cars
France	60	15
Tunisia	30	5

⇒ French workers more efficient in the production of the two goods

⇒ French workers 2 times more efficient in the production of textile, 3 times more efficient in cars

Opportunity cost of producing cars, in terms of textile :

▷ France : $60/15=4$.

▷ Tunisia : $30/5=6$.

Production of 1 more car requires to drop 4 units of textile in France or 6 units of textile in Tunisia

- ▶ Opportunity cost is lower in France
- ▶ France has a **comparative advantage** in the production of cars and Tunisia has a **comparative advantage** in the production of textile.

Comparative advantage :

France :

- ▶ Absolute advantage in the production of the two goods
- ▶ Lower opportunity cost for the production of cars

In the case where one country has an absolute advantage in the production of the two goods, there is still an incentive to specialize into one production

Specialization increases the world production of the two goods

Comparative advantage (David Ricardo)

Definition : *A country has a comparative advantage in the production of a good, if its relative productivity for the production of this good (relative to other goods) is higher than for the other country.*

A comparative advantage also corresponds to a lower opportunity cost for the production of a good, as compared to the foreign country

II. The Ricardian model

The comparative advantage is based on international differences regarding technologies

Hypotheses :

- ▷ 2 countries
- ▷ 2 sectors
- ▷ Only one factor of production (L)
- ▷ Labor is mobile across sectors
- ▷ Perfect competition : price = marginal cost (no profit)

We note a_j the unit labor requirement for the production of good j ($j = 1, 2$) = quantity of labor that is required for the production of this good

⇒ $1/a_j$ is the production per worker (productivity)

⇒ marginal cost = wages \times unit labor requirement

II.a. Equilibrium in autarky

Production : $q_j = (1/a_j)L_j \quad j = 1, 2$

$(1/a_j) = A_j =$ productivity of labor (sector j).

All workers are employed in the production of the two goods (no unemployment) : $L_1 + L_2 = L \Leftrightarrow q_1 a_1 + q_2 a_2 = L$

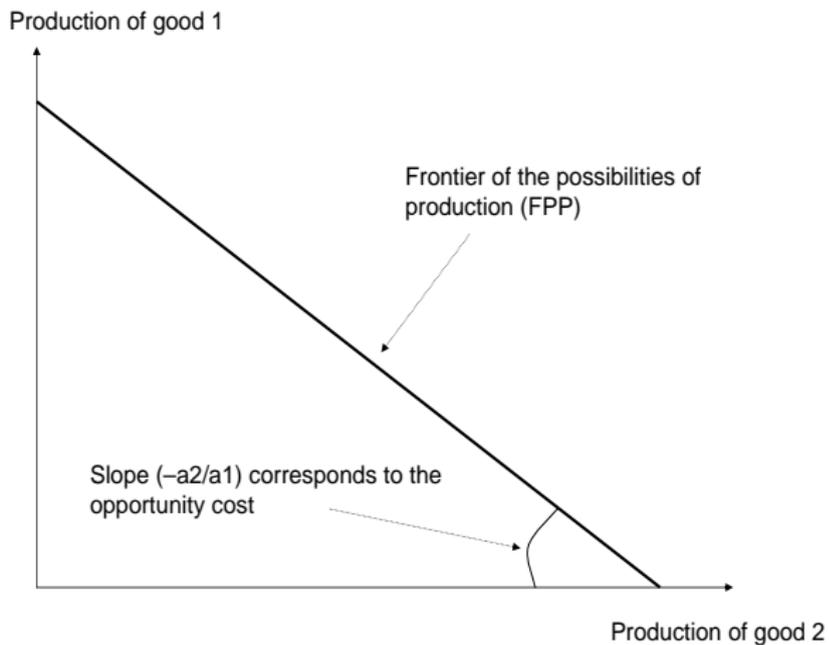
We obtain **the frontier of the production possibilities (FPP)** :

$$q_1 = (L/a_1) - (a_2/a_1)q_2$$

All combinations of productions are possible along this curve

The slope of the curve is negative, and corresponds to the opportunity cost

The frontier of the production possibilities (FPP)



Determination of production and consumption in autarky

- ▶ Requires an equilibrium in the goods market : domestic supply has to be equal to domestic demand, for each good
- ▶ Demand for each good will depend on consumers preferences
- ▶ Supply is subject to the perfect competition \Rightarrow No profit is possible

Real wages in autarky

Zero profit implies :

$$\Pi_j = p_j q_j - w_j a_j q_j = 0$$

$$\Rightarrow p_j = a_j w_j$$

$$\Rightarrow w_j = \frac{p_j}{a_j}$$

- ▶ **Wages are determined by the productivity level**
 \Rightarrow Low wage countries have low productivity level
- ▶ **Wages increase with productivity**

Relative prices in autarky :

Wages equalize across sectors due to free mobility of workers

$$w_1 = w_2 = w$$

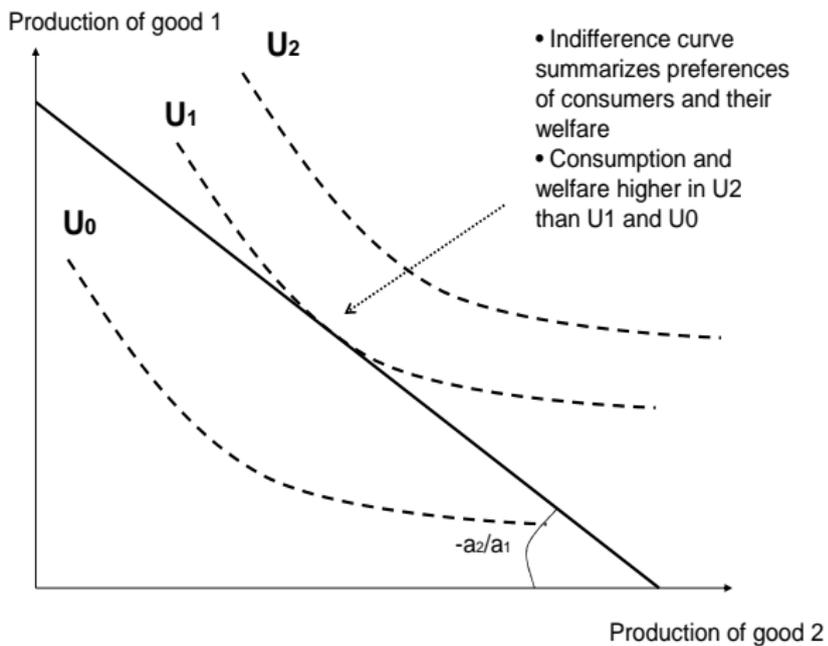
$$w_1 = w_2 \Rightarrow \frac{p_1}{a_1} = \frac{p_1}{a_1}$$

$$\frac{p_2}{p_1} = \frac{a_2}{a_1}$$

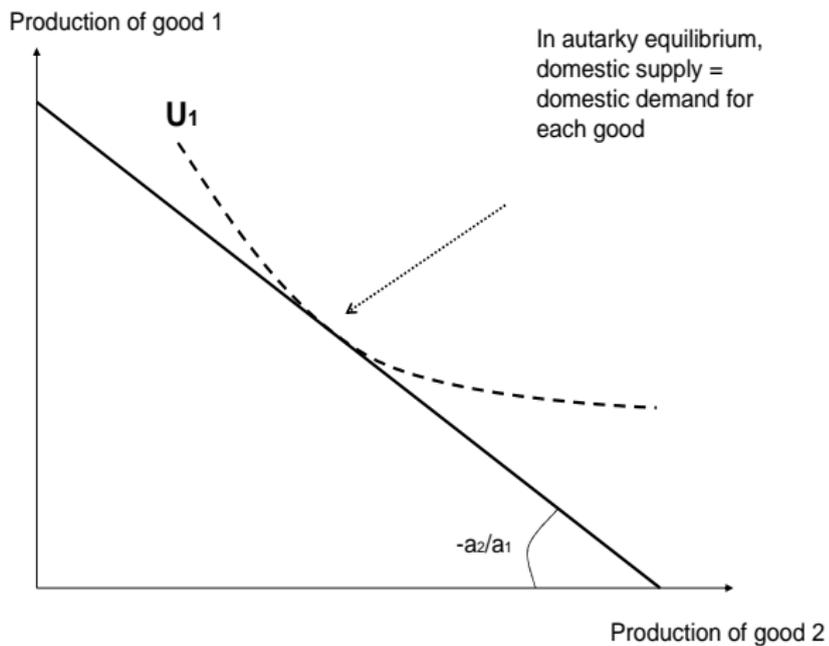
⇒ Relative prices determined by relative production costs

⇒ Countries which are relatively more productive in the production of a good have also lower relative prices

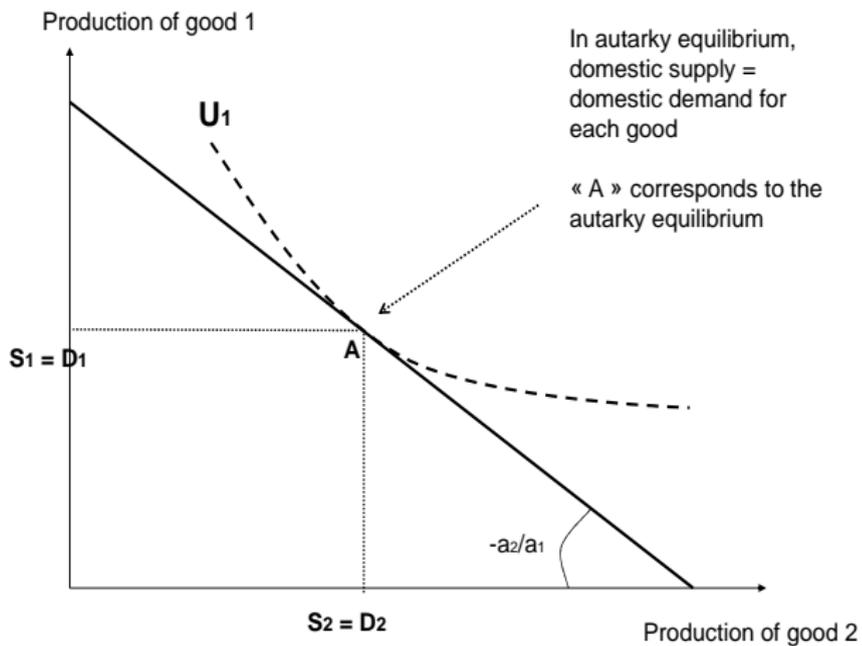
Autarky equilibrium



Autarky equilibrium



Autarky equilibrium



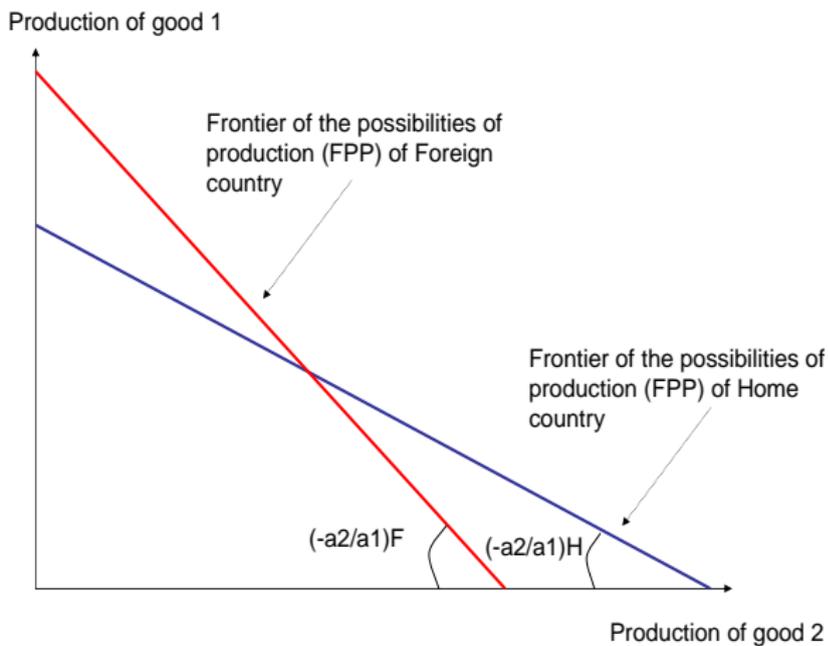
II. b. Free trade equilibrium

We start with two countries that differ in terms of relative productivity.

Home (H) and Foreign (F) with $(\frac{a_2}{a_1})_H < (\frac{a_2}{a_1})_F$

- ▶ Country H is relatively more productive in the production of good 2 than country F

The frontier of the production possibilities (FPP) with two countries



Specialization and free trade

2 potential gains from free trade :

- ▶ Gains from specialization : increases world production
- ▶ Gains from trade : enables separation of production and demand decisions

Requires specialization in comparative advantage industry :

- ▶ Home specializes in industry 2 and Foreign country in industry 1
- ▶ Incentive come from terms of trade

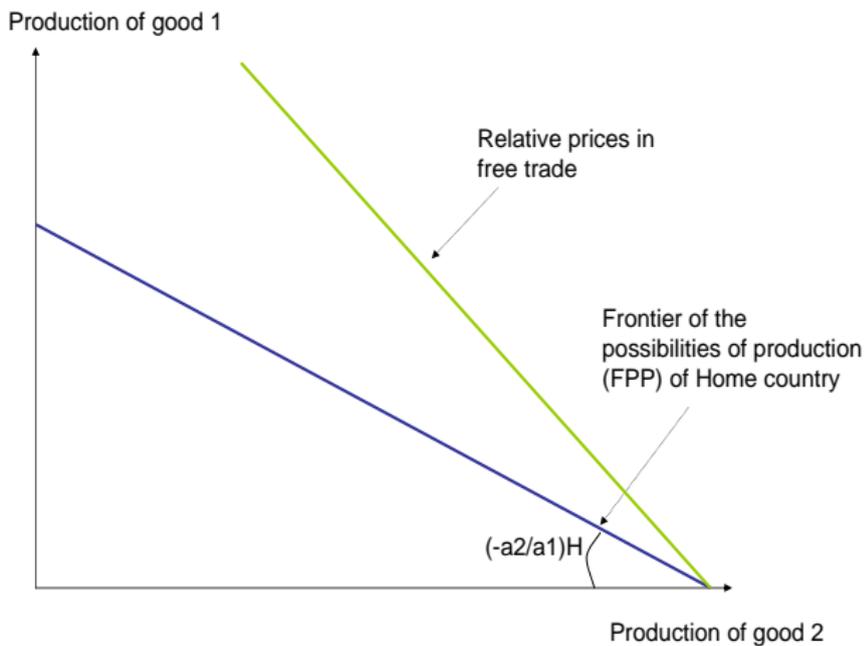
Complete specialization

- ▶ Production of good 1 in H country has to satisfy demand in both country
- ▶ Free mobility of labor across sectors : all workers of industry 1 in country H are now working in industry 2
- ▶ Specialization in comparative advantage industry enables increase production of each good at World level

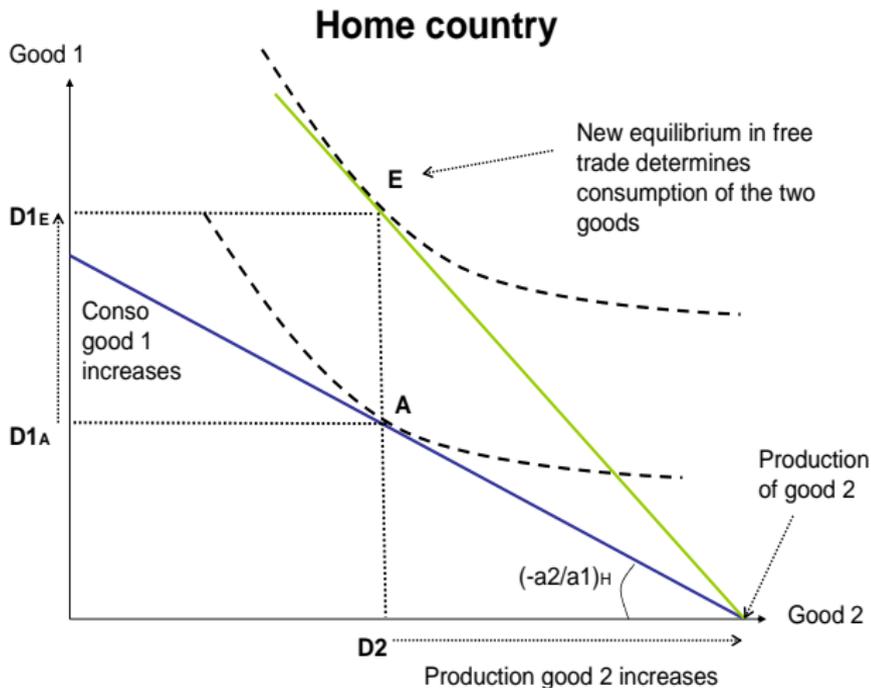
Determination of equilibrium in Free Trade

- ▶ Free trade enables to separate production and consumption decisions
- ▶ Supply and Demand for each good have to be equal **at the World level**
- ▶ Relative price enables equilibrium on World's goods markets $P_{FT} = \frac{P_{2,FT}}{P_{1,FT}}$ with $P_H < P_{FT} < P_F$

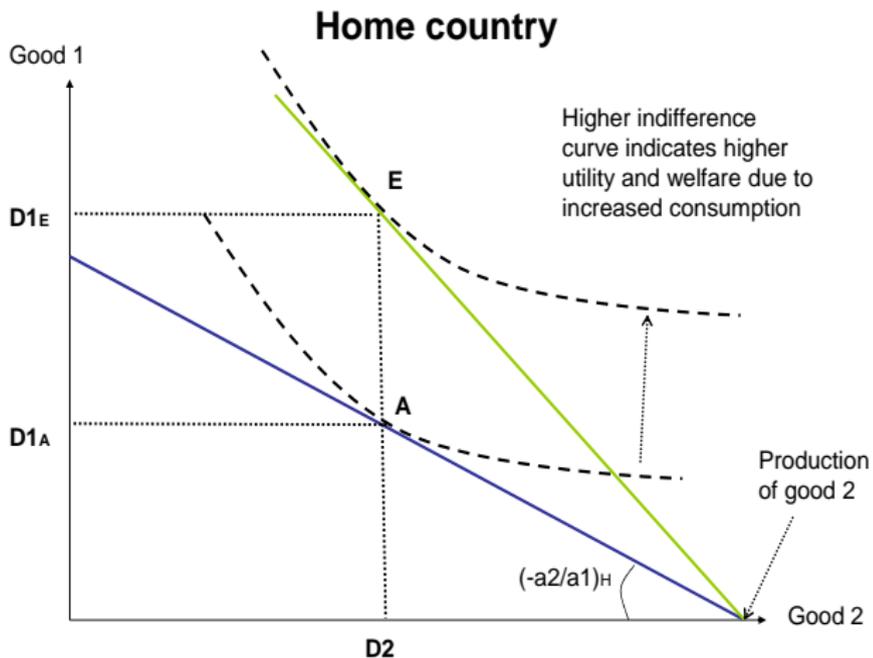
Home : FPP and relative prices in the free trade



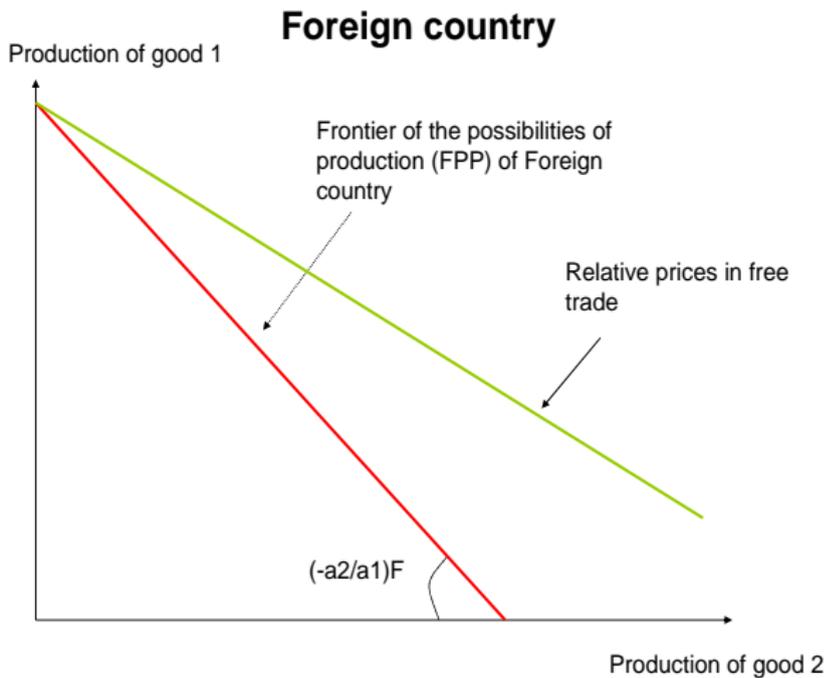
Home : production and consumption in the free trade



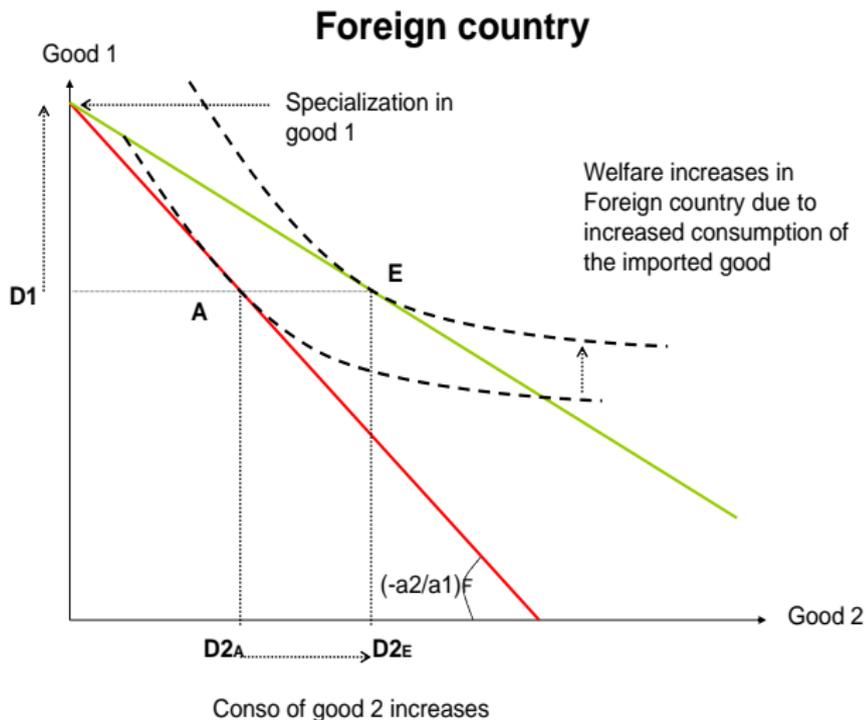
Home : production and consumption in the free trade



Foreign : FPP and relative prices in the free trade



Foreign : production and consumption in the free trade



Why do countries gain from trade ?

World production of the two goods increased due to specialization in comparative advantage industries (efficiency gain)

Free trade enables to increase aggregate consumption (Gains from trade) \Rightarrow Increase of welfare

First conclusions

- ▶ International trade is based on the differences in relative productivities.
- ▶ Trade is **inter-industry** : exported good \neq imported good.
- ▶ Full specialization in comparative advantage industry in both countries \uparrow World production (efficiency gain)
- ▶ Specialization \uparrow production by worker (productivity) and therefore \uparrow wealth per capita
- ▶ Free trade enables to keep consuming both goods. Aggregate consumption increases. (Gains from trade)
- ▶ Both countries gain from trade \Rightarrow Free trade = positive-sum game.
- ▶ None of the countries loses from free trade \Rightarrow Pareto optimum

What happens if countries differ a lot in their size ?

Specialization is **incomplete** for the large country : continues production of the two goods

- ▶ Terms of trade remain unchanged under free trade in the large country
- ▶ No gain from trade in large country

Small country specializes fully in comparative advantage industry

- ▶ Adopts terms of trade of the large country
- ▶ Large gains from trade

In Ricardian models, small countries have higher gains from trade than large countries

⇒ Think of small open economy with no influence on World prices

Effect of free trade on wages

Real wages determined by the level of productivity

- ▶ Specialiation on comparative advantage industry increases aggregate productivity
- ▶ Free trade is expected to increase real wages in each economy, and GDP per capita

Hypotheses behind :

- ▶ Workers are homogenous (no skill differences across workers) and get the same wage
- ▶ Workers can move easily from one sector to the other
 - ⇒ Allows allocation of resources to the comparative advantage sector
 - ⇒ No unemployment and no adjustment cost

III. The Ricardian model & Globalization

Are developing countries productive enough to participate to the world trade ?

In the Ricardian model :

- ▶ **Comparative advantage** and trade result from the comparison of **relative** productivity , not the **absolute** productivity.
- ▶ Country with absolute advantage in many industries still has an incentive to concentrate resources in productions for which it is the most efficient
- ▶ Specialization leads to increase of World production

But Basic Ricardian model does not account for insecurity, trade cost or lack of infrastructures

⇒ These factors are good candidates to explain why some countries remain durably isolated from Globalization process

Can developed economies face the competition from low wage countries ?

Ricardian model : **wages reflect productivity levels**

- ▶ If wages $>$ productivity : firms have an incentive to \uparrow demand of labour
- ▶ This would increase wages and decrease productivity
- ▶ Reverse is true

Empirically, wages are closely related to productivity

- ▶ Wages in China are = 2.1% the wages of France, but Chinese productivity = 2.7% productivity level of France.
- ▶ Wages increase in China due to productivity gains
- ▶ Chinese affiliates of foreign companies have been shown to pay higher wages

So, countries with low wages have also a low productivity.

- ▶ High wage countries can specialize in industries in which they have a relative cost advantage

Is Globalization associated with full specialization as in Ricardo model ?

Rich economies have decreased significantly their market share in some industries, like in textile and apparel

- ▶ But no sector has fully disappeared
- ▶ Some “tasks” within firms have been relocated , while others continue being produced at home
⇒ Idea that some tasks can be more easily produced at home and other abroad (Grossman and Rossi-Hansberg, *American Economic Review* 2008)
- ▶ Some firms (least productive) have disappeared whereas other continue producing
⇒ Adjustment occurs accross firms within sectors rather than between sectors (Melitz, *Econometrica* 2003)