

KRUGMAN | OBSTFELD | MELITZ  
INTERNATIONAL  
ECONOMICS  
THEORY & POLICY



TENTH EDITION

## Chapter 4

# Specific Factors and Income Distribution



# Preview

- Motivation
- The Specific Factors Model
- International Trade in the Specific Factors Model
- Income Distribution and the Gains from Trade
- Political Economy of Trade: A Preliminary View
- International Labor Mobility
- Summary



# Motivation

- The Ricardian model implied that international trade makes every individual better off.
- If trade is so good for the economy, why is there such opposition?
- Two main reasons why international trade has strong effects on the distribution of income within a country:
- Resources cannot move immediately or costlessly from one industry to another.
  - Short-run consequences of international trade, see Chapter 4.
- Industries differ in the factors of production they use.
  - Long-run consequences of international trade, see Chapter 5.



# The Specific Factors Model

- The **specific factors model** allows trade to affect income distribution.
- Assumptions of the model:
  - Two goods, cloth and food.
  - Three factors of production: labor ( $L$ ), capital ( $K$ ) and land ( $T$  for terrain).
  - Perfect competition prevails in all markets.
  - Cloth produced using capital and labor (but not land).
  - Food produced using land and labor (but not capital).
  - Labor is a mobile factor that can move between sectors.
  - Land and capital are both specific factors used only in the production of one good.



# What Is a Specific Factor?

- In the model, there are two specific factors (land and capital) which are permanently tied to particular sectors
  - Economists usually think of factor specificity as a matter of time
  - The machines for brewing beers can not be used for cloth production. Given time, however, it is possible to redirect investment from breweries to cloth production.
- In practice, there is also no clear distinction between mobile and specific factor.
  - In the model, labor is a mobile factor, however a coal miner would not be able to become an IT specialist immediately.
  - Fallick (1993, JLE) – after four years, a displaced worker in the U.S. has the same probability of being employed as a similar worker who was not displaced.



# What Is a Specific Factor?

- Nevertheless, labor is relatively more mobile factor than capital.
  - Compare 4-year estimate for an average worker with the lifetime of a machine (say 15 or 20 years) or with 30 to 50 years for structures (a shopping mall, office building, or production plant).
- Kambourov, Manovskii (2009) – a displaced worker who is re-employed in a different occupation suffers an 18% permanent drop in wages (on average), while only 6% drop if he does not switch occupations.
  - Labor is a truly mobile factor only before a worker has invested in any occupation-specific skills.



# The Specific Factors Model

- The production function for cloth gives the quantity of cloth that can be produced given any input of capital and labor:

$$Q_C = Q_C(K, L_C) \quad (4-1)$$

- $Q_C$  is the output of cloth,  $K$  is the capital stock,  $L_C$  is the labor force employed in cloth

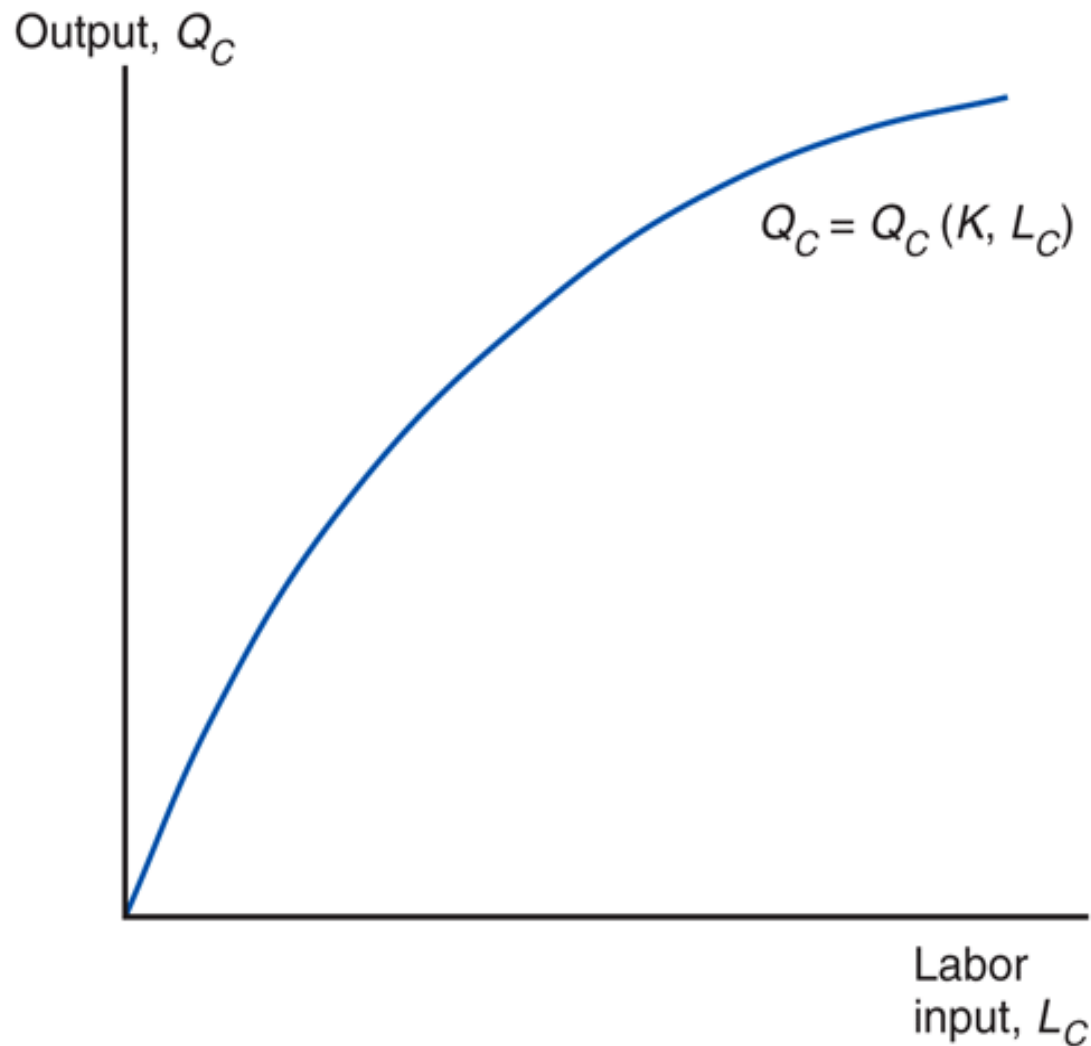
- The production function for food gives the quantity of food that can be produced given any input of land and labor:

$$Q_F = Q_F(T, L_F) \quad (4-2)$$

- $Q_F$  is the output of food,  $T$  is the supply of land,  $L_F$  is the labor force employed in food



# Fig. 4-1: The Production Function for Cloth



The production function is upward-sloping and concave

The shape of the production function reflects the law of **diminishing marginal returns**.

Adding one worker to the production process (without increasing the amount of capital) means that each worker has less capital to work with.

Therefore, each additional unit of labor adds less output than the last.





# Fig. 4-2: The Marginal Product of Labor

Marginal product  
of labor,  $MPL_C$

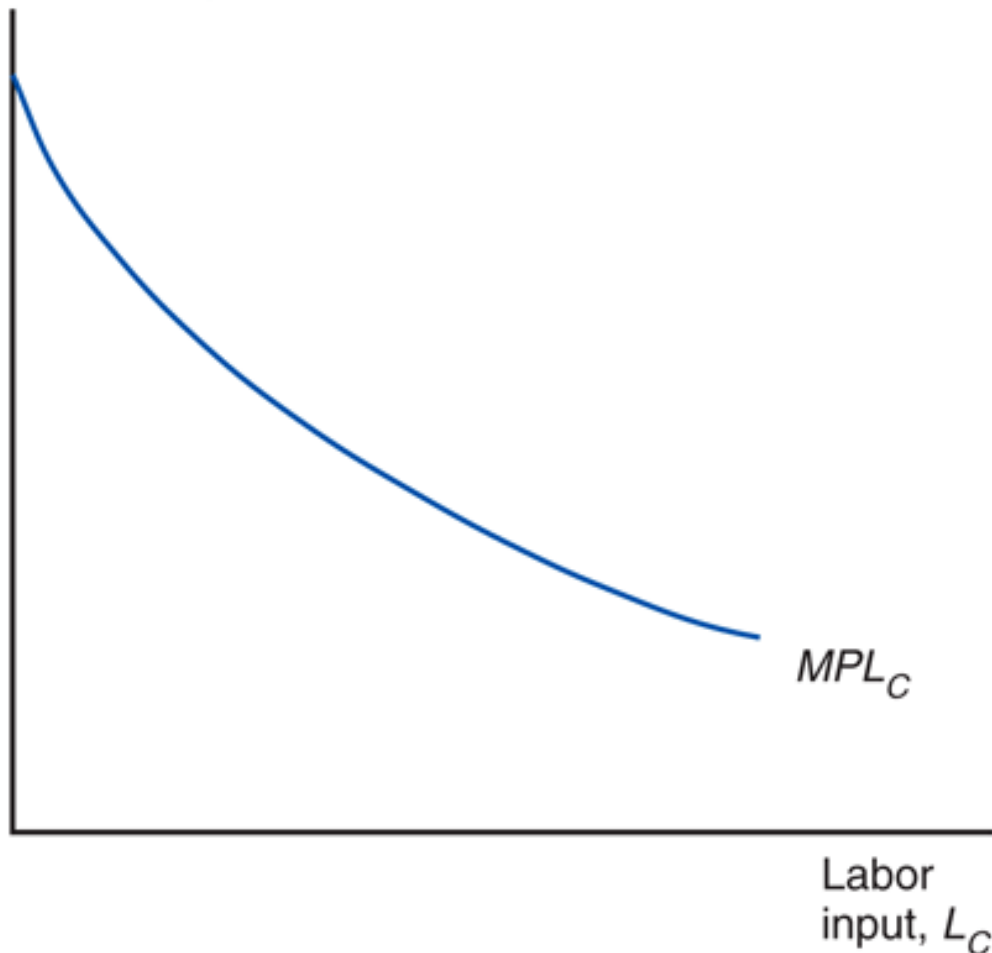


Figure shows the **marginal product of labor**, which is the increase in output that corresponds to an extra unit of labor.

It is also equal to the slope of the production function from the previous figure.

Because of the law of **diminishing marginal returns**, each additional unit of labor adds less output than the last.

The marginal product of labor therefore declines as more labor is used.



# Production Possibilities

- For the economy as a whole, the total labor employed in cloth and food must equal the total labor supply:

$$L_C + L_F = L \quad (4-3)$$

- Using production functions (4-1), (4-2) and equation of labor constraint (4-3) we can derive the **production possibilities frontier** of an economy.

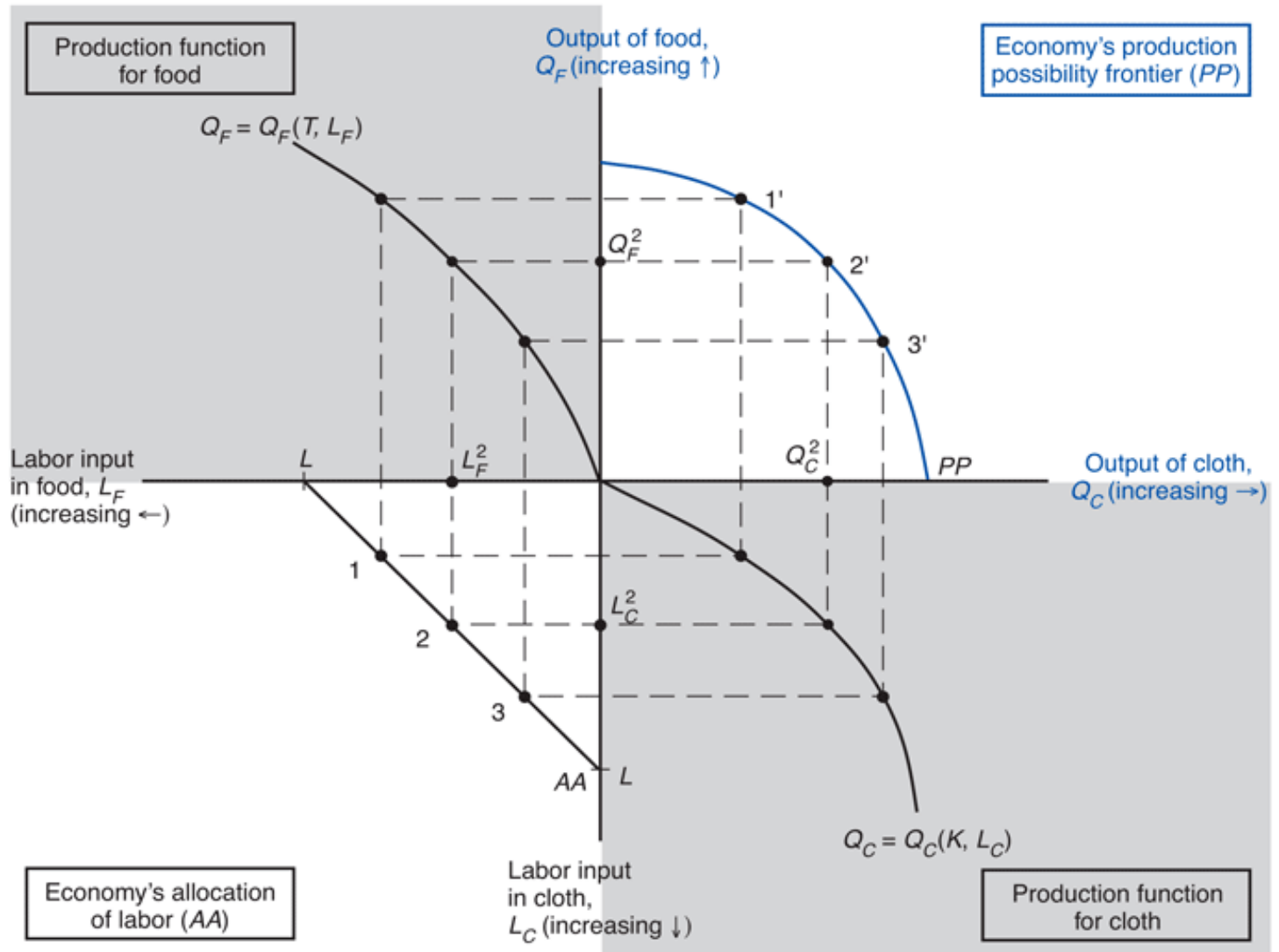


# Production Possibilities

- Use a four-quadrant diagram to construct production possibilities frontier in Figure 4-3.
  - Lower left quadrant indicates the allocation of labor.
  - Lower right quadrant shows the production function for cloth from Figure 4-1.
  - Upper left quadrant shows the corresponding production function for food.
  - Upper right quadrant indicates the combinations of cloth and food that can be produced.



# Fig. 4-3: The Production Possibility Frontier in the Specific Factors Model





# Production Possibilities

- Why is the production possibilities frontier curved?
  - Diminishing returns to labor in each sector cause the opportunity cost to rise when an economy produces more of a good.
  - Opportunity cost of cloth in terms of food is the slope of the production possibilities frontier – the slope becomes steeper as an economy produces more cloth.
- Opportunity cost of producing one more yard of cloth is  $MPL_F/MPL_C$  pounds of food.
  - To produce one more yard of cloth, you need  $1/MPL_C$  hours of labor.
  - To free up one hour of labor, you must reduce output of food by  $MPL_F$  pounds.
  - The marginal product of labor in food rises and the marginal product of labor in cloth falls, so  $MPL_F/MPL_C$  rises.



# Prices, Wages, and Labor Allocation

- How much labor is employed in each sector?
  - Need to look at supply and demand in the labor market.
- Demand for labor:
  - In each sector, employers will maximize profits by demanding labor up to the point where the value produced by an additional hour equals the marginal cost of employing a worker for that hour.

- The demand curve for labor in the cloth sector:

$$MPL_C \times P_C = w \quad (4-4)$$

- The wage equals the value of the marginal product of labor in cloth.
- The demand curve for labor in the food sector:

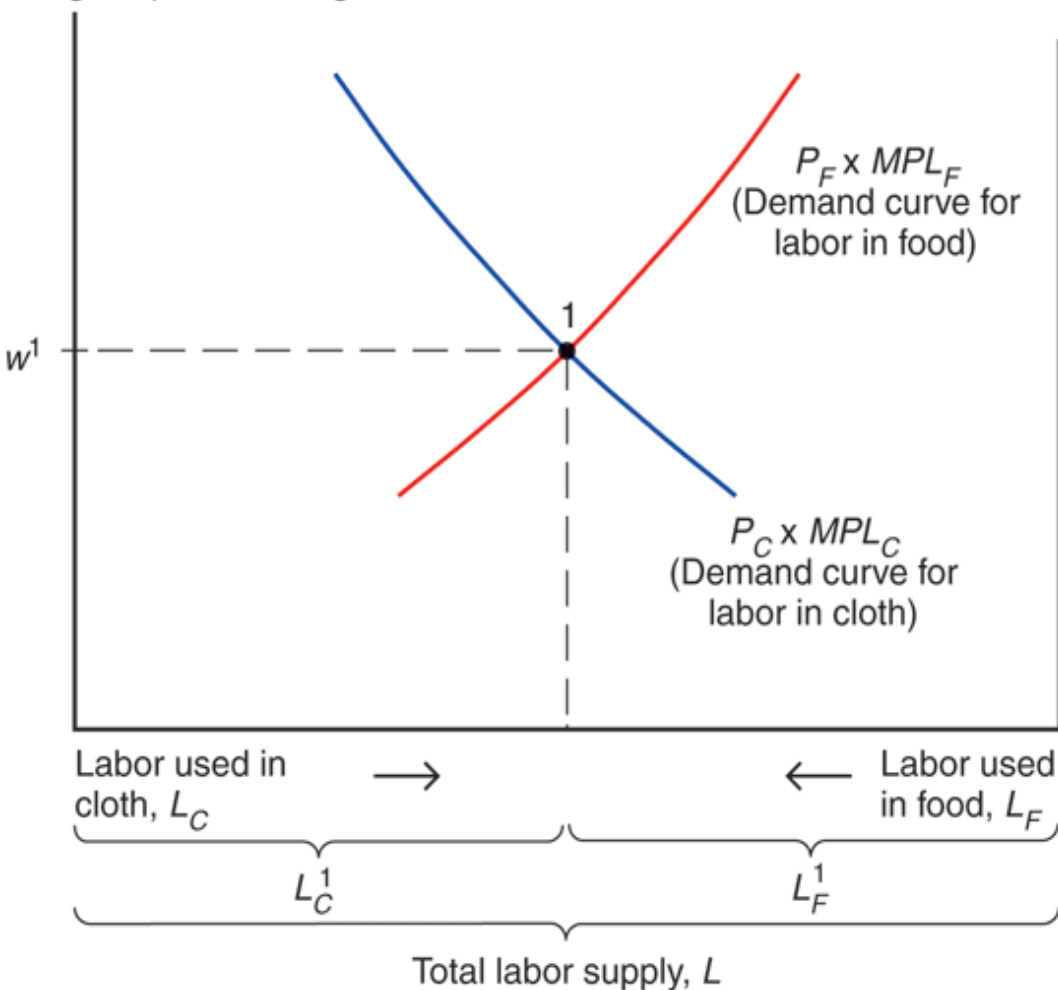
$$MPL_F \times P_F = w \quad (4-5)$$

- The wage equals the value of the marginal product of labor in food.



# Fig. 4-4: The Allocation of Labor

Value of labor's marginal product, wage rate



The demand for labor in the food sector is measured from the right.

The horizontal axis represents the total labor supply  $L$ .

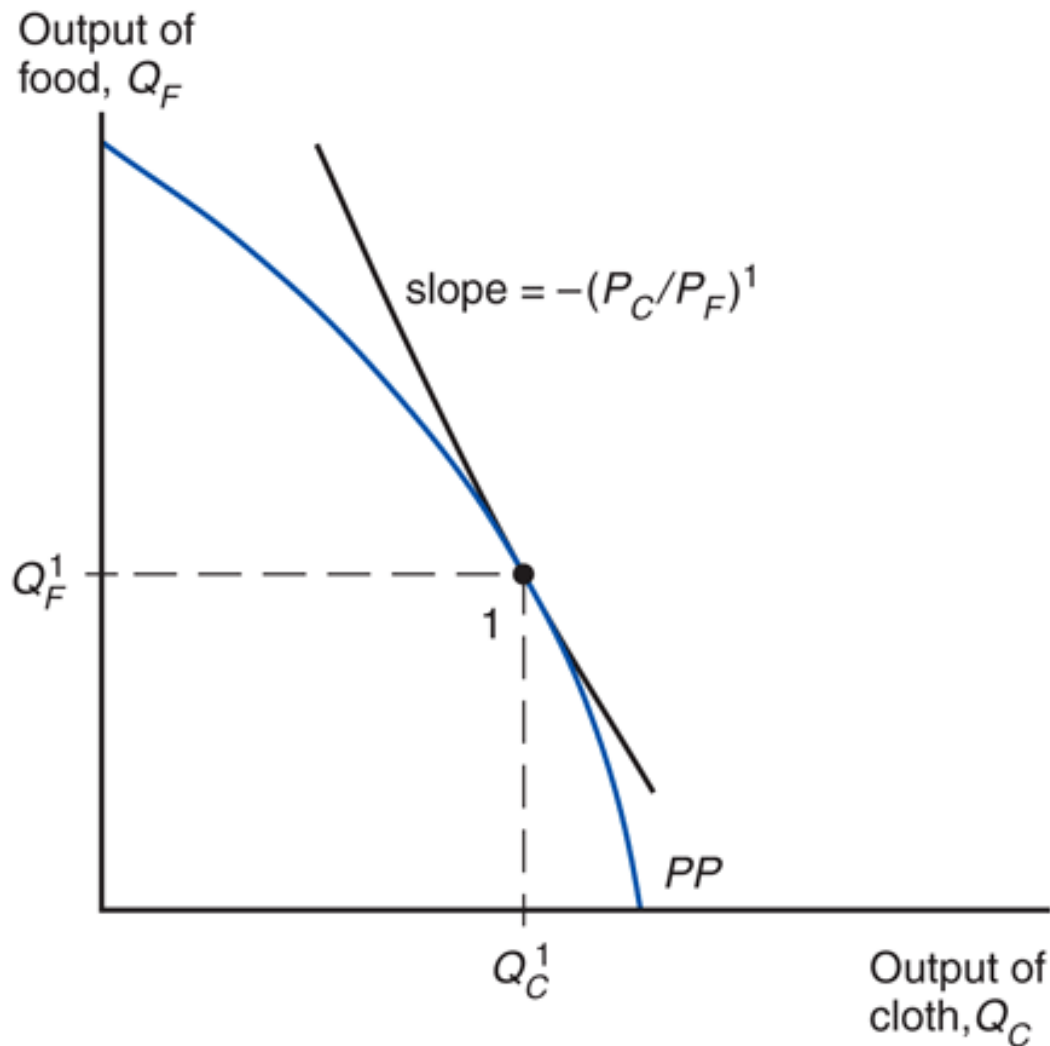
The two sectors must pay the same wage because labor can move between sectors.

If the wage were higher in the cloth sector, workers would move from making food to making cloth until the wages become equal.

Where the labor demand curves intersect gives the equilibrium wage and allocation of labor between the two sectors.



# Fig. 4-5: Production in the Specific Factors Model



At the production point, the production possibility frontier must be tangent to a line whose slope is minus the price of cloth divided by that of food.

Formally, relation between relative prices and output is following:

$$-MPL_F/MPL_C = -P_C/P_F$$

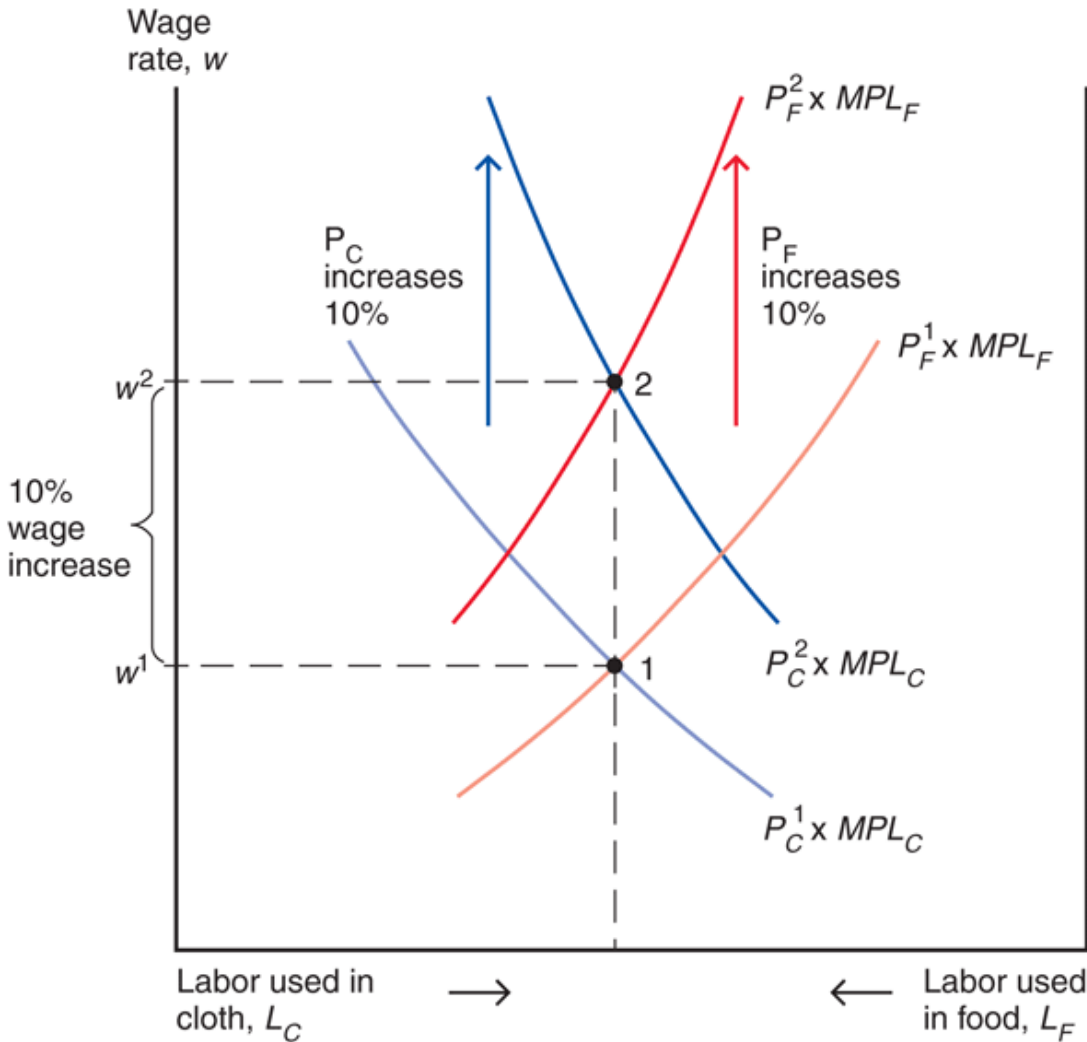




# Prices, Wages, and Labor Allocation

- What happens to the allocation of labor and the distribution of income when the prices of food and cloth change?
- Two cases:
  1. An equal proportional change in prices
  2. A change in relative prices

# Fig. 4-6: An Equal-Proportional Increase in the Prices of Cloth and Food



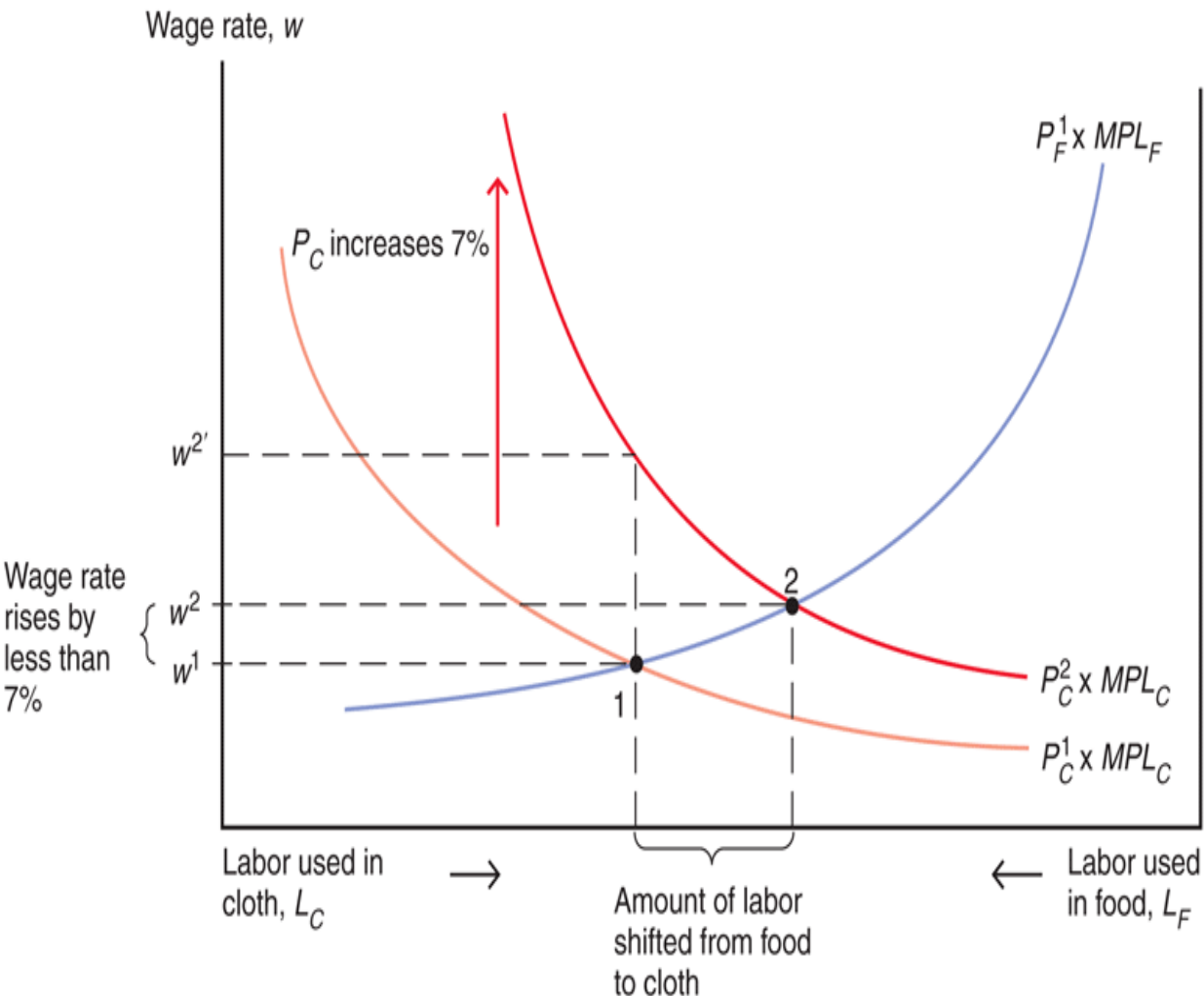
When both prices change in the same proportion, no real changes occur.

The wage rate ( $w$ ) rises in the same proportion as the prices, so real wages (i.e., the ratios of the wage rate to the prices of goods) are unaffected.

The real incomes of capital owners and landowners also remain the same.



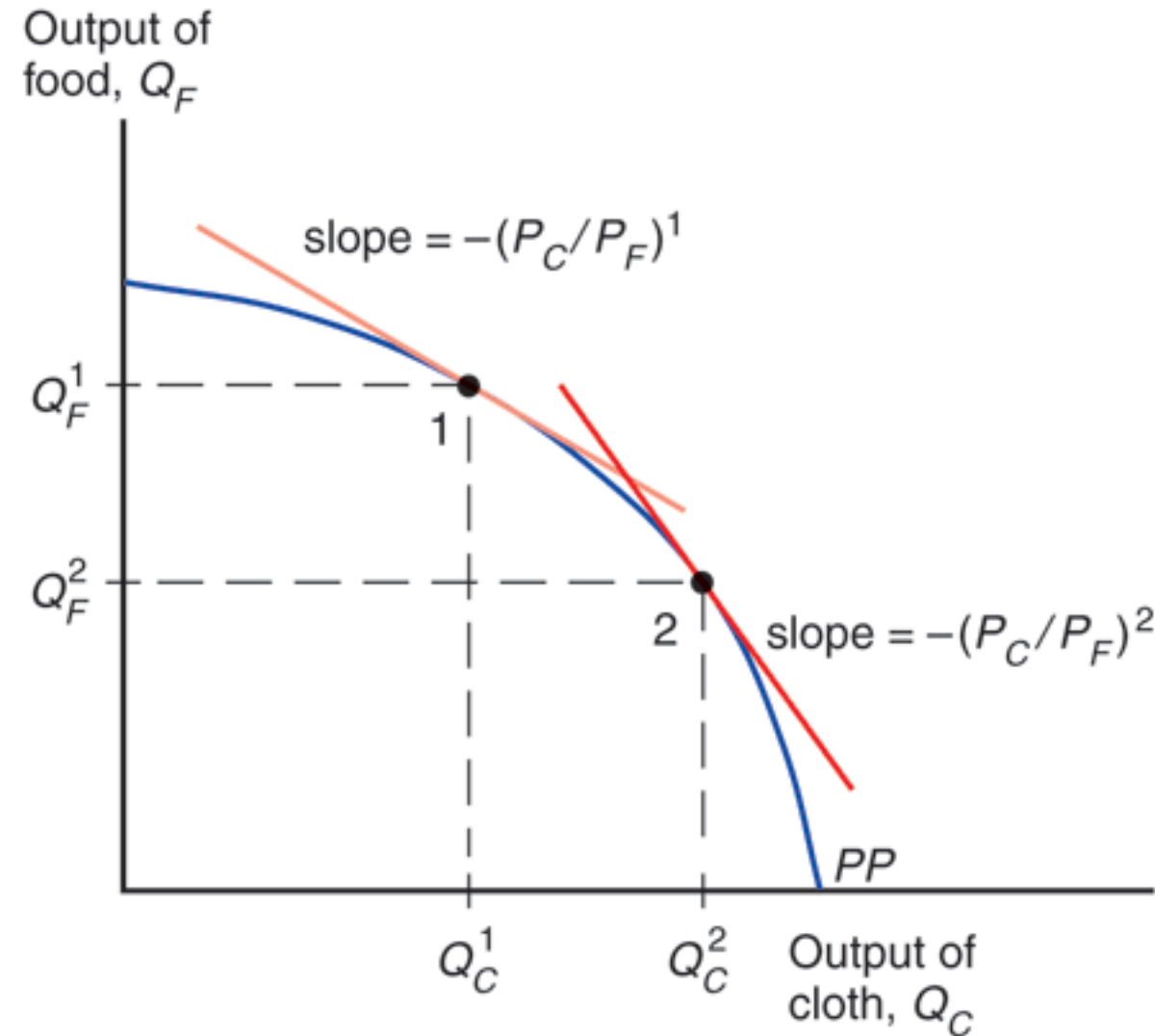
# Fig. 4-7: A Rise in the Price of Cloth



When only  $P_C$  rises, labor shifts from the food sector to the cloth sector and the output of cloth rises while that of food falls.

The wage rate ( $w$ ) does not rise as much as  $P_C$  since cloth employment increases and thus the marginal product of labor in that sector falls.

# Fig. 4-8: The Response of Output to a Change in the Relative Price of Cloth

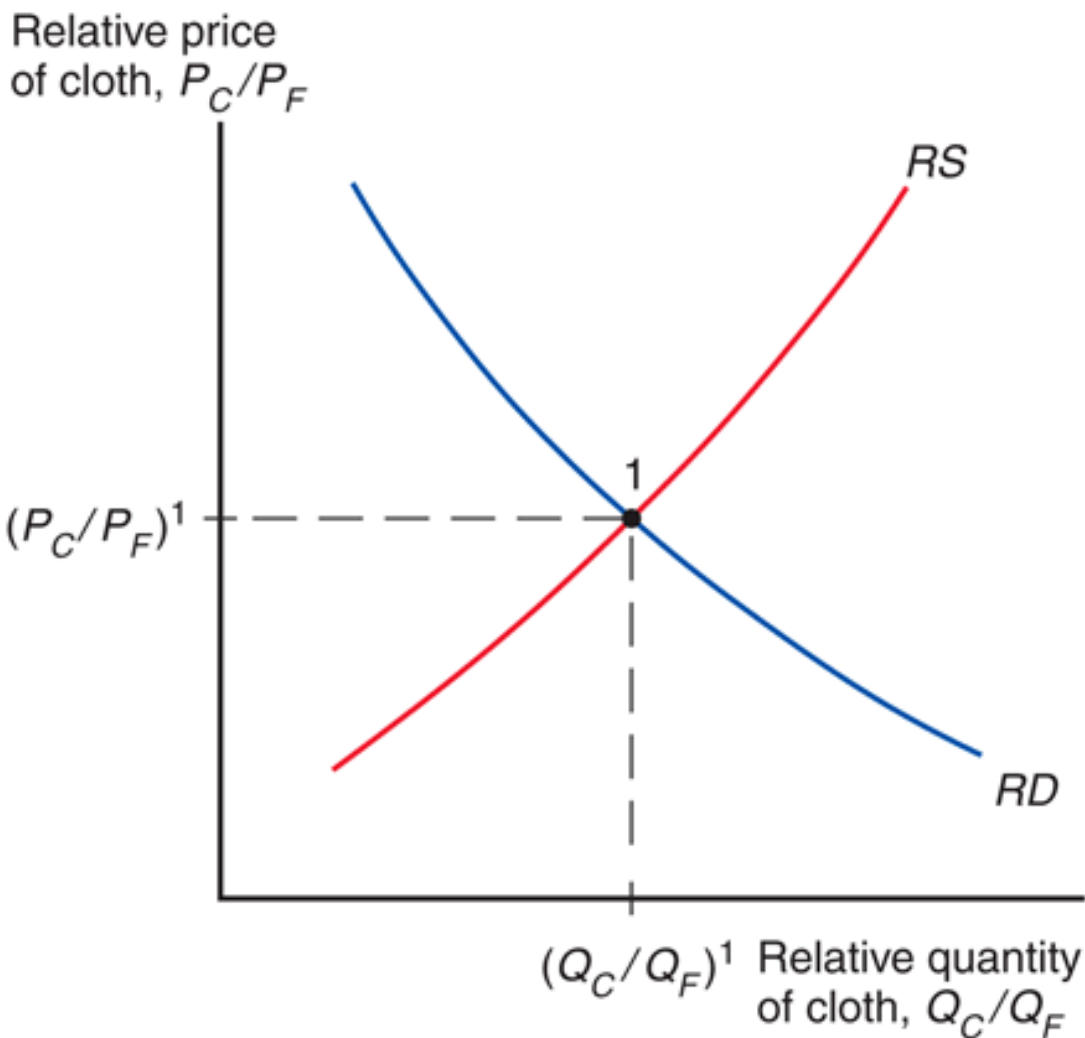


The economy always produces at the point on its PPF where the slope of PPF equals minus the relative price of cloth.

Thus, an increase in relative price of cloth causes production to move down and to the right along the PPF. It results in higher production of cloth and lower production of food.



# Fig. 4-9: Determination of Relative Prices



The previous figure shows that an increase in the relative price of cloth leads to an increase in the output of cloth relative to that of food.

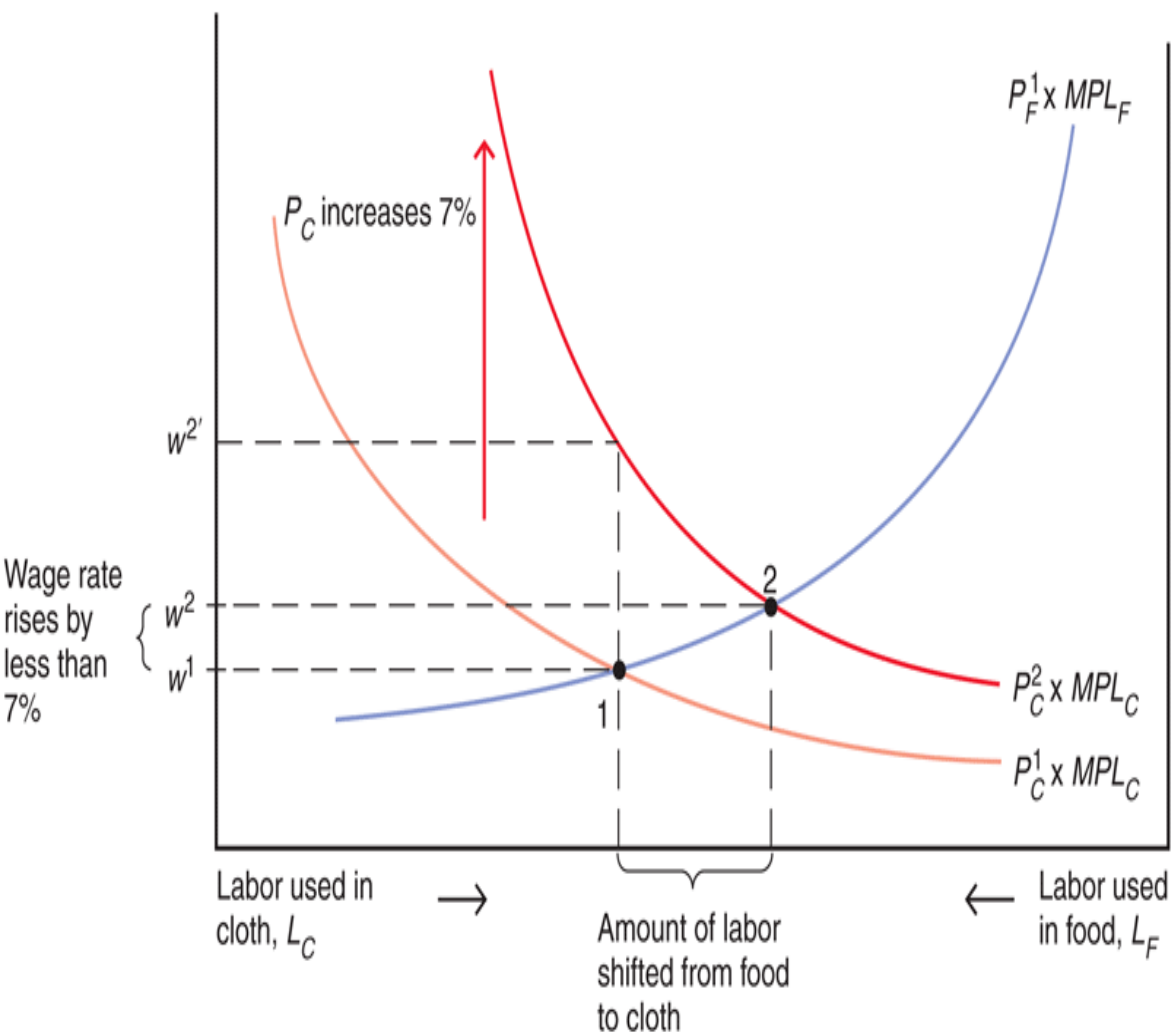
Thus, the relative supply of cloth ( $RS$ ) is upward sloping.

Equilibrium relative prices and quantities are determined by the intersection of the relative supply curve ( $RS$ ) with the relative demand curve ( $RD$ ).



# Prices, Wages, and Labor Allocation

Wage rate,  $w$



Suppose that  $P_C$  increases by 7%. Then, the wage would rise by less than 7%.

Workers: cannot say whether workers are better or worse off. It depends on the relative importance of cloth and food in workers' consumption.

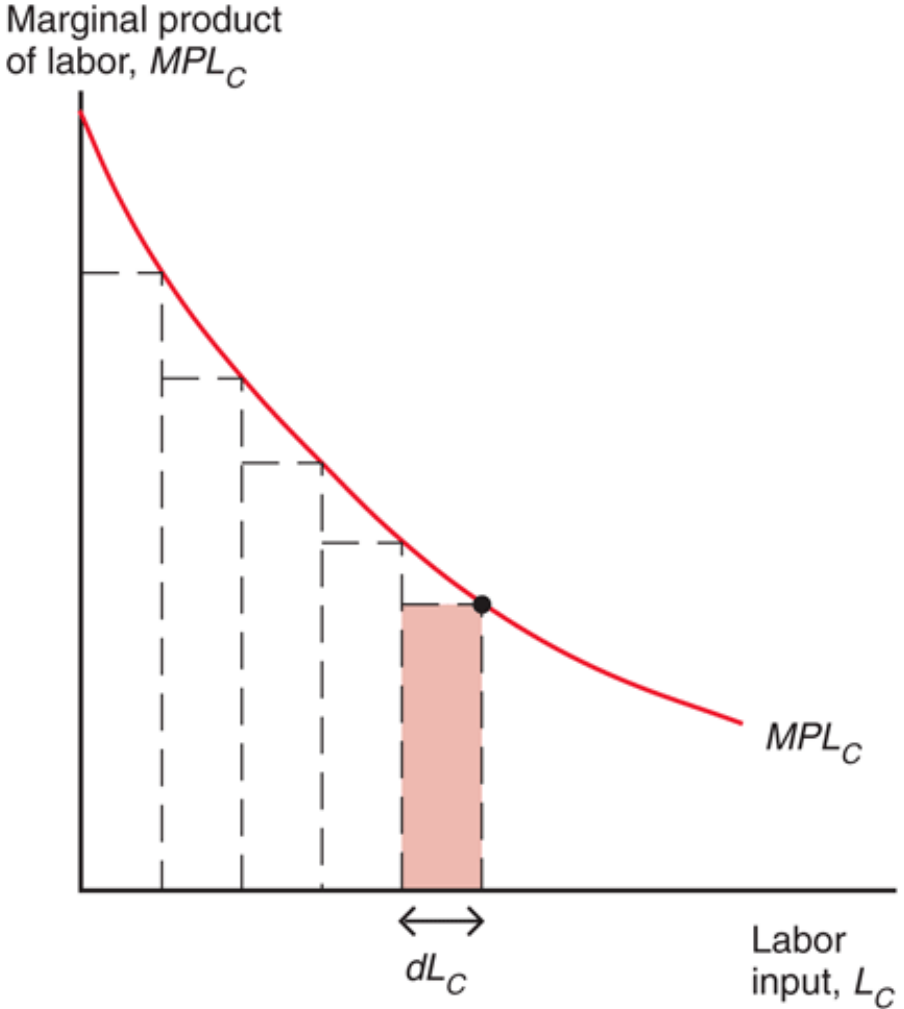
Owners of capital are definitely better off.

**Why?**

Landowners are definitely worse off. **Why?**

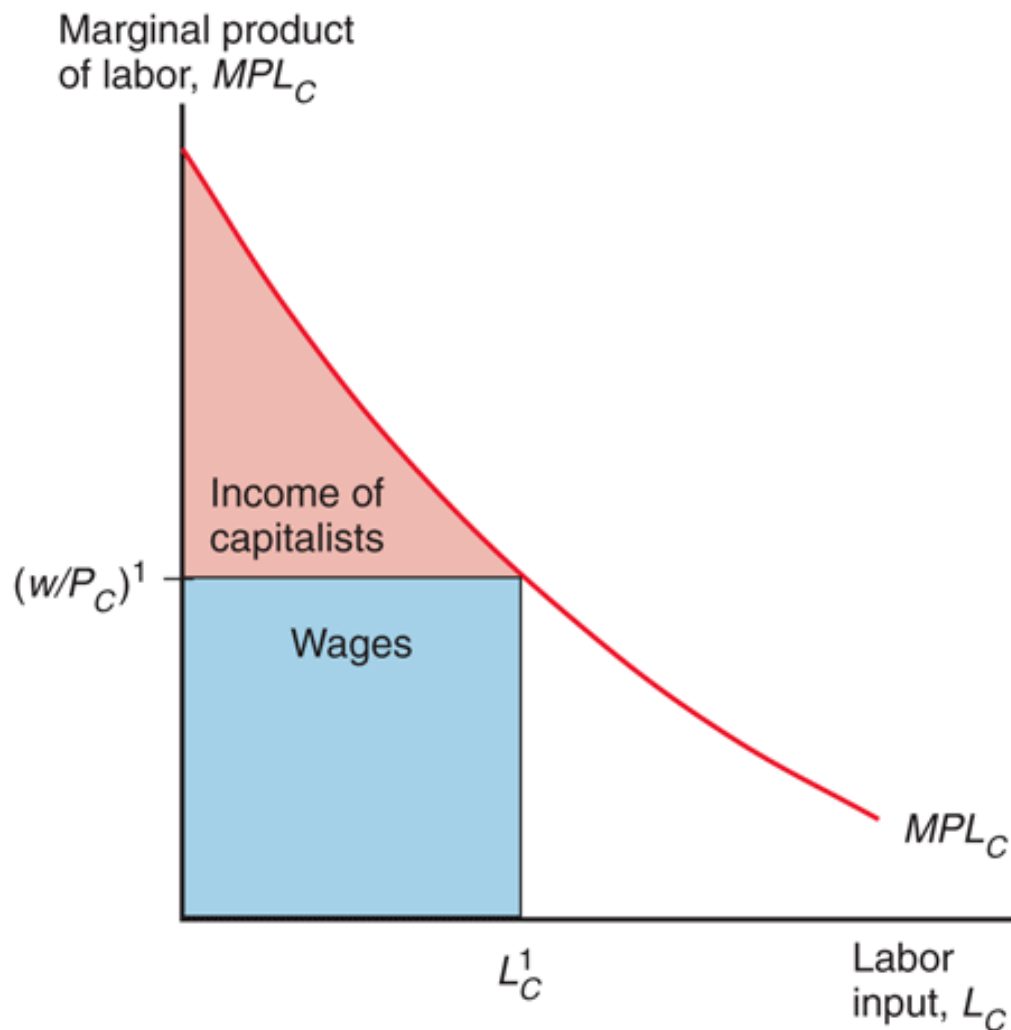


# Fig. 4A-1: Output Is Equal to the Area under the Marginal Product Curve





# Fig. 4A-2: The Distribution of Income within the Cloth Sector

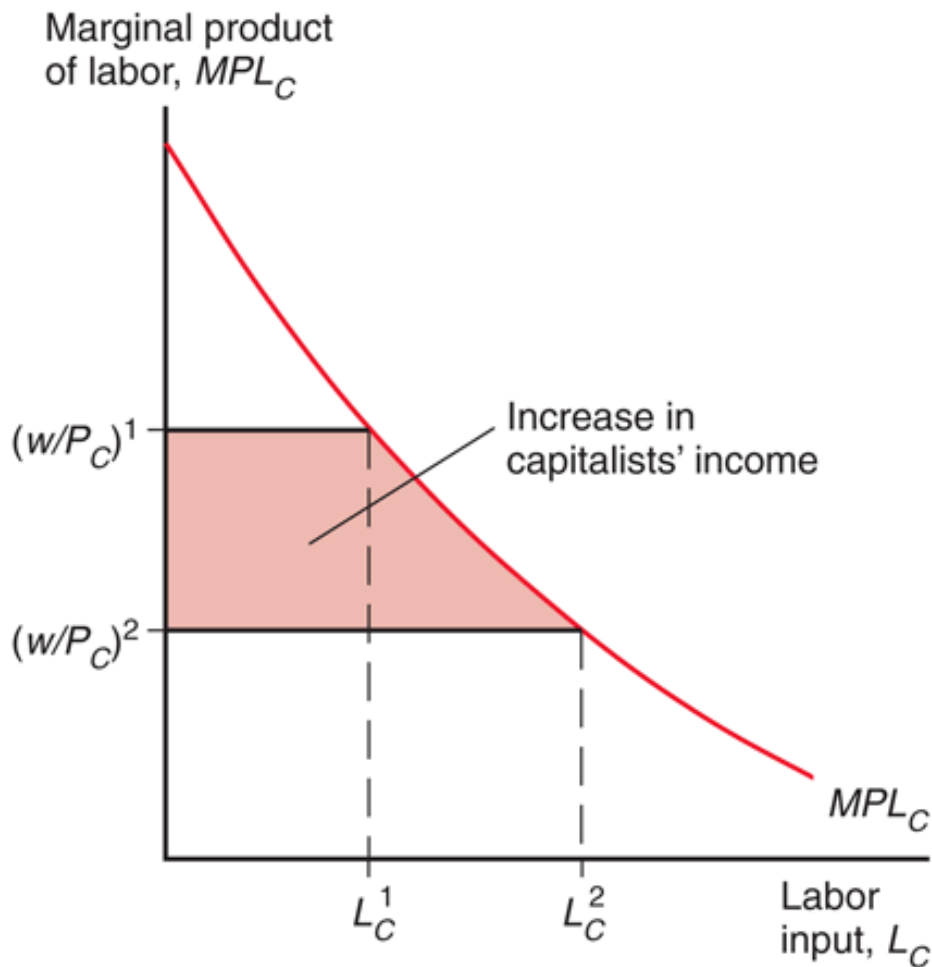


The real labor income is equal to the real wage times employment.

The rest of real output accrues as real income to the owners of capital.



# Fig. 4A-3: A Rise in $P_C$ Benefits the Owners of Capital



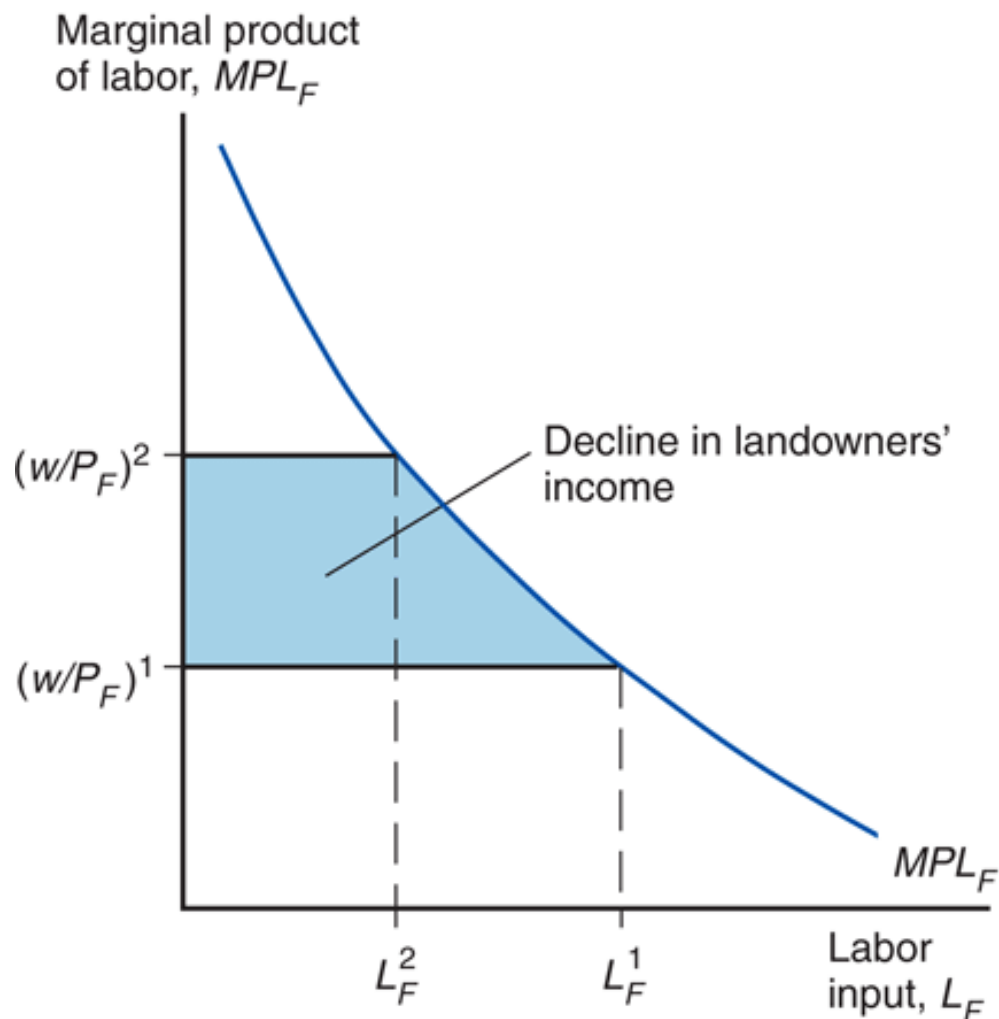
A rise in price of cloth  $P_C$  leads to less than proportional increase of wage  $w$ , so the real wage  $w/P_C$  falls.

As a result, the real income of capitalists rises.

Note, that the real income of capitalists rises not only in terms of cloth (price of which has risen), but also in terms of food (price of which has unchanged).



# Fig. 4A-4: A Rise in $P_C$ Hurts Landowners



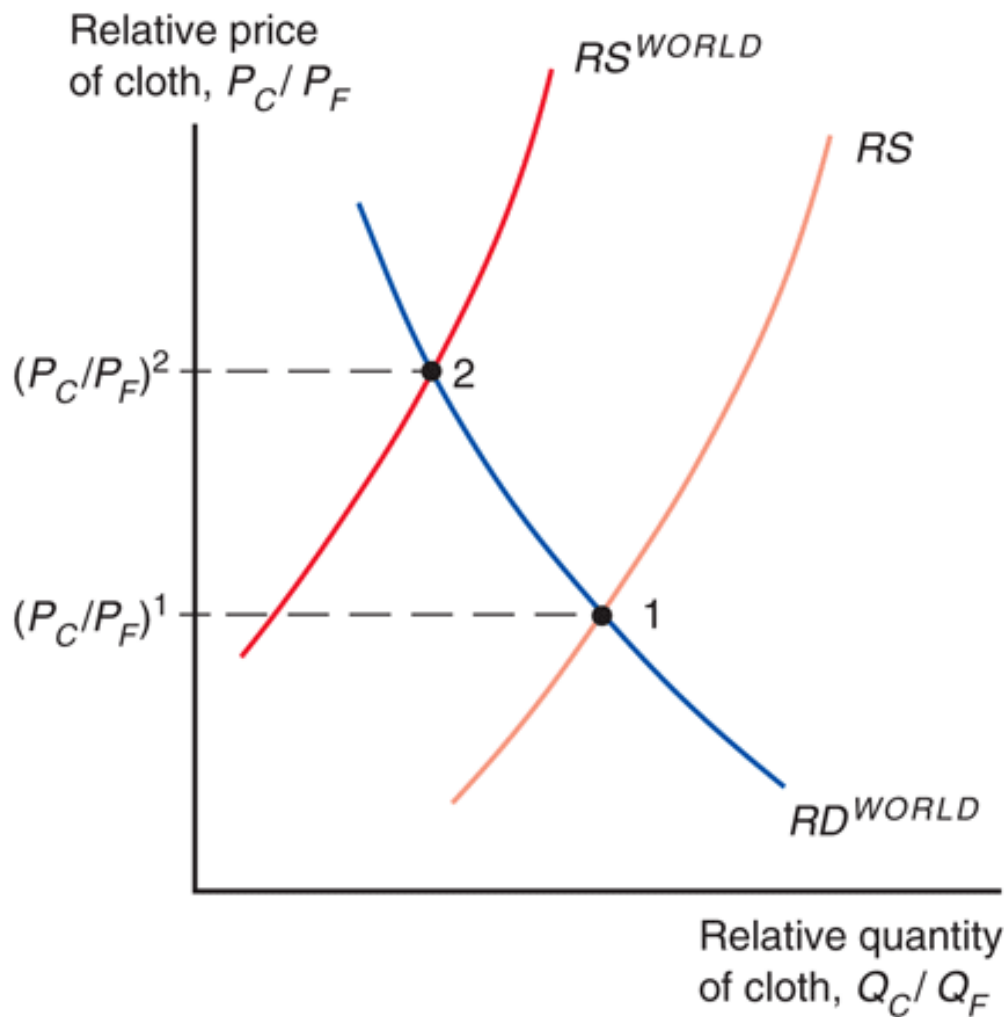
A rise in price of cloth  $P_C$  leads to an increase of wage  $w$ , so the real wage in terms of food  $w/P_F$  rises.

As a result, the real income of landowners falls.

Note, that the real income of landowners falls not only in terms of food (price of which has not changed), but also in terms of cloth (price of which has risen).



# Fig. 4-10: Trade and Relative Prices



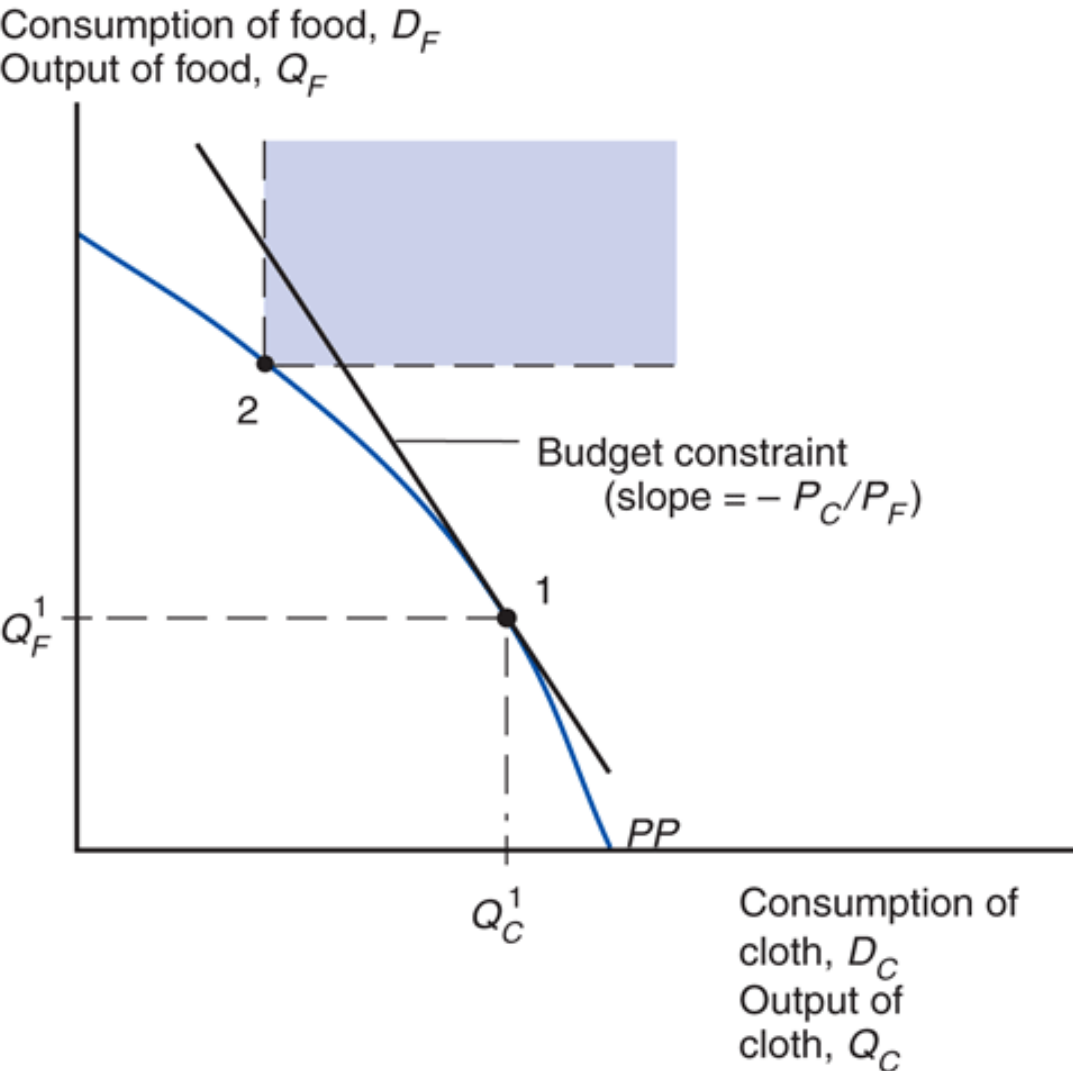
Let's assume that there are no differences in preferences of consumers, so the home relative demand is the same as the world relative demand.

The relative price of cloth prior to trade is determined by the intersection of the economy's relative supply of cloth and its relative demand.

Free trade relative price of cloth is determined by the intersection of world relative supply of cloth and world relative demand.

Opening up to trade increases the relative price of cloth in domestic economy whose relative supply of cloth is larger than for the world as a whole.

# Fig. 4-11: Budget Constraint for a Trading Economy and Gains from Trade



Without trade, the economy's output of a good must equal its consumption.

International trade allows the mix of cloth and food consumed to differ from the mix produced.

The economy is able to afford amounts of cloth and food that the country is not able to produce itself.

The budget constraint with trade lies above the production possibilities frontier.



# Income Distribution and Trade Politics

- International trade shifts the relative price of cloth to food, so factor prices change.
- Trade benefits the factor that is specific to the export sector of each country, but hurts the factor that is specific to the import-competing sectors.
- Trade has ambiguous effects on mobile factors.
- Trade benefits a country by expanding choices.
  - Possible to redistribute income so that everyone is better off.
  - Those who gain from trade could compensate those who lose and still be better off themselves.
  - That everyone could gain from trade does not mean that they actually do – redistribution is usually hard to implement.



# Income Distribution and Trade Politics

- Trade often produces losers as well as winners.
- Optimal trade policy must weigh one group's gain against another's loss.
  - Some groups may need special treatment because they are already relatively poor (e.g., shoe and garment workers in USA).
- Most economists strongly favor free trade.
- Typically, those who gain from trade are a much less concentrated and organized group than those who lose.
  - Example: Consumers and producers in the U.S. sugar industry
- Governments usually provide a “safety net” of income support to cushion the losses to groups hurt by trade (or other changes).



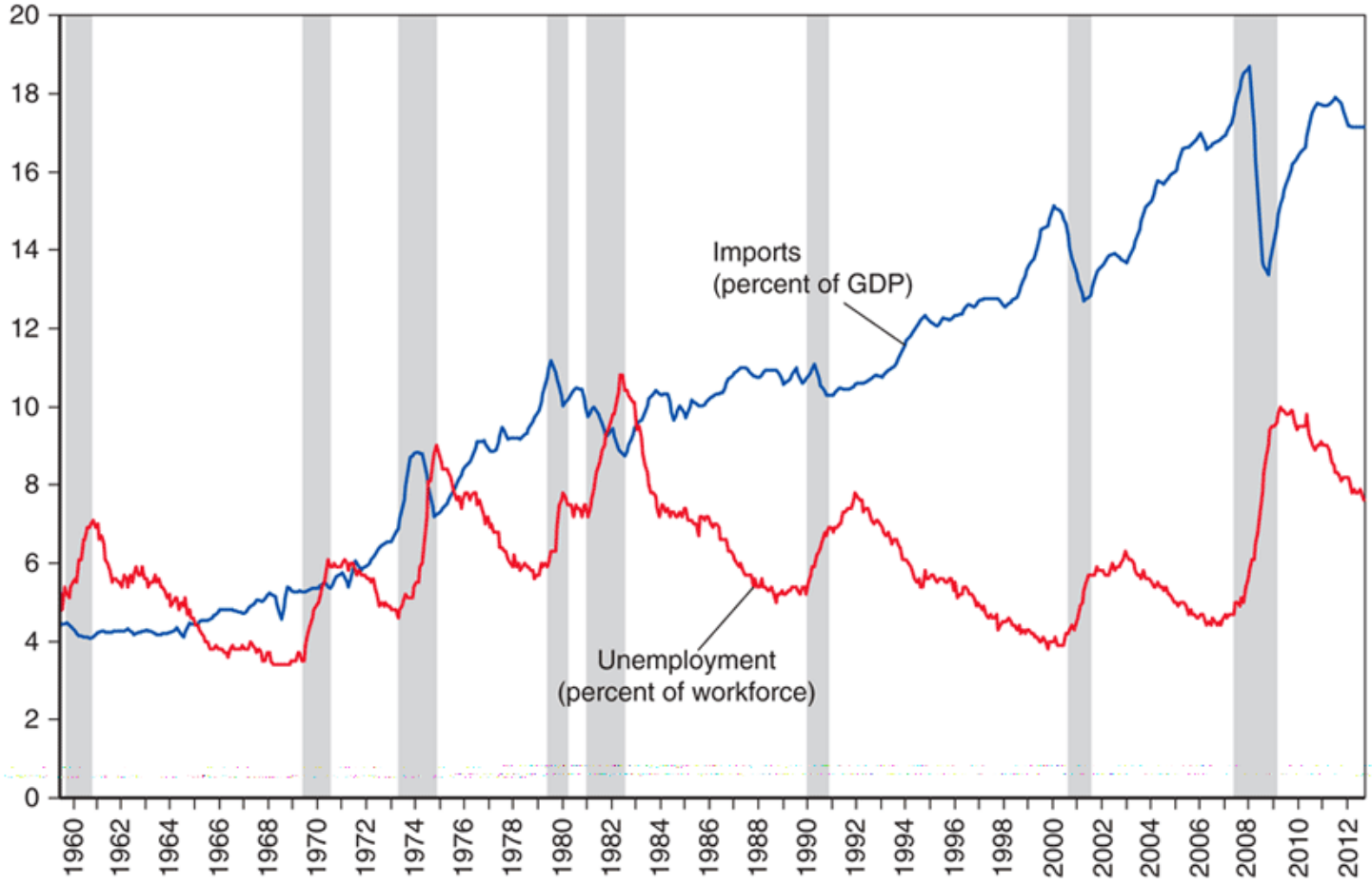
# Trade and Unemployment

- Trade shifts jobs from import-competing sectors to export sectors.
  - Process not instantaneous – some workers will be unemployed as they look for new jobs.
- How much unemployment can be traced back to trade?
  - From 2001 to 2010, only about 2% of involuntary displacements stemmed from import competition or plants moved overseas.
- Figure 4-12 shows that there is no obvious correlation between unemployment rate and openness to trade.
  - Unemployment is primarily a macroeconomic problem that rises during recessions. The best way to reduce unemployment is by adopting macroeconomic policies to help the economy recover, not by adopting trade protection.



# Fig. 4-12: Unemployment and Import Penetration in the United States

MyEconLab Real-time data



Source: U.S. Bureau of Economic Analysis for imports and U.S. Bureau of Labor Studies for unemployment.



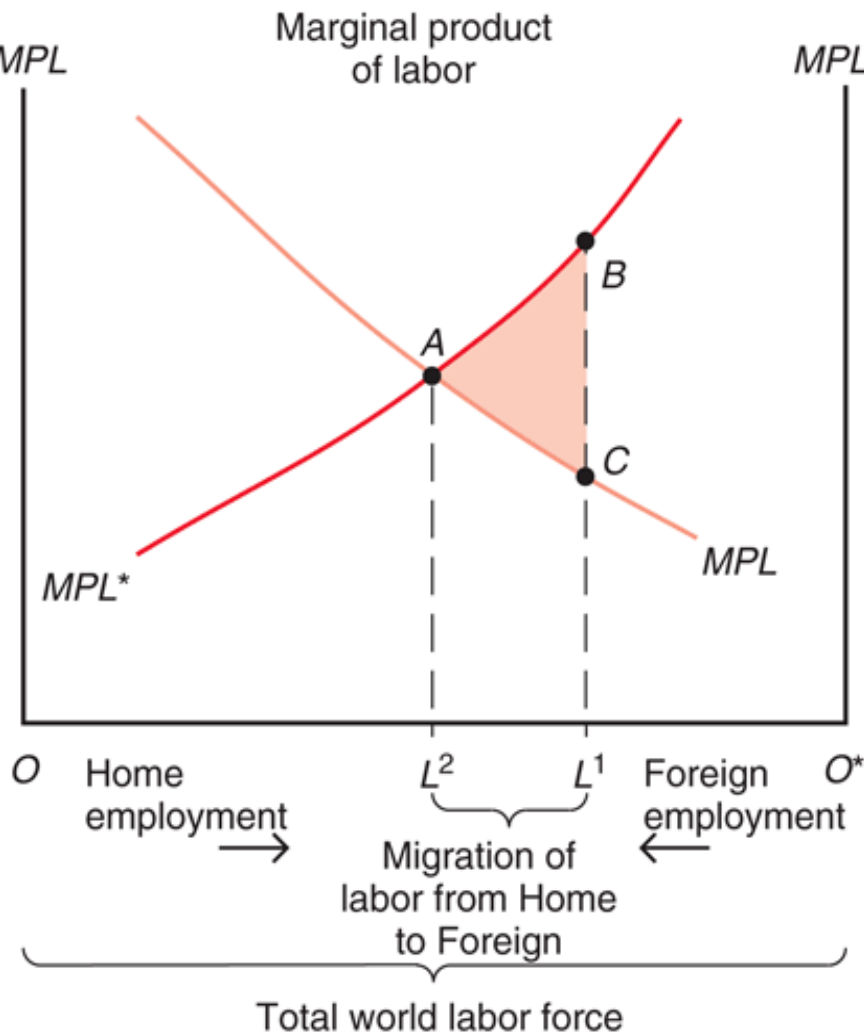


# International Labor Mobility

- Like trade with goods, movements of factors of production are politically sensitive and are often restricted.
- Why does labor migrate and what effects does it cause?
- Workers migrate to wherever wages are highest.
- Suppose two countries produce one non-traded good (food) using two factors of production:
  - Land cannot move across countries but labor can.



# Fig. 4-13: Causes and Effects of International Labor Mobility



Start with  $OL^1$  workers in Home earning a lower real wage (point C) than the  $L^1O^*$  workers in Foreign (point B). **Why?**

Workers in the home country want to migrate to the foreign country where they can earn more.

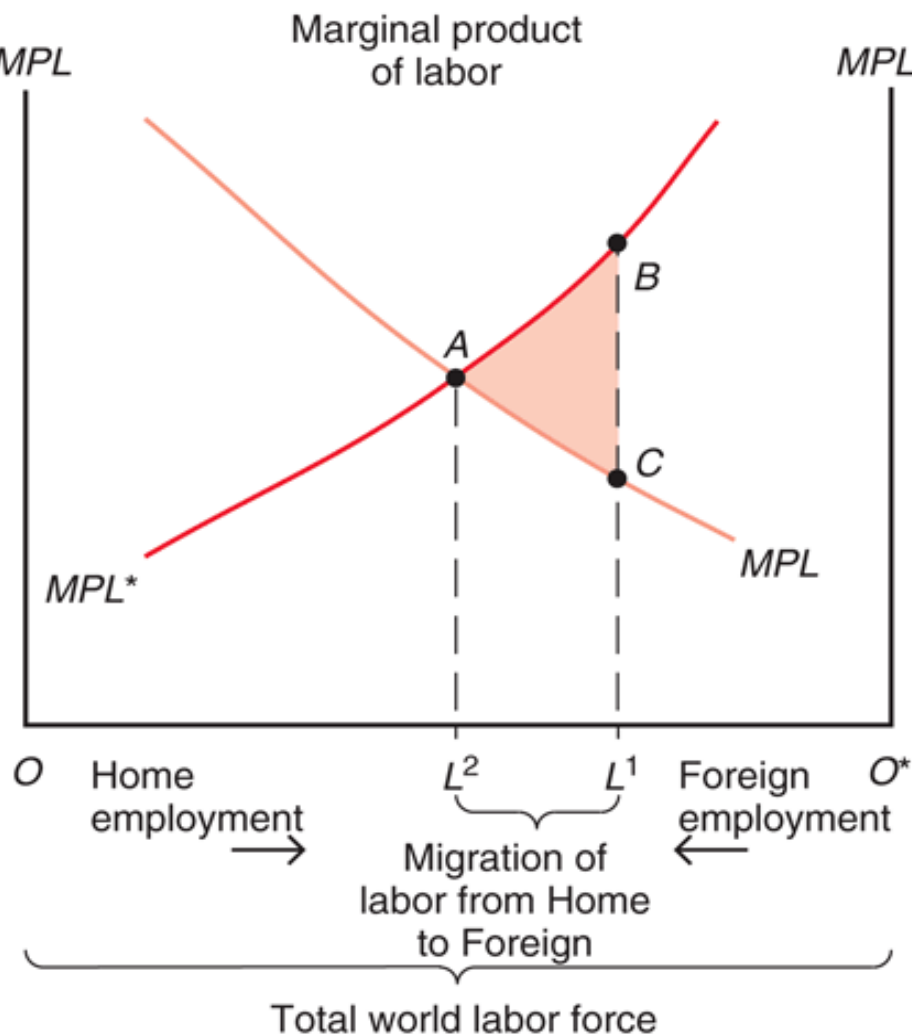
If no obstacles to labor migration exist, workers move from Home to Foreign until the purchasing power of wages is equal across countries (point A), with  $OL^2$  workers in Home and  $L^2O^*$  workers in Foreign.

Emigration from Home decreases the supply of labor and raises real wage of the workers who remain there.

Immigration into Foreign increases the supply of labor and decreases the real wage there.



# Fig. 4-13: Causes and Effects of International Labor Mobility



Labor migration increases world output.

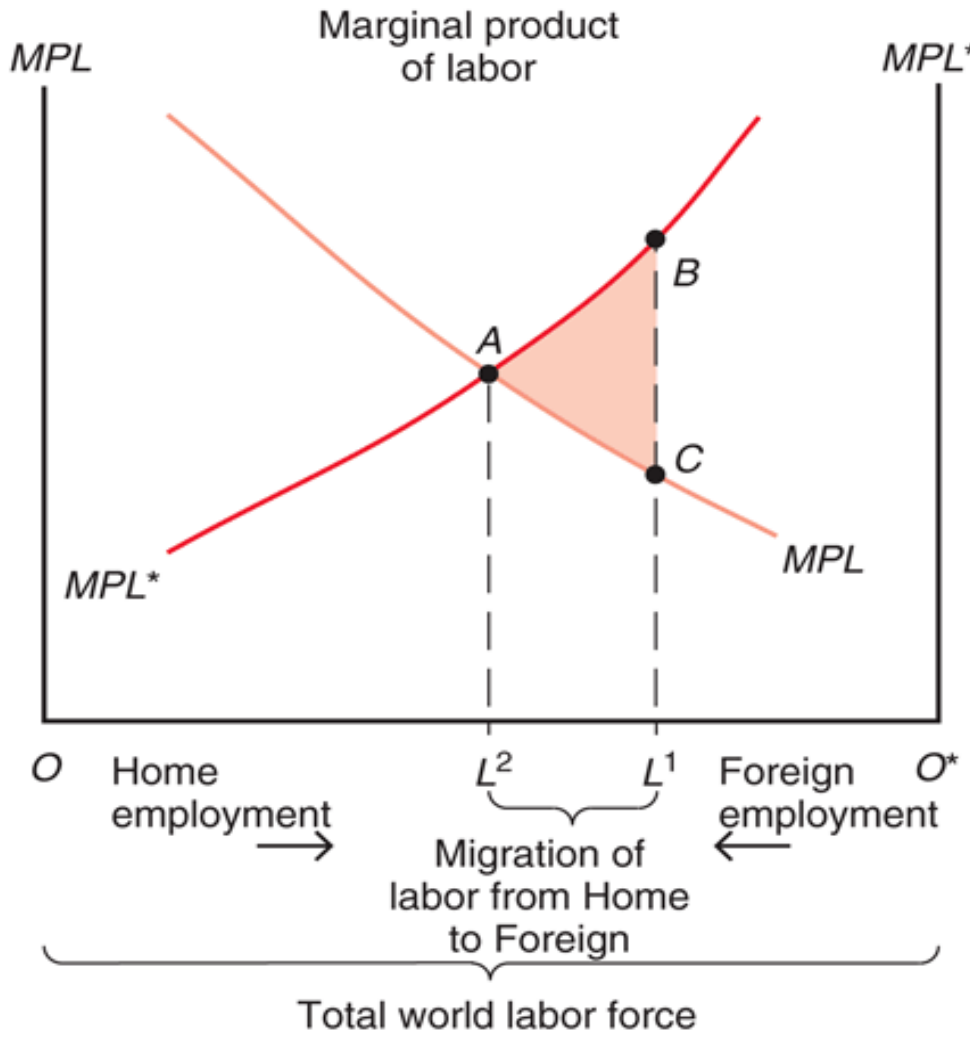
The value of foreign output rises by the area under its  $MPL^*$  curve from  $L^1$  to  $L^2$

The value of domestic output falls by the area under its  $MPL$  curve from  $L^2$  to  $L^1$

World output rises because labor moves to where it is more productive (where wages are higher).

The value of world output is maximized when the marginal productivity of labor is the same across countries.

# Fig. 4-13: Causes and Effects of International Labor Mobility



Workers initially in Home benefit while workers in Foreign are hurt by inflows of other workers.

Landowners in Foreign gain from the inflow of workers decreasing real wages and increasing output.

Landowners in Home are hurt by the outflow of workers increasing real wages and decreasing output.



# International Labor Mobility

- Does migration lead to the wage changes predicted?
  - Wages do not actually equalize, due to barriers to migration such as policies restricting immigration and natural reluctance to move.
- Is there at least tendency to their equalization?
- Table 4-1 shows that real wages in 1870 were much higher in destination countries than in origin countries.
- Up until the eve of World War I in 1913, wages rose faster in origin countries than in destination countries (except Canada).
- Migration moved the world toward more equalized wages.



# Tab. 4-1

	Real Wage, 1870 (U.S. = 100)	Percentage Increase in Real Wage, 1870–1913
<b>Destination Countries</b>		
Argentina	53	51
Australia	110	1
Canada	86	121
United States	100	47
<b>Origin Countries</b>		
Ireland	43	84
Italy	23	112
Norway	24	193
Sweden	24	250

**Source:** Jeffrey G. Williamson, “The Evolution of Global Labor Markets Since 1830: Background Evidence and Hypotheses,” *Explorations in Economic History* 32 (1995), pp. 141–196.



# Summary

1. International trade often has strong effects on the distribution of income within countries - produces losers as well as winners.
2. Income distribution effects arise for two reasons:
  - Factors of production cannot move costlessly and quickly from one industry to another.
  - Changes in an economy's output mix have differential effects on the demand for different factors of production.



# Summary

3. International trade affects the distribution of income in the specific factors model.
  - Factors specific to export sectors in each country gain from trade, while factors specific to import-competing sectors lose.
  - Mobile factors that can work in either sector may either gain or lose.
4. Trade nonetheless produces overall gains in the sense that those who gain could in principle compensate those who lose while still remaining better off than before.
5. Most economists would prefer to address the problem of income distribution directly, rather than by restricting trade.





# Summary

6. Those hurt by trade are often better organized than those who gain, causing trade restrictions to be adopted.
7. Labor migrates to countries with higher labor productivity and higher real wages, where labor is scarce.
  - Real wages fall due to immigration and rise due to emigration.
  - World output increases.
  - Real wages across countries are far from equal due to differences in technology and due to immigration barriers.