

Specific factors model

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Last lecture we discussed comparative advantage which entails that some countries have an advantage in the production of particular goods due to lower opportunity costs

- ▶ These are due to technological differences which means that there are potential gains to be made from free trade

In the Ricardian model countries will focus their production on the good in which they have a comparative advantage

- ▶ Full specialisation will occur under the free trade equilibrium

The main insight of this model is that free trade will benefit all participants, even if some countries are terrible at everything

- ▶ All workers gain since all income goes to labour

Despite the useful insights it provides, the Ricardian model has two main shortcomings relating to the predictions it generates

1. Full specialisation rarely happens
2. Everyone is expected to benefit from trade since there is only one production factor

Recall that the law of comparative advantage establishes a relationship between trade flows and relative autarky prices

$$\frac{p_x}{p_y} > \frac{p_x^*}{p_y^*}$$

It is unclear however in the Ricardian framework where these autarky prices come from.

Factor proportion theory provides a solution as we do know that countries differ in

1. Factor abundance or the relative factor supply
2. Factor intensity or the relative factor demand

The interaction between factor abundance and intensity determines relative prices and thus trade patterns. We will be discussing two models relying on this concept

1. Specific factors
2. Heckscher-Ohlin

Factor proportion theory can help us better understand who benefits from trade.

Let's go back to the prediction of the Ricardian model that trade will be beneficial for all. This ignores the effect of trade on within-country income distribution as trade affects income because

1. Industries differ in production factors that they use
 - ▶ Stolper-Samuelson Theorem
2. Production factors cannot move instantly and without costs between industries

Stolper-Samuelson theorem

Under constant returns to scale, an increase in the price of a commodity will increase the return to the factor used intensively in the production of the commodity and decrease the return to other factors.

We will discuss into more detail next lecture.

Besides benefits there are also costs associated with opening up to trade, or reducing trade barriers. There are costs in the

1. short run, such as adjustment costs
2. long run, due to decrease in the requirement of certain production factors

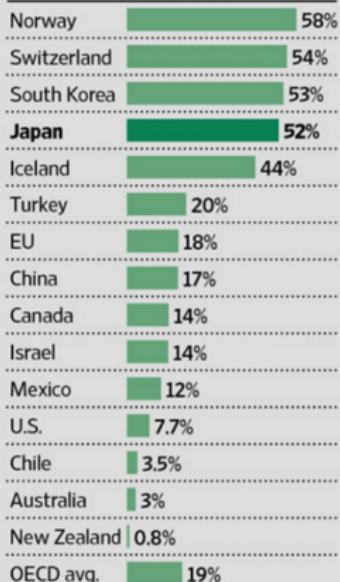
Farm Protections

Japan's long-standing tradition of protecting its farmers is coming under criticism from some farmers, who say it has stymied efforts to bring more competition to agriculture.

Japan tariffs on certain farm goods, end of March 2012

Rice	778%
Butter	360%
Sugar	305%
Barley	256%
Wheat	252%
Nonfat dry milk	218%
Beef	39%

Subsidies as a percentage of farm income, for 2011*



*China figure is from 2010

Sources: Ministry of Agriculture, Japan (tariffs); OECD (subsidies)

The Wall Street Journal

Consider farm protection in Japan where tariffs allow very little rice to be imported

- ▶ Importing 100 EUR worth of rice involves a tariff of 778 EUR

Due to land scarcity producing rice in Japan is expensive; country would be better off allowing rice imports. However, this would hurt Japanese farmers

- ▶ Farmers could move to other industry, such as working in the Toyota factory
- ▶ Farming skills would probably be useless though

In the short turn farmers can't move to working in another industry.

Some groups in society oppose free trade due to the potentially negative effect on income

- ▶ The specific factors model allows trade to affect income distribution

The specific factors model assumes that all countries have the same technology, only a different factor mix

- ▶ The differences in factor mix leads countries to specialise
- ▶ e.g. more labour will produce garments, more capital will produce cars

In the basic model there are

- ▶ Two countries: *Home, Foreign*
- ▶ Two goods: X, Y
- ▶ Three production factors: labour L , capital K , land T

Two of the three production factors will be sector specific.

Going through the model we will focus on two goods: cloth and food. Cloth is produced using capital and labour

$$Q_c = Q_c(K, L_c)$$

Food is produced using land and labour

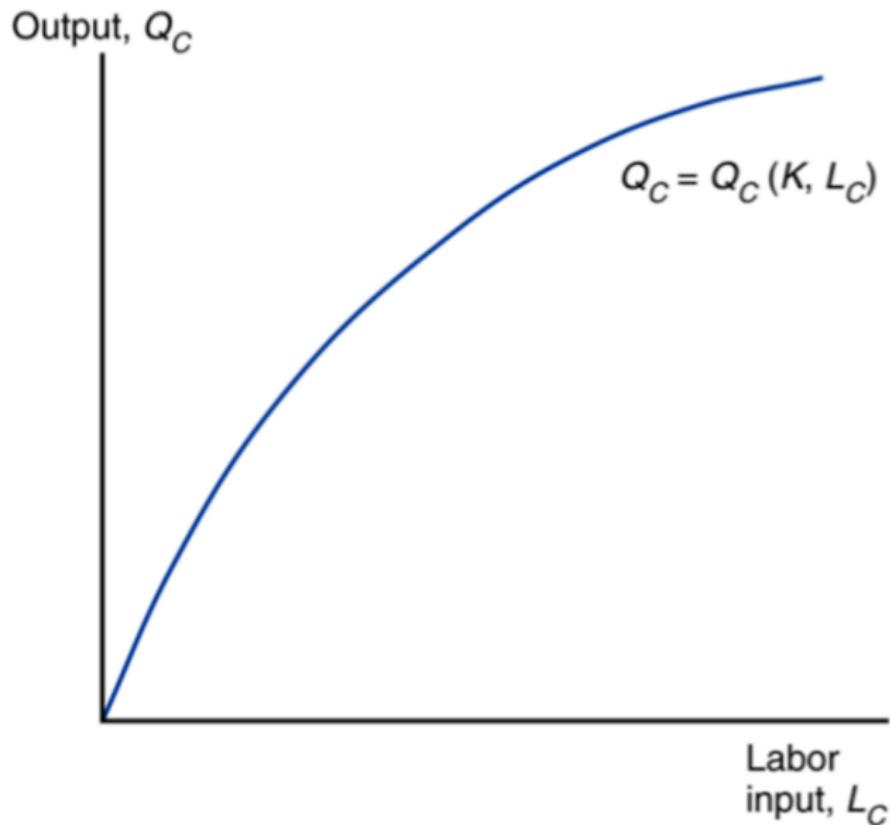
$$Q_f = Q_f(T, L_f)$$

Similar to the Ricardian model labour L is mobile between the two sectors

$$L = L_c + L_f$$

In addition there are two specific factors capital K and land T which are used in production of only one good.

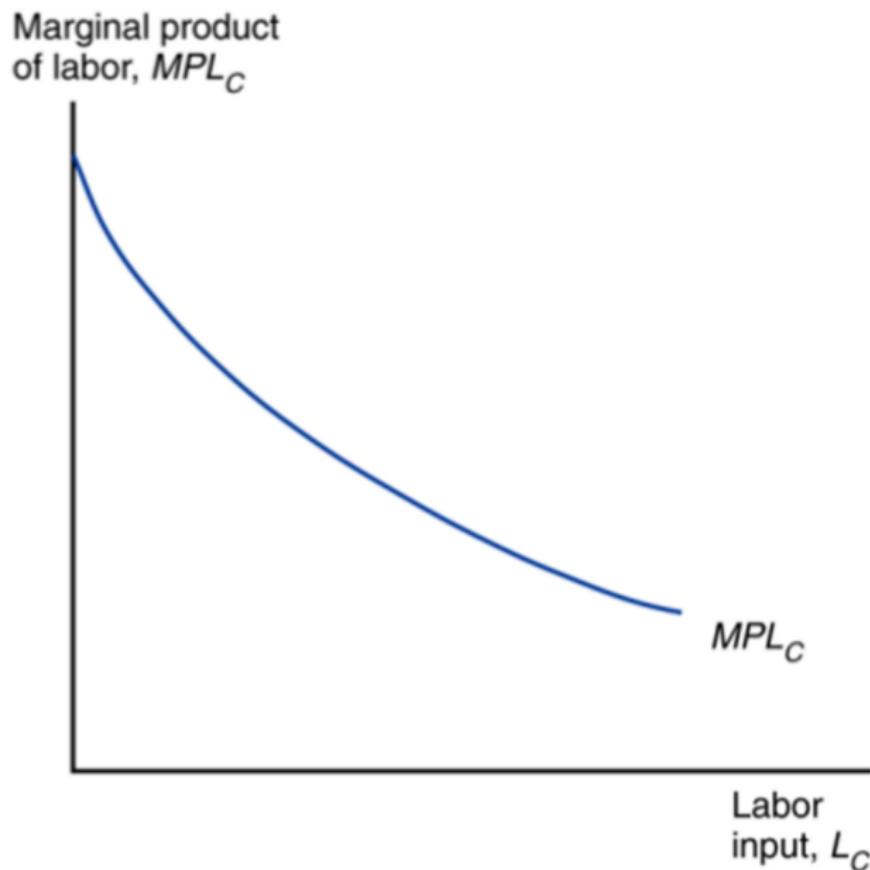
Cloth production function



The specific factors model follows the law of diminishing returns. So for example a worker is added to the cloth production process, while the capital level stays constant. This means that

- ▶ each worker has less capital to work with
- ▶ each additional unit of labour adds less output than the last

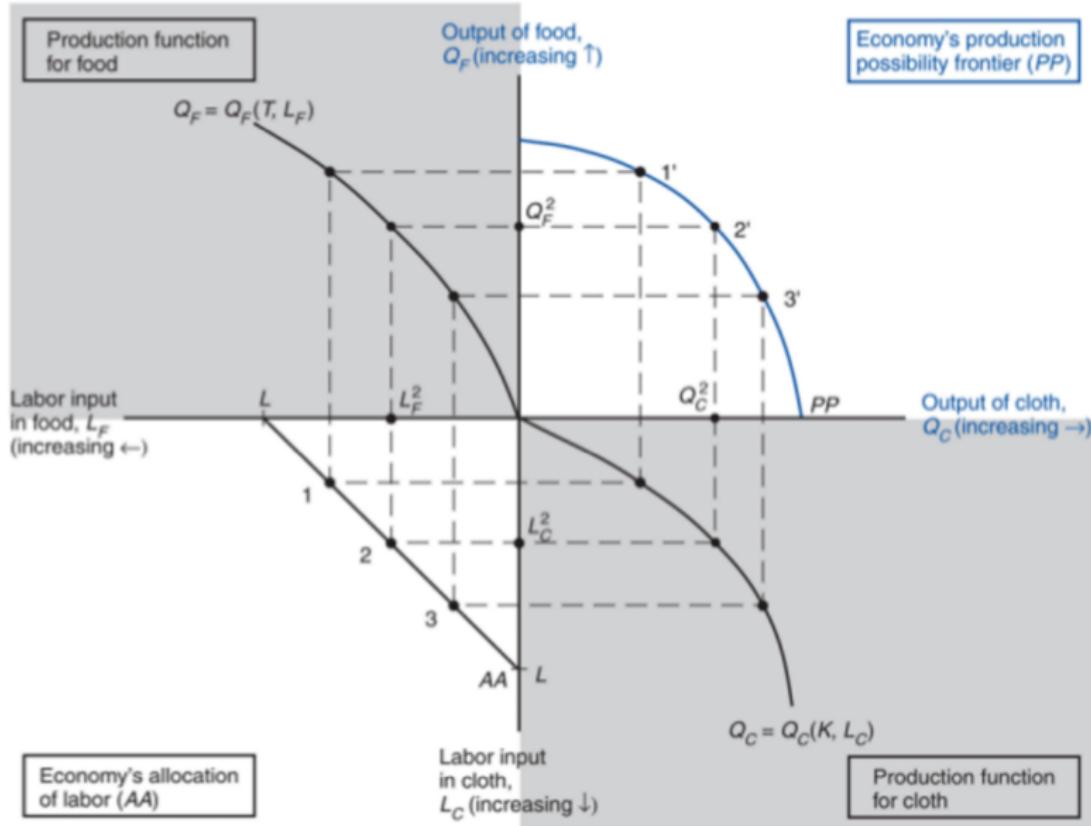
Labour marginal product



To illustrate the PPF we use a four-quadrant diagram

1. Labour allocation shown in lower-left
2. Cloth production function shown in lower right
3. Food production function shown in upper left
4. Combination of food/cloth than can be produces in upper right

PPF



The Production Possibilities Frontier (PPF) describes the level of output an economy can generate and the slope is given by

$$-\frac{Q_L^F(T, L_F)}{Q_L^C(K, L_C)} = -\frac{MPL_F}{MPL_C}$$

The slope gives the amount of food foregone to produce more clothing.

- ▶ Diminishing returns to labour in each sector cause the opportunity costs to rise when an economy produces more of a good

One important question is which goods will a country produce after it opens up to trade? The specific factors model builds on the idea of comparative advantage of Ricardo

- ▶ Each country will export the good in which it has a comparative advantage

The comparative advantage will be determined by the specific factor in which it is relatively abundant.

- ▶ e.g. a capital intensive good (cloth) will be produced by the capital abundant country; food will be produced by the land abundant country

Importantly there will be incomplete specialisation.

- ▶ The country will produce on that point of the PPF where the slope equals the relative price of the two goods

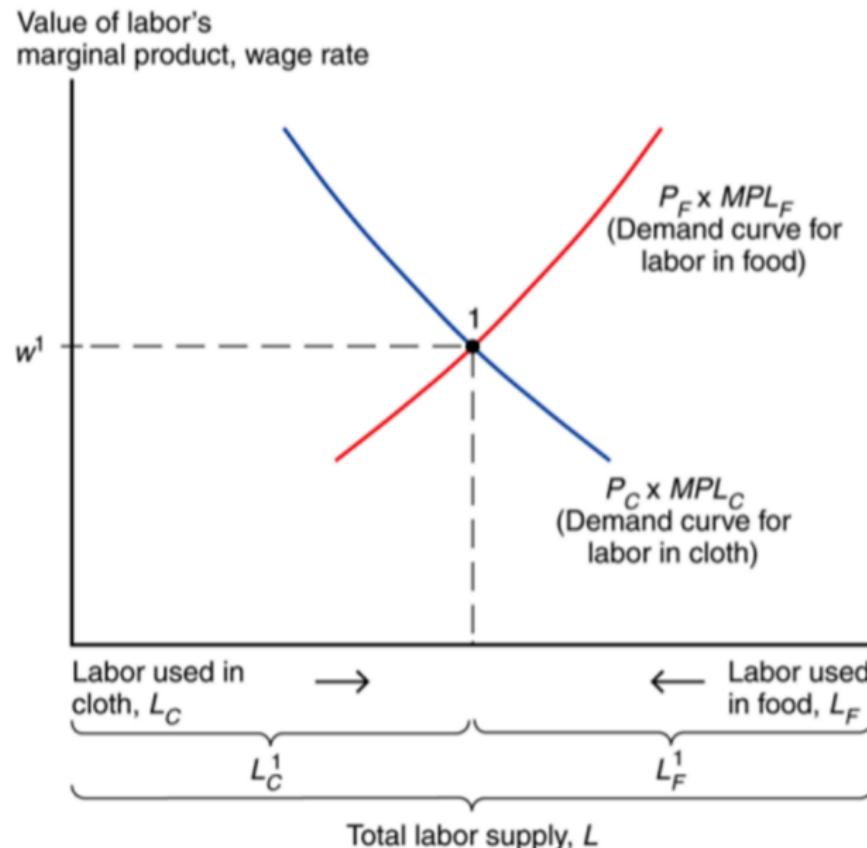
The specific factors model accounts for the effect of trade on income. Let's have a look at the determination of wages and prices. For each sector wage w will equal the marginal product of labour MPL times the price p or

$$w = p_c \cdot MPL_c = p_f \cdot MPL_F$$

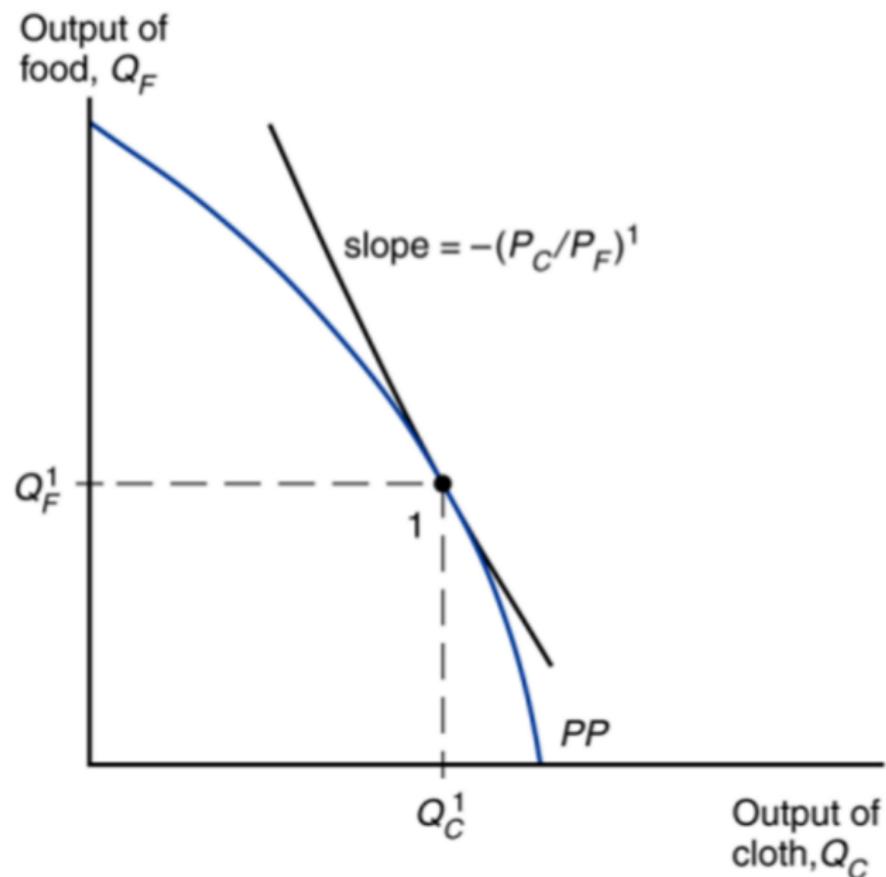
Note that due to labour mobility both sectors will pay the same wage. In terms of relative prices we have

$$-\frac{p_c}{p_f} = -\frac{MPL_F}{MPL_C}$$

Labour allocation in autarky



Production function



Besides labour we also have capital and land as production factors, and the returns to these are given by

$$r_K = \frac{p_c \cdot Q_c - w \cdot L_c}{K}$$

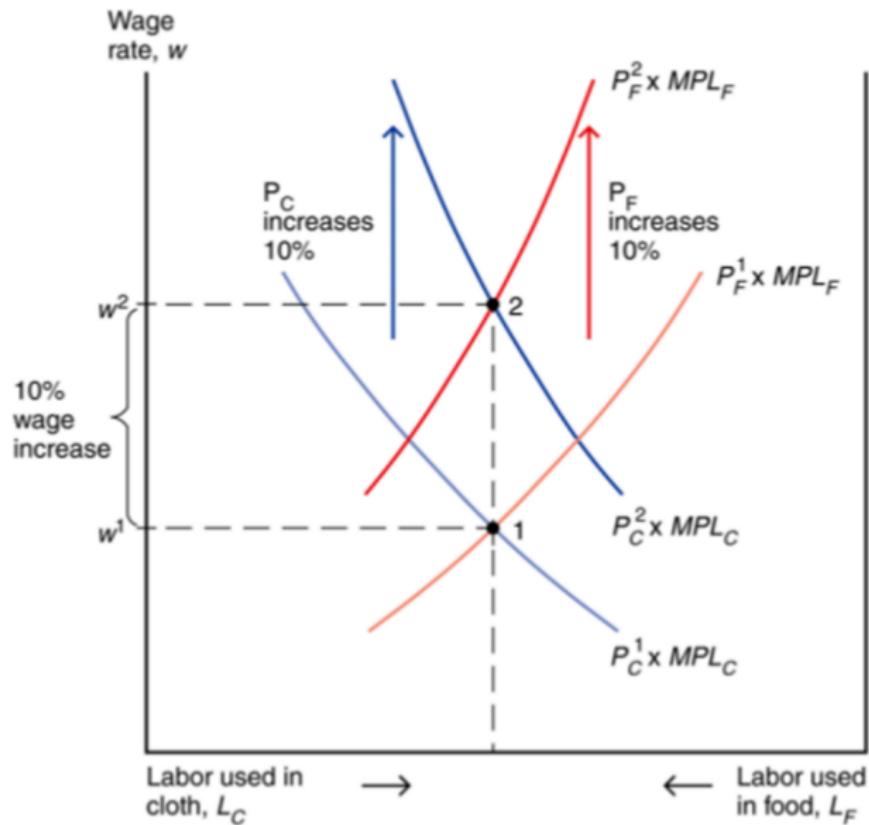
$$r_T = \frac{p_f \cdot Q_f - w \cdot L_f}{T}$$

- ▶ K, T earn what is left from sales revenues pQ after labour is paid wL

We can now check what will happen to labour allocation and the income distribution following a change in prices. Here we will consider a change in

1. Prices in equal proportions
2. Relative prices

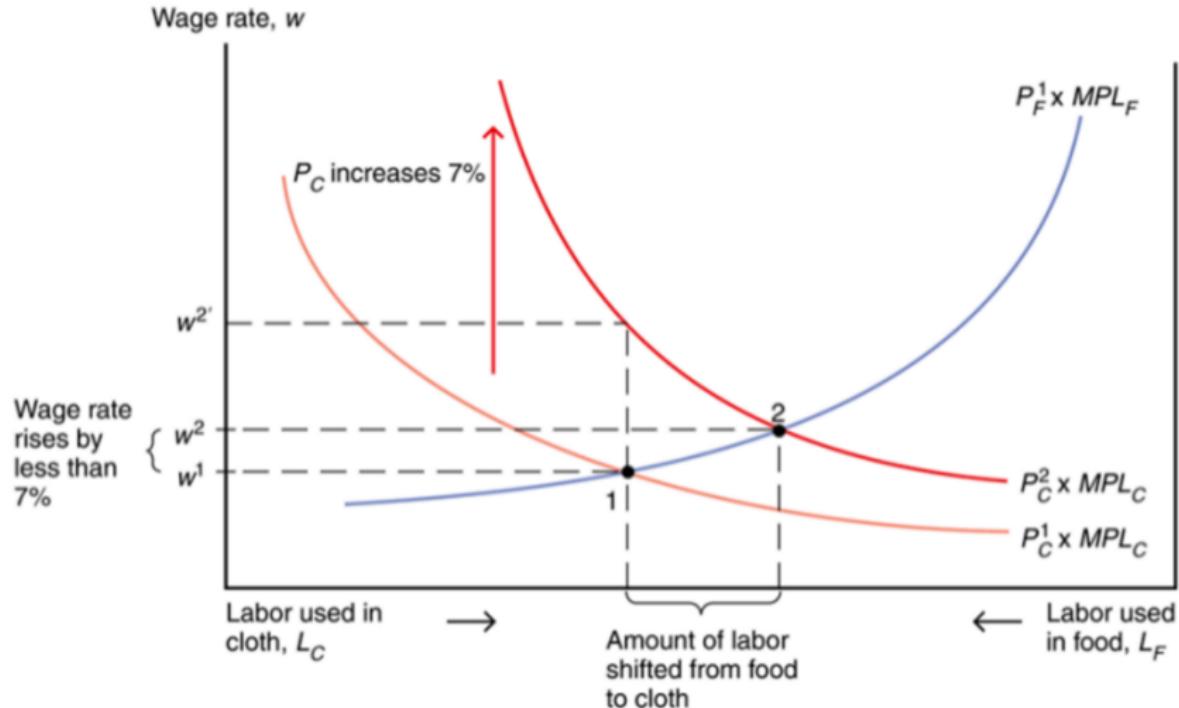
Equal proportional change in prices



Following an equal proportional change in price no real changes occur

- ▶ w rises in the same proportion, real wages are unaffected
- ▶ Real incomes of capital and landowners stay the same

Increase in the price of cloth

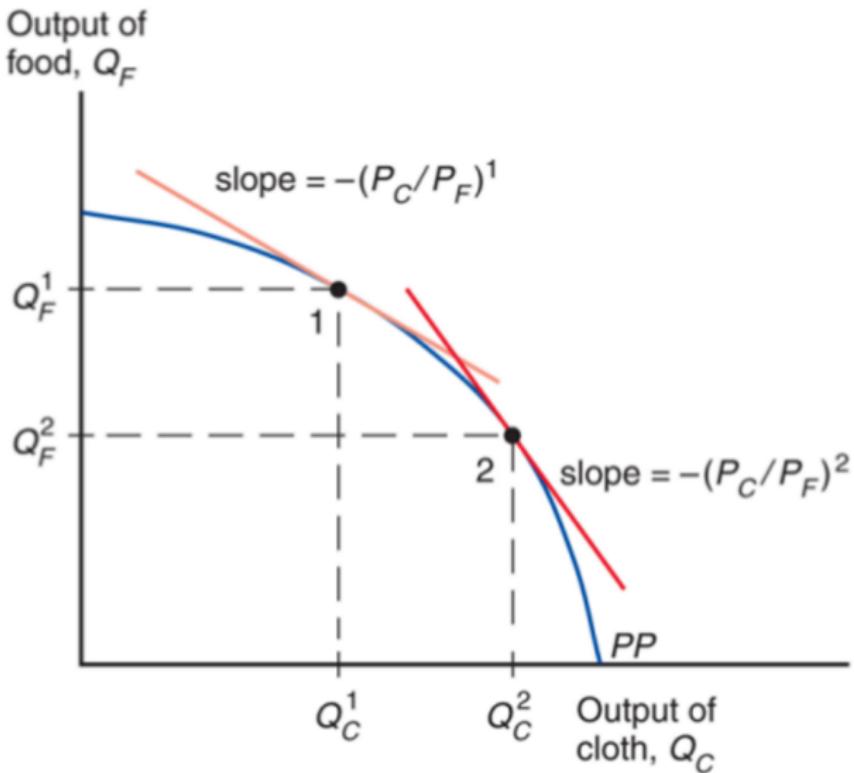


Following a change in relative prices, when p changes in one sector does lead to changes

1. Labour moves to sector with higher prices
2. Output in other sector decreases

w does not increase as much as p given that the marginal product of labour will decrease

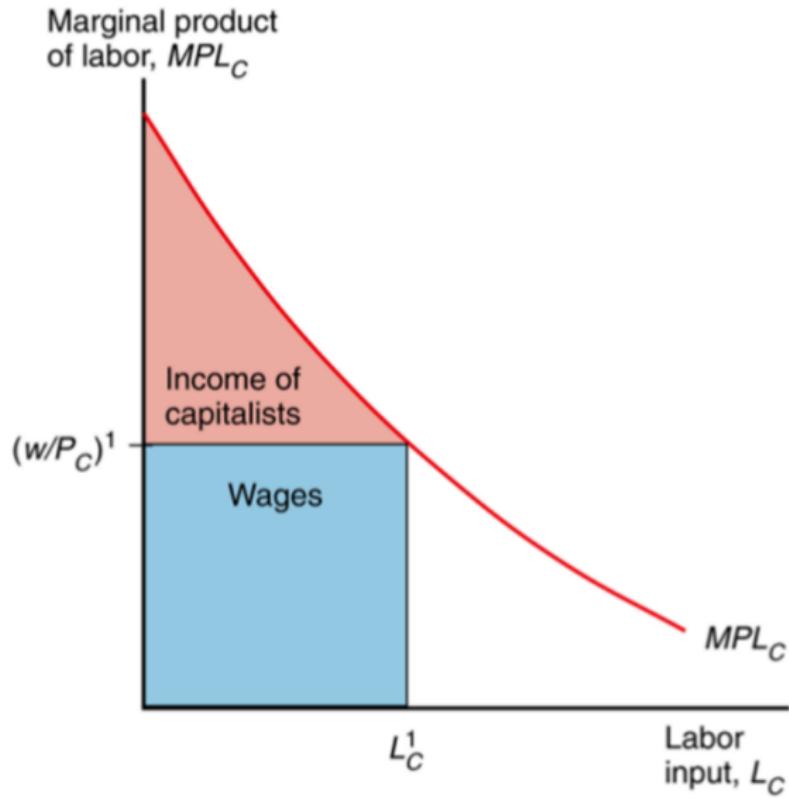
Effect of cloth price change on output



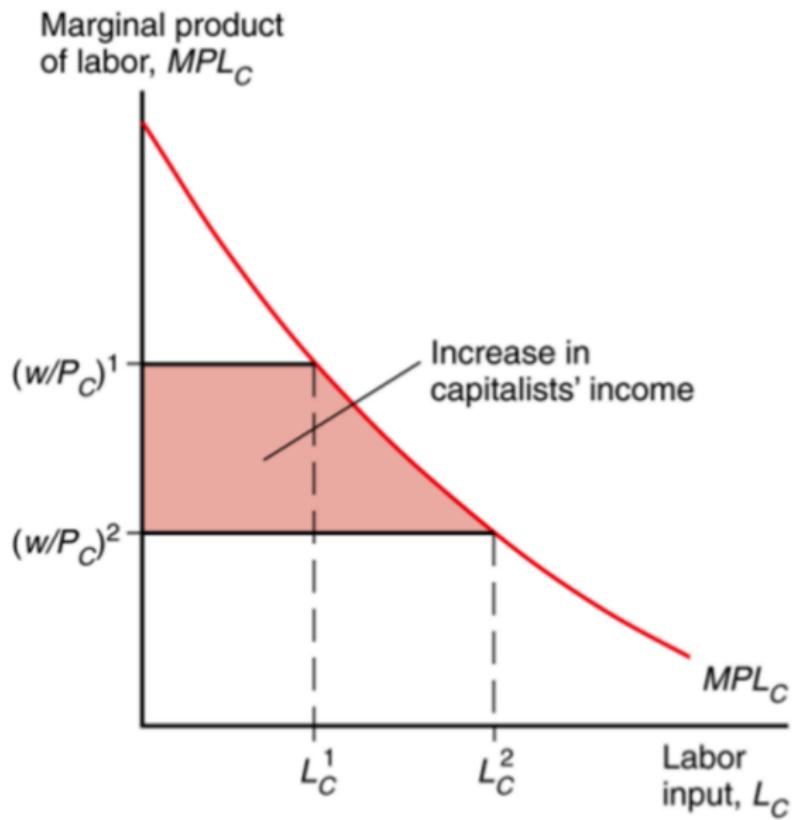
The relative price change also affects real income

1. Capital owners are better off due to positive price shock in capital intensive sector
 - ▶ r_k increases, marginal product of K is expected to increase
2. Landowners are worse off since land is not a production factor in the cloth industry
 - ▶ r_t decreases, marginal product of T is expected to decrease
3. Effect of workers is ambiguous; depends on relative importance of cloth and food in consumption
 - ▶ Wages increase, but so does the textile price
 - ▶ Can afford more food but less clothes

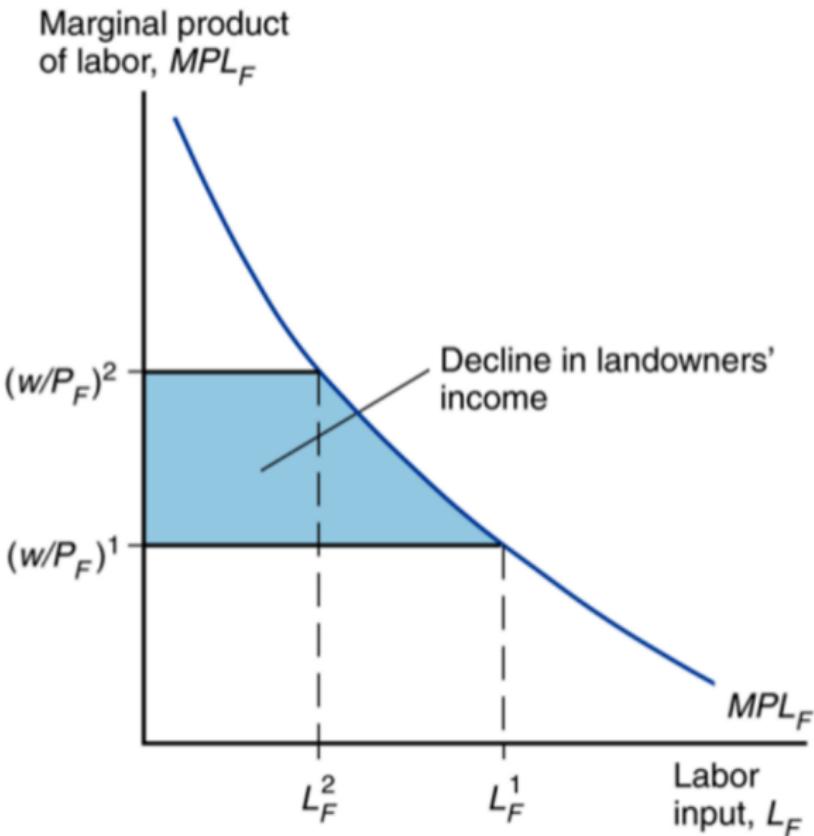
Income distribution in cloth sector



Effect of price change on income capital owners



Effect of price change on income landowners



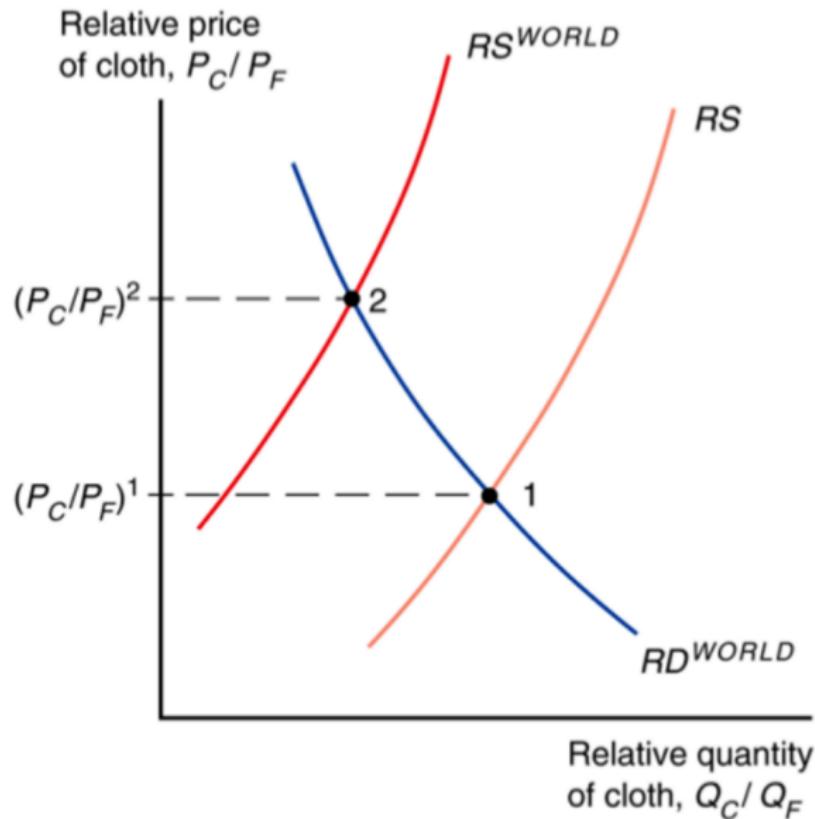
Note the political implications of the model: the issue of free trade will diametrically oppose the two specific factors each one vying for the support of the mobile factor.

Opening up to trade is the same as a change in relative prices which means that some will gain and others will lose. The direction of the change depends on two factors:

1. Economy's relative demand and supply
2. World's relative demand and supply

In an economy whose relative supply of cloth is larger than for the world as a whole, opening up to trade will increase the relative price of cloth.

Relative prices under international trade



In the model relative prices will converge due to international trade. Let's consider two trading economies

1. Japan
2. USA

Assume that they have the same relative demand, which entails that relative supply is the source of international trade. Relative supply might differ because the countries are different in terms of

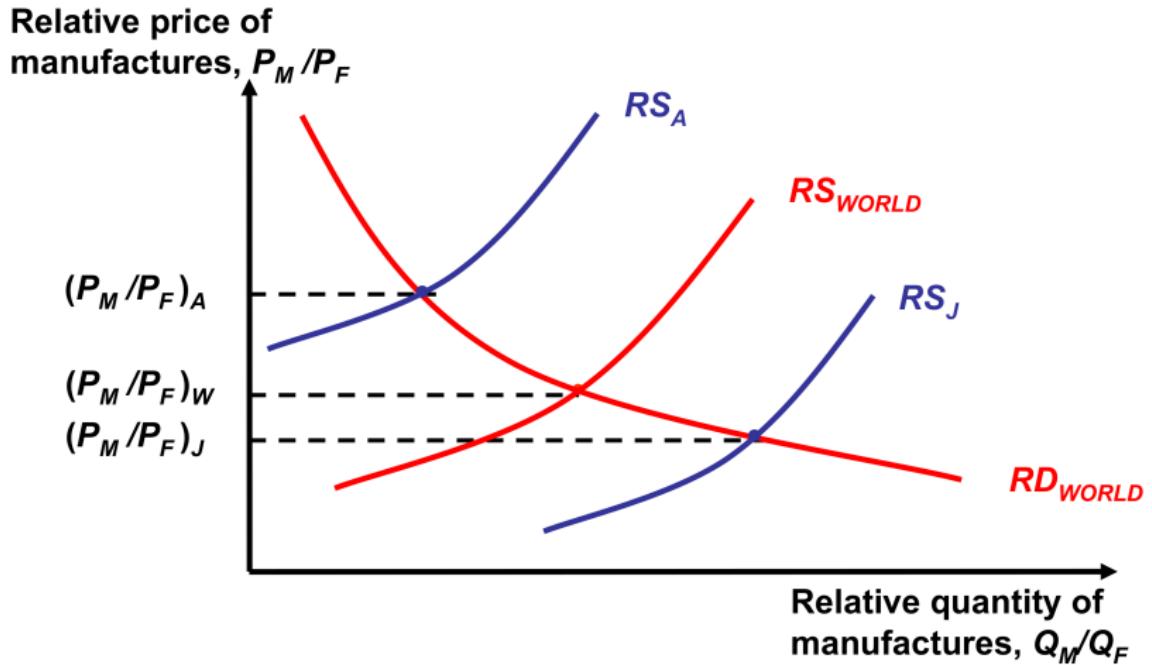
- ▶ Technology level
- ▶ Factors of production

Also assume that both countries produce the same two goods

1. Manufactures, which are capital intensive
2. Food, which is land intensive

While Japan has more capital per worker, the USA will have more land.

- ▶ This means that the autarky relative price in Japan of a capital intensive good is lower compared to that of the USA



The model predicts that the economy as a whole will gain: In autarky a country's output must equal its consumption whereas trade allows the consumption mix to differ from production mix. Consumption is constrained by

$$p_c \cdot D_c + p_f \cdot D_f = p_c \cdot Q_c + p_f \cdot Q_f$$

i.e. a country cannot spend more than it earns.

Under free trade it is able to afford amounts of cloth and food that it is not able to produce itself

$$D_f - Q_f = \frac{p_c}{p_f} \cdot (Q_c - D_c)$$

i.e. it imports food equal to the relative price of cloth times cloth exported.

When a country opens up to trade the factor prices will change

- ▶ Trade benefits factor that is specific to the export sector
- ▶ Trade hurts factor that is specific to the import-competing sector
- ▶ Effect on mobile factor is ambiguous

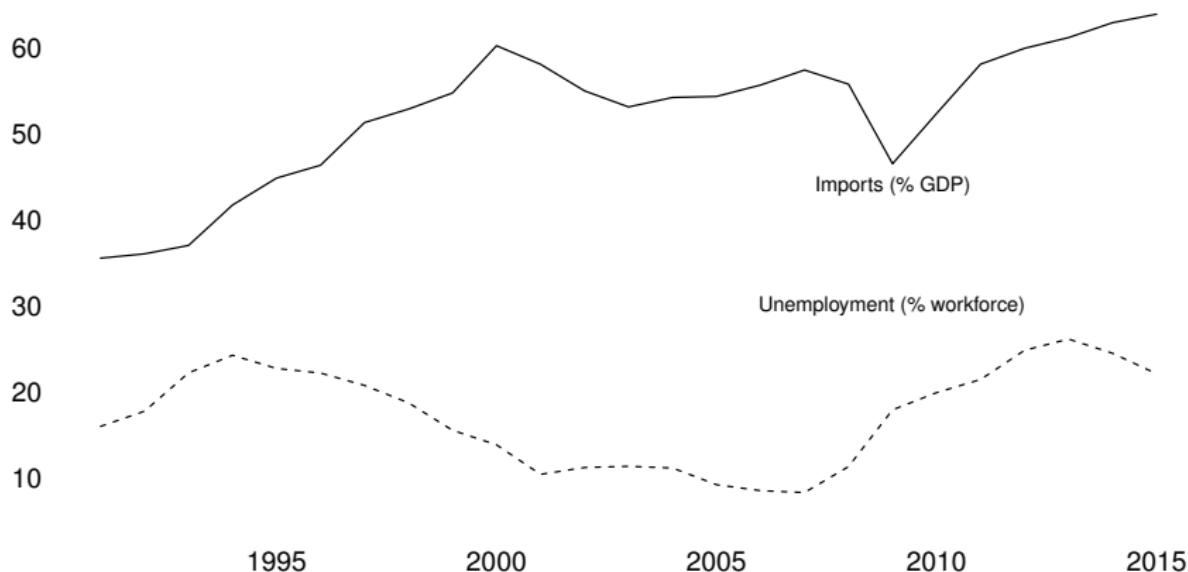
Trade will expand consumption possibilities but also creates winners and losers

- ▶ Losers can be compensated by income redistribution

Opening up to trade there will also be a shift in employment from the import-competing to the export sector.

- ▶ Process not instantaneous: some will be unemployed
- ▶ No strong correlation between unemployment and trade though

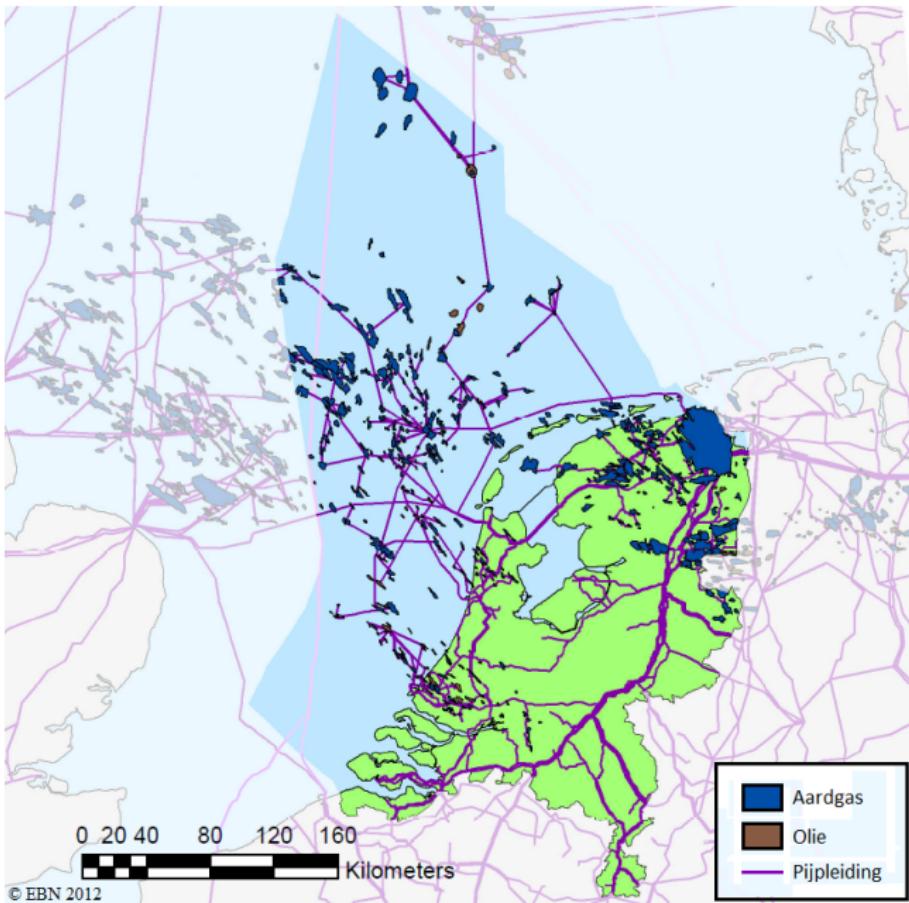
Unemployment and import penetration in Spain



Besides import-competing sectors, trade can also hurt some exporting sectors following a windfall in one particular sector.

- ▶ The dynamics are similar to a change in relative prices

This is known as the Dutch disease.



0 20 40 80 120 160

Kilometers

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In 1959 the Dutch Petroleum Company found the largest natural gas field in Europe near Slochteren in the province of Groningen

- ▶ Besides the gas field in Groningen there are about 250 other fields on land and in the North Sea

After creating a domestic gas market the Dutch became the 9th largest exporter of natural gas in the world and the largest in Europe

- ▶ Currently the Netherlands rank 17th due to a decrease in production.

0.6

Proportion of total Dutch exports

0.5

0.4

0.3

0.2

0.1

0.0

1950

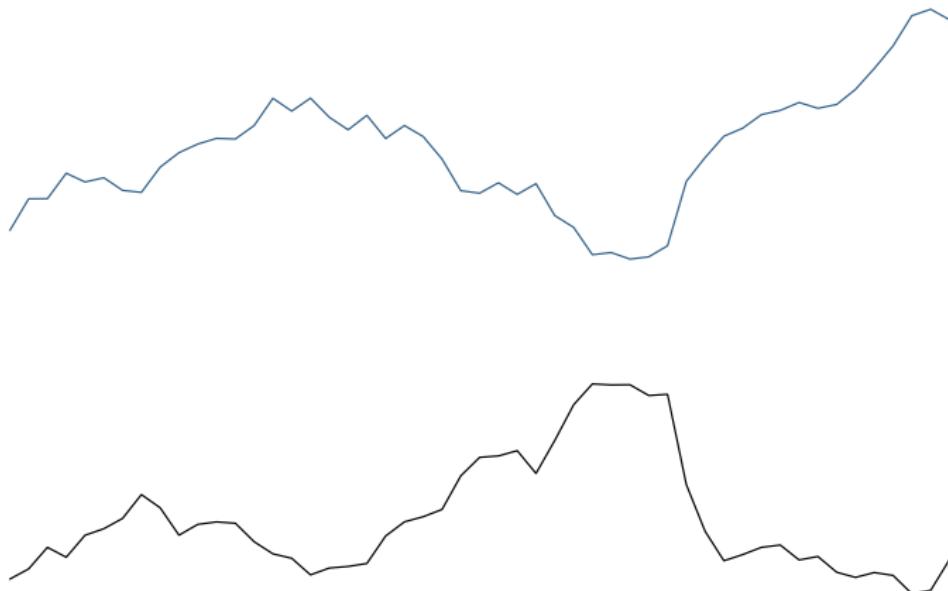
1960

1970

1980

1990

2000

Manufactures +
machinery

Mineral fuels

The expansion of the gas sector made other sectors such as manufacturing less competitive.

- ▶ The manufacturing sector contracted becoming "too" small.

Why is this a problem?

- ▶ A trading sector will benefit most from learning-by-doing
- ▶ Shrinking the sector will reduce learning-by-doing and reduce growth

In the case of the Netherlands the natural resource revenues made the national currency appreciate in value, making it harder for other sectors to export.

More broadly in terms of international trade we can define the **Dutch disease** as

A favourable change in the economic development of one exporting sector that has adverse consequences for other exporting sectors.

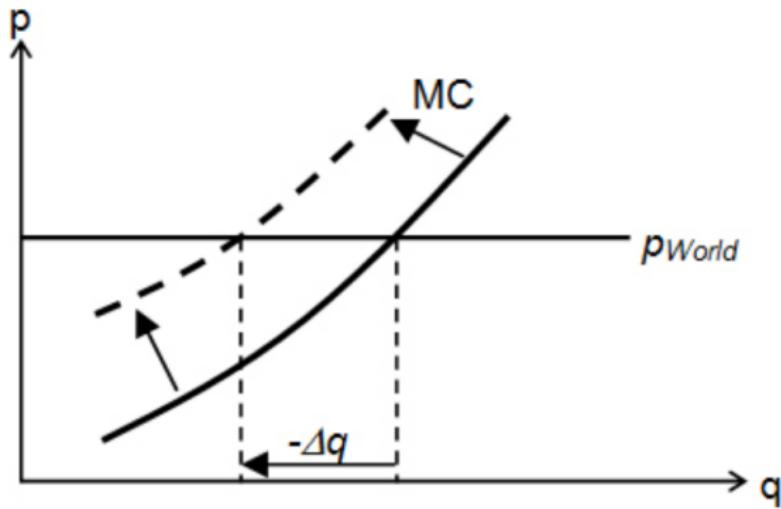
More general: Suppose that there are N industries which produce and sell their products on the world market

- ▶ They each need labour L for their production, combined with another factor
- ▶ Recall that L is mobile across industries

When the world market price for one industry i increases, this industry will expand leading to an increase in wage w .¹ This wage increase will hamper the other $N - i$ exporting industries

- ▶ They face higher marginal costs due to a wage increase
- ▶ Yet the world market price for their product remained the same

¹Capital will also be drawn towards the industry experiencing the windfall.



We can also consider the movement of production factors across countries rather than only industries, such as

- ▶ Labour migration
- ▶ International borrowing and lending
- ▶ FDI

Movement of production factors can be politically sensitive and subject to restrictions.

Let's focus on labour mobility. Suppose that there are two countries, *Home*, *Foreign*, who produce one non-traded good using two production factors

1. Land, which is fixed
2. Labour, which can move across countries and workers will migrate to the country with the higher wage

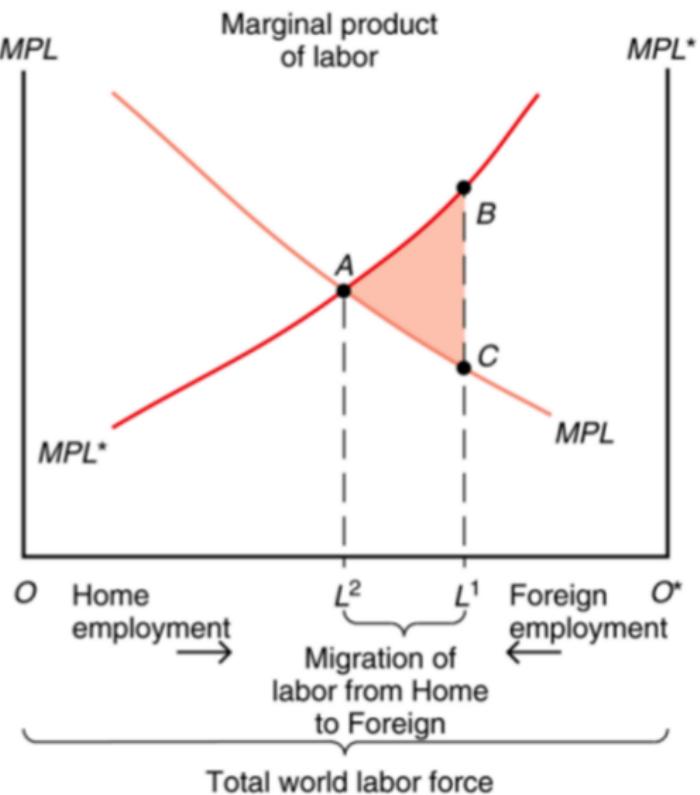
Let's assume that wages in *Home* are lower than in *Foreign* due to lower productivity.

- ▶ This means that *Home* workers want to migrate to *Foreign*

Without obstacles workers will migrate until purchasing power of wages is equal across countries.²

²In real life this doesn't happen due to barriers to migration.

Labour mobility across countries



In this example workers in *Home* will benefit while those in *Foreign* will be hurt. What is the effect on owners of the other production factor, land?

1. *Foreign* landowners will benefit by labour inflow; decreasing real wages and increasing output
2. *Home* landowners will be hurt by labour outflow; increasing real wages and decreasing output

From an economic perspective there is a case for barrier-free migration as it increases world output as L moves to more productive areas.

- ▶ The value of world output is maximised when marginal productivity of labour is equal across countries

Real wages in origin and destination countries

source: Williamson, 1995

Real wage 1870, US = 100 Increase real wage 1870-1913 (%)

Origin countries

	Real wage 1870, US = 100	Increase real wage 1870-1913 (%)
Ireland	43	84
Italy	23	112
Norway	24	193
Sweden	24	250

Destination countries

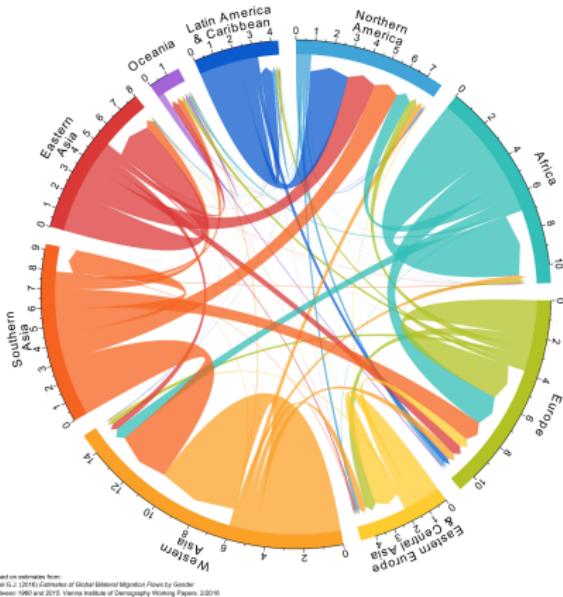
	Real wage 1870, US = 100	Increase real wage 1870-1913 (%)
Argentina	53	51
Australia	110	1
Canada	86	121
US	100	47

Food for thought:

By 1910 about 14 million immigrants were living in the USA on a population of 92 million. Who do you think would have favoured migration in the USA?

1. Capitalists
2. Landowners
3. Labour unions

Recall: Migration flows between 2005-2010



NB - Largest migration flows between developing countries.

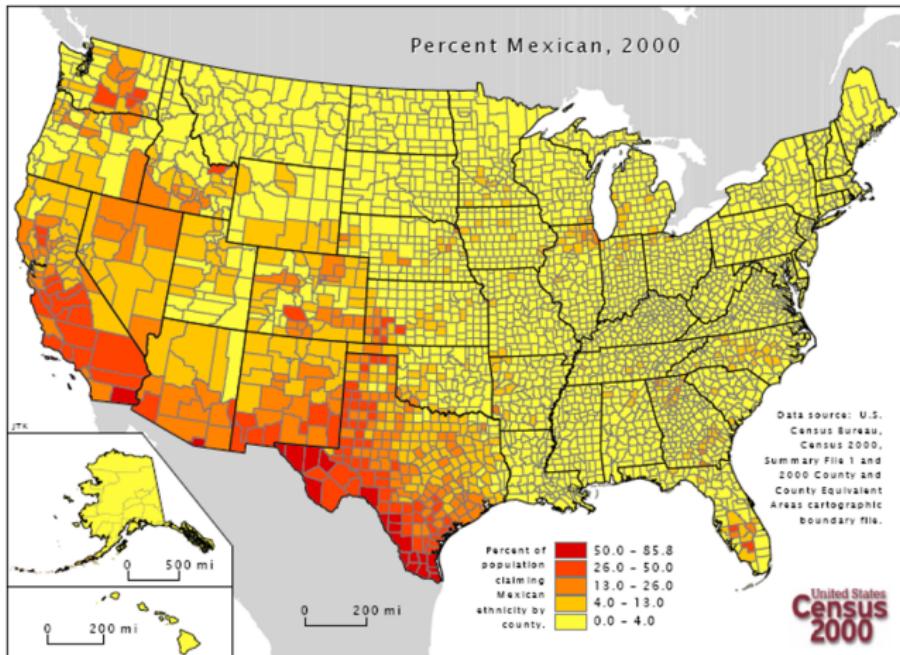
The USA is a popular destination country for migrants, specifically from Mexico

- ▶ One third of foreign-born US residents are Mexican
- ▶ 1 in 10 Mexicans end up living in the US
- ▶ 97% of Mexican migrants go to US

Most migrants are low-skilled workers and much of Mexican-US migration is cyclical. In recent years there has been a decrease in migration

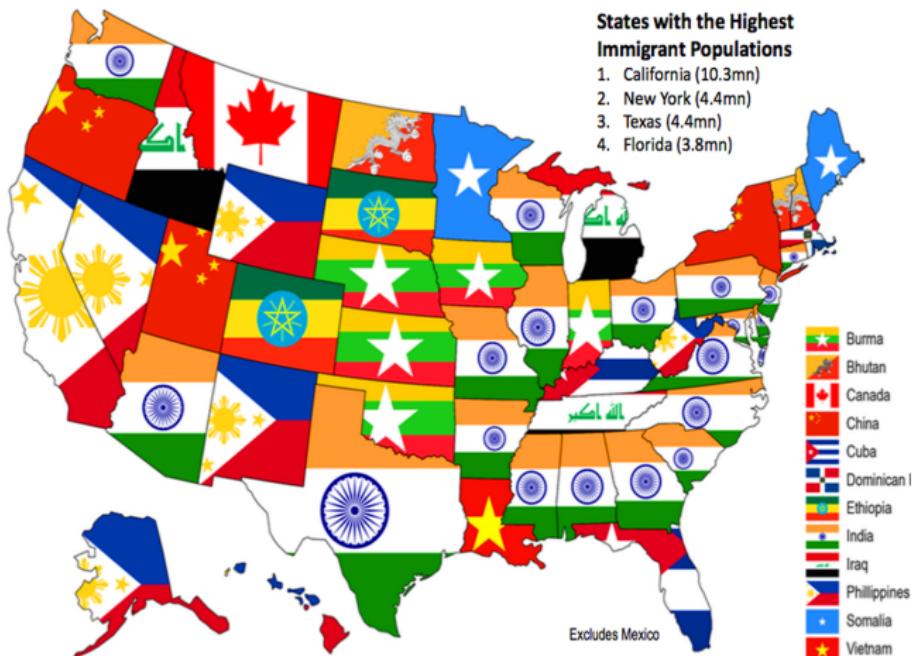
1. Enhanced border protection
2. Recession decreased job prospects

Percent Mexican, 2000



Most immigrants per country

source: Business Insider

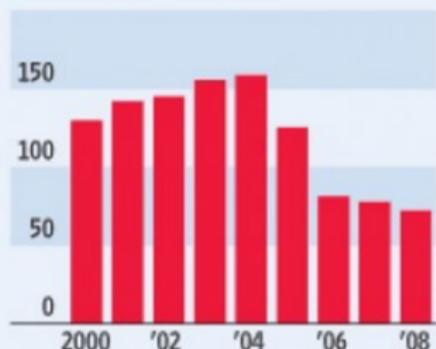


Immigration in Japan

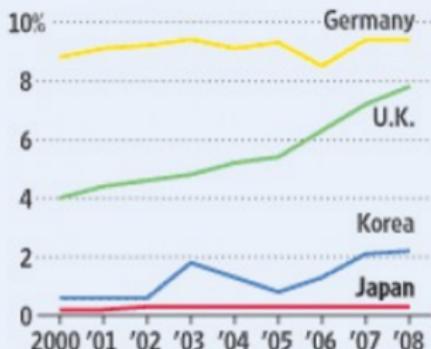
source: The Wall Street Journal

Japan | A closed nation

Inflows of foreign workers into Japan, in thousands



Stocks of foreign-labor force in selected OECD countries, percentage of total labor force



Source: OECD International Migration Outlook 2010

Returning to the question about immigration to America: let's assume that their economy produces two goods

- ▶ clothing C and food F

with three production factors

- ▶ labour L , capital K , and land T

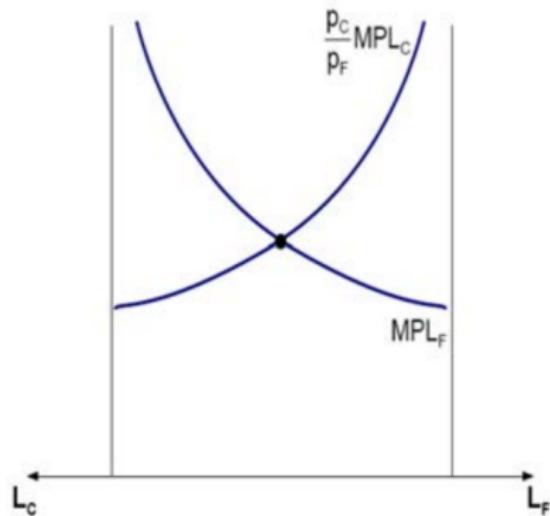
Each factor is paid the value of its marginal product.

$$r_c = p_c \cdot MPK_c; r_f = p_f \cdot MPT_f$$

$$w = p_c \cdot MPL_c = p_f \cdot MPL_f$$

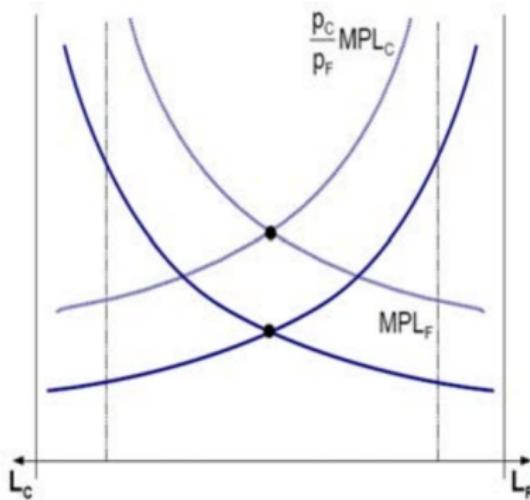
While K and T are fixed, L changes in response to shocks such as immigration.

Labour allocation pre-immigration



y-axis is $\frac{w}{p_f} = MPL_f = \frac{p_c}{p_f} MPL_c$

Effect of increase in labour endowment



Following an increase in labour endowment, additional labour will go to both sectors. What will be the impact on worker's welfare?

$$MPL_c = \frac{w}{p_c}$$

$$MPL_f = \frac{w}{p_f}$$

Marginal productivity will decrease in both sectors due to labour increase: welfare falls.

What about the welfare of the capital owners?

$$MPK_c = \frac{r_c}{p_c}$$

$$MPT_f = \frac{r_f}{p_f}$$

At constant relative prices the returns to capital and land will increase in both sectors due to the labour increase: welfare increases

The specific factors model can help us understand why certain people are pro-trade while others are not. Mayda & Rodrik (2006) test this empirically using survey data and found that pro-trade preferences are correlated with

- ▶ Individual's level of human capital
- ▶ Trade exposure of the sector in which the individual works:
non-traded sectors are more pro-trade

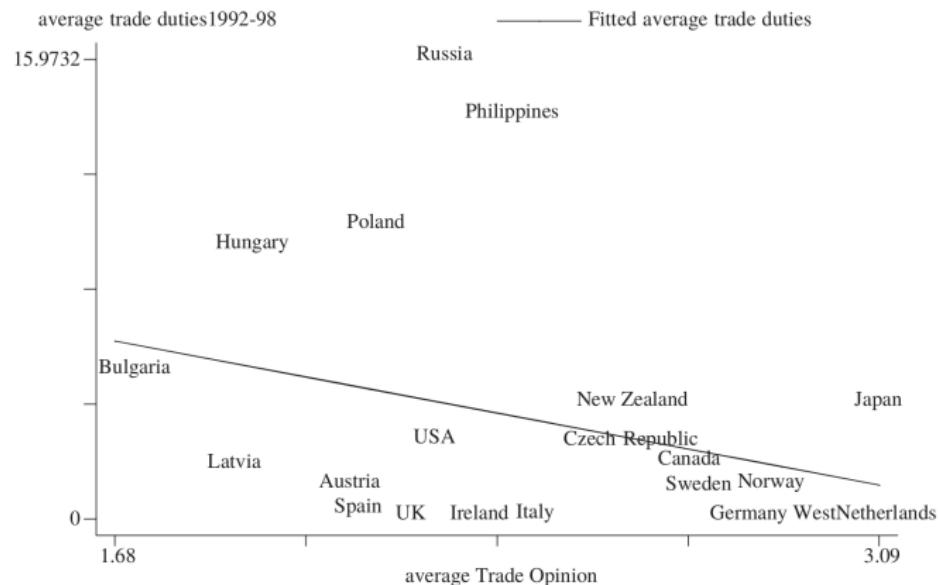


Fig. 1. Relationship between trade opinion and average trade duties (ISSP data set).

Summarising, in contrast with the Ricardian model the import-competing sector does not vanish in the specific-factors model when a country opens up to trade.

- ▶ There is a strong effect of changes in relative prices on income distribution and welfare across sectors

Importantly, countries can share the same technologies and still benefit from trade

- ▶ Comparative advantage is driven by differences in factor abundance
- ▶ In Ricardian model there is no incentive for trade when they have the same technology