CHAPTER 4

Specific Factors and Income Distribution

As we saw in Chapter 3, international trade can be mutually beneficial to the nations engaged in it. Yet throughout history, governments have protected sectors of the economy from import competition. For example, despite its commitment in principle to free trade, the United States limits imports of textiles, sugar, steel, and other commodities. If trade is such a good thing for the economy, why is there opposition to its effects? To understand the politics of trade, it is necessary to look at the effects of trade not just on a country as a whole, but on the distribution of income within that country.

The Ricardian model of international trade developed in Chapter 3 illustrates the potential benefits from trade. In that model, trade leads to international specialization, with each country shifting its labor force from industries in which that labor is relatively inefficient to industries in which it is relatively more efficient. Because labor is the only factor of production in that model, and it is assumed that labor can move freely from one industry to another, there is no possibility that individuals will be hurt by trade. The Ricardian model thus suggests not only that all *countries* gain from trade, but also that every *individual* is made better off as a result of international trade, because trade does not affect the distribution of income. In the real world, however, trade has substantial effects on the income distribution within each trading nation, so that in practice the benefits of trade are often distributed very unevenly.

There are two main reasons why international trade has strong effects on the distribution of income. First, resources cannot move immediately or without cost from one industry to another—a short-run consequence of trade. Second, industries differ in the factors of production they demand. A shift in the mix of goods that a country produces will ordinarily reduce the demand for some factors of production, while raising the demand for others—a long-run consequence of trade. For both of these reasons, international trade is not as unambiguously beneficial as it appeared to be in Chapter 3. While trade may benefit a nation as a whole, it often hurts significant groups within the country in the short run, and potentially, but to a lesser extent, in the long run.

Consider the effects of Japan's rice policy. Japan allows very little rice to be imported, even though the scarcity of land means that rice is much more expensive to produce in Japan than in other countries (including the United States). There is little question that Japan as a whole would have a higher standard of living if free imports of rice were allowed. Japanese rice farmers, however, would be hurt by free trade. While the farmers displaced by imports could probably find jobs in manufacturing or services, they would find changing employment costly and inconvenient: The special skills they developed for rice farming would be useless in those other jobs. Furthermore, the value of the land that the farmers own would fall along with the price of rice. Not surprisingly, Japanese rice farmers are vehemently opposed to free trade in rice, and their organized political opposition has counted for more than the potential gains from trade for the nation as a whole.

A realistic analysis of trade must go beyond the Ricardian model to models in which trade can affect income distribution. In this chapter, we focus on the short-run consequences of trade on the income distribution when factors of production cannot move without cost between sectors. To keep our model simple, we assume that the sector-switching cost for some factors is high enough that such a switch is impossible in the short run. Those factors are *specific* to a particular sector.

LEARNING GOALS

After reading this chapter, you will be able to:

- Understand how a mobile factor will respond to price changes by moving across sectors.
- Explain why trade will generate both winners and losers in the short run.
- Understand the meaning of gains from trade when there are losers.
- Discuss the reasons why trade is a politically contentious issue.
- Explain the arguments in favor of free trade despite the existence of losers.

The Specific Factors Model

The **specific factors model** was developed by Paul Samuelson and Ronald Jones.[1] Like the simple Ricardian model, it assumes an economy that produces two goods and that can allocate its labor supply between the two sectors. Unlike the Ricardian model, however, the specific factors model allows for the existence of factors of production besides labor. Whereas labor is a **mobile factor** that can move between sectors, these other factors are assumed to be **specific**. That is, they can be used only in the production of particular goods.

[1] Paul Samuelson, "Ohlin Was Right," *Swedish Journal of Economics* 73 (1971), pp. 365–384; and Ronald W. Jones, "A Three-Factor Model in Theory, Trade, and History," in Jagdish Bhagwati et al., eds., *Trade, Balance of Payments, and Growth* (Amsterdam: North-Holland, 1971), pp. 3–21.

What Is a Specific Factor?

In the model developed in this chapter, we assume that there are two factors of production, land and capital, that are permanently tied to particular sectors of the economy. In advanced economies, however, agricultural land receives only a small part of national income. When economists apply the specific factors model to economies like those of the United States or France, they typically think of factor specificity not as a permanent condition but as a matter of time. For example, the vats used to brew beer and the stamping presses used to build auto bodies cannot be substituted for each other, and so these different kinds of equipment are industry-specific. Given time, however, it would be possible to redirect investment from auto factories to breweries or vice versa. As a result, in a long-term sense both vats and stamping presses can be considered to be two manifestations of a single, mobile factor called capital.

In practice, then, the distinction between specific and mobile factors is not a sharp line. Rather, it is a question of the speed of adjustment, with factors being more specific the longer it takes to redeploy them between industries. So how specific are the factors of production in the real economy?

Worker mobility varies greatly with the characteristics of the worker (such as age) and the job occupation (whether it requires general or job-specific skills). Nevertheless, one can measure an average rate of mobility by looking at the duration of unemployment following a worker's displacement. After four years, a displaced worker in the United States has the same probability of being employed as a similar worker who was not displaced.* This four-year time-span compares with a lifetime of 15 or 20 years for a typical specialized machine, and 30 to 50 years for structures (a shopping mall, office building, or production plant). So labor is certainly a less specific factor than most kinds of capital. However, even though most workers can find new employment in other sectors within a four-year time-span, switching occupations entails additional costs: A displaced worker who is re-employed in a different occupation suffers an 18 percent permanent drop in wages (on average). This compares with a 6 percent drop if the worker does not switch occupations.† Thus, labor is truly flexible only before a worker has invested in any occupation-specific skills.

*See Bruce Fallick, "The Industrial Mobility of Displaced Workers," *Journal of Labor Economics* 11 (April 1993), pp. 302–323.
†See Gueorgui Kambourov and Iourii Manovskii, "Occupational Specificty of Huamn Capital," *International Economic Review* 50 (February 2009), pp. 63–115.

Assumptions of the Model

Imagine an economy that can produce two goods, cloth and food. Instead of one factor of production, however, the country has *three*: labor (L), capital (K), and land (T for *terrain*). Cloth is produced using capital and labor (but not land), while food is produced using land and labor (but not capital). Labor is therefore a *mobile* factor that can be used in either sector, while land and capital are both *specific* factors that can be used only in the production of one good. Land can also be thought of as a different type of capital, one that is specific to the food sector (see box below).

How much of each good does the economy produce? The economy's output of cloth depends on how much capital and labor are used in that sector. This relationship is summarized by a **production function** that tells us the quantity of cloth that can be produced given any input of capital and labor. The production function for cloth can be summarized algebraically as

$$Q_C = Q_C(K,L_C), \tag{4-1}$$

where Q_C is the economy's output of cloth, K is the economy's capital stock, and L_C is the labor force employed in cloth. Similarly, for food we can write the production function

$$Q_F = Q_F(T,L_F), \tag{4-2}$$

where Q_F is the economy's output of food, T is the economy's supply of land, and L_F is the labor force devoted to food production. For the economy as a whole, the labor employed must equal the total labor supply L:

$$L_C + L_F = L. \tag{4-3}$$

Production Possibilities

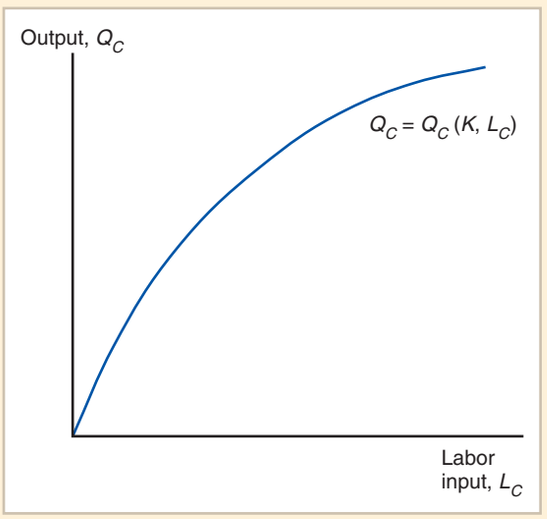
The specific factors model assumes that each of the specific factors, capital and land, can be used in only one sector, cloth and food, respectively. Only labor can be used in either sector. Thus to analyze the economy's production possibilities, we need only to ask how the economy's mix of output changes as labor is shifted from one sector to the other. This can be done graphically, first by representing the production functions (4-1) and (4-2), and then by putting them together to derive the production possibility frontier.

Figure 4-1 illustrates the relationship between labor input and output of cloth. The larger the input of labor, for a given capital supply, the larger will be output. In Figure 4-1, the slope of $Q_C(K,L_C)$ represents the **marginal product of labor,** that is, the addition to output generated by adding one more person-hour. However, if labor input is increased without increasing capital as well, there will normally be **diminishing returns:** Because adding a worker means that each worker has less capital to work with, each successive increment of labor will add less to production than the last. Diminishing returns are reflected in the shape of the production function: $Q_C(K,L_C)$ gets flatter as we move to the right, indicating that the marginal product of labor declines as more labor is used.[2]

Figure 4-1

The Production Function for Cloth

The more labor that is employed in the production of cloth, the larger the output. As a result of diminishing returns, however, each successive person-hour increases output by less than the previous one; this is shown by the fact that the curve relating labor input to output gets flatter at higher levels of employment.



[2] Diminishing returns to a single factor does not imply diminishing returns to scale when all factors of production are adjusted. Thus, diminishing returns to labor is entirely consistent with constant returns to scale in both labor and capital.

Figure 4-2

The Marginal Product of Labor

The marginal product of labor in the cloth sector, equal to the slope of the production function shown in Figure 4-1, is lower the more labor the sector employs.

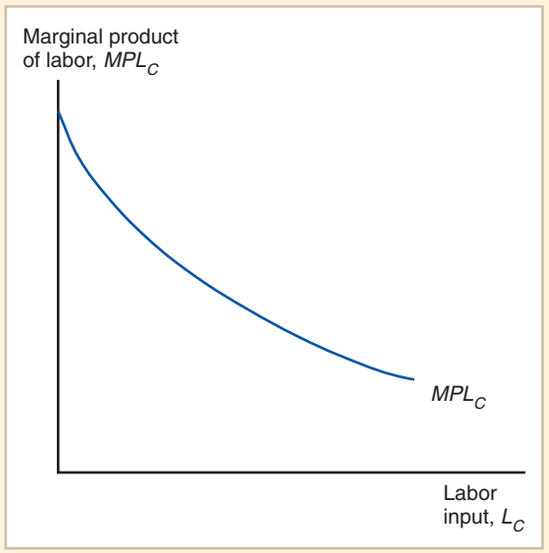


Figure 4-2 shows the same information a different way. In this figure we directly plot the marginal product of labor as a function of the labor employed. (In the appendix to this chapter, we show that the area under the marginal product curve represents the total output of cloth.)

A similar pair of diagrams can represent the production function for food. These diagrams can then be combined to derive the production possibility frontier for the economy, as illustrated in Figure 4-3. As we saw in Chapter 3, the production possibility frontier shows what the economy is capable of producing; in this case it shows how much food it can produce for any given output of cloth and vice versa.

Figure 4-3 is a four-quadrant diagram. In the lower right quadrant we show the production function for cloth illustrated in Figure 4-1. This time, however, we turn the figure on its side: A movement downward along the vertical axis represents an increase in the labor input to the cloth sector, while a movement to the right along the horizontal axis represents an increase in the output of cloth. In the upper left quadrant we show the corresponding production function for food; this part of the figure is also flipped around, so that a movement to the left along the horizontal axis indicates an increase in labor input to the food sector, while an upward movement along the vertical axis indicates an increase in food output.

The lower left quadrant represents the economy's allocation of labor. Both quantities are measured in the reverse of the usual direction. A downward movement along the vertical axis indicates an increase in the labor employed in cloth; a leftward movement along the horizontal axis indicates an increase in labor employed in food. Since an increase in employment in one sector must mean that less labor is available for the other, the possible allocations are indicated by a downward-sloping line. This line, labeled *AA*, slopes downward at a 45-degree angle, that is, it has a slope of -1. To see why this line represents the possible labor allocations, notice that if all labor were employed in food production, L_F would equal L, while L_C would equal 0. If one were then to move labor gradually into the cloth sector, each person-hour moved would increase L_C by one unit while reducing L_F by one unit, tracing a line with a slope

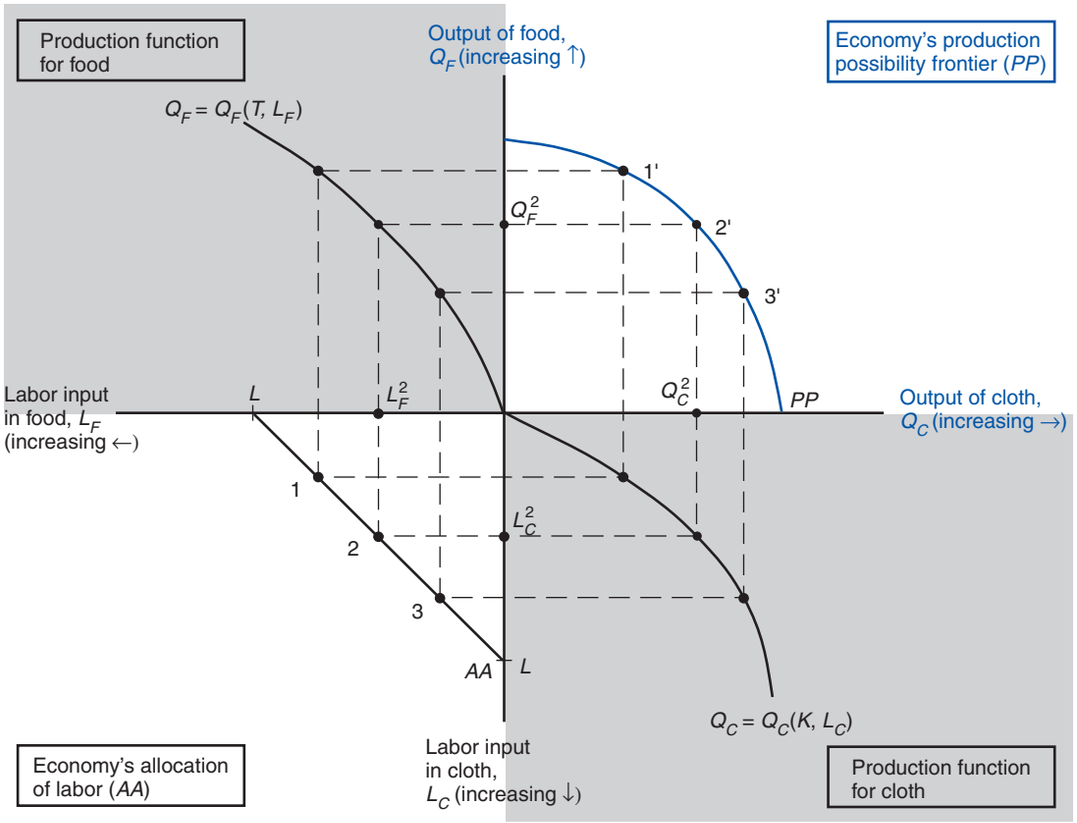


Figure 4-3

The Production Possibility Frontier in the Specific Factors Model

Production of cloth and food is determined by the allocation of labor. In the lower left quadrant, the allocation of labor between sectors can be illustrated by a point on line *AA*, which represents all combinations of labor input to cloth and food that sum up to the total labor supply *L*. Corresponding to any particular point on *AA*, such as point 2, is a labor input to cloth (L_C^2) and a labor input to food (L_F^2). The curves in the lower right and upper left quadrants represent the production functions for cloth and food, respectively; these allow determination of output (Q_C^2, Q_F^2) given labor input. Then in the upper right quadrant, the curve *PP* shows how the output of the two goods varies as the allocation of labor is shifted from food to cloth, with the output points 1′, 2′, 3′ corresponding to the labor allocations 1, 2, 3. Because of diminishing returns, *PP* is a bowed-out curve instead of a straight line.

of -1, until the entire labor supply L is employed in the cloth sector. Any particular allocation of labor between the two sectors can then be represented by a point on *AA*, such as point 2.

We can now see how to determine production given any particular allocation of labor between the two sectors. Suppose that the allocation of labor were represented by point 2 in the lower left quadrant, that is, with L_C^2 hours in cloth and L_F^2 hours in food. Then we can use the production function for each sector to determine output: Q_C^2 units of cloth, Q_F^2 units of food. Using coordinates Q_C^2, Q_F^2, point 2′ in the upper right quadrant of Figure 4-3 shows the resulting outputs of cloth and food.

To trace the whole production possibility frontier, we simply imagine repeating this exercise for many alternative allocations of labor. We might start with most of the labor allocated to food production, as at point 1 in the lower left quadrant, then gradually increase the amount of labor used in cloth until very few workers are employed in food, as at point 3; the corresponding points in the upper right quadrant will trace out the curve running from 1′ to 3′. Thus *PP* in the upper right quadrant shows the economy's production possibilities for given supplies of land, labor, and capital.

In the Ricardian model, where labor is the only factor of production, the production possibility frontier is a straight line because the opportunity cost of cloth in terms of food is constant. In the specific factors model, however, the addition of other factors of production changes the shape of the production possibility frontier *PP* to a curve. The curvature of *PP* reflects diminishing returns to labor in each sector; these diminishing returns are the crucial difference between the specific factors and the Ricardian models.

Notice that when tracing *PP* we shift labor from the food to the cloth sector. If we shift one person-hour of labor from food to cloth, however, this extra input will increase output in that sector by the marginal product of labor in cloth, MPL_C. To increase cloth output by one unit, then, we must increase labor input by $1/MPL_C$ hours. Meanwhile, each unit of labor input shifted out of food production will lower output in that sector by the marginal product of labor in food, MPL_F. To increase output of cloth by one unit, then, the economy must reduce output of food by MPL_F/MPL_C units. The slope of *PP*, which measures the opportunity cost of cloth in terms of food—that is, the number of units of food output that must be sacrificed to increase cloth output by one unit—is therefore

$$\text{Slope of production possibilities curve} = -MPL_F/MPL_C.$$

We can now see why *PP* has the bowed shape it does. As we move from 1′ to 3′, L_C rises and L_F falls. We saw in Figure 4-2, however, that as L_C rises, the marginal product of labor in cloth falls; correspondingly, as L_F falls, the marginal product of labor in food rises. As more and more labor is moved to the cloth sector, each additional unit of labor becomes less valuable in the cloth sector and more valuable in the food sector: The opportunity cost (foregone food production) of each additional cloth unit rises, and *PP* thus gets steeper as we move down it to the right.

We have now shown how output is determined, given the allocation of labor. The next step is to ask how a market economy determines what the allocation of labor should be.

Prices, Wages, and Labor Allocation

How much labor will be employed in each sector? To answer this we need to look at supply and demand in the labor market. The demand for labor in each sector depends on the price of output and the wage rate. In turn, the wage rate depends on the combined demand for labor by food and cloth producers. Given the prices of cloth and food together with the wage rate, we can determine each sector's employment and output.

First, let us focus on the demand for labor. In each sector, profit-maximizing employers will demand labor up to the point where the value produced by an additional person-hour equals the cost of employing that hour. In the cloth sector, for example, the value of an additional person-hour is the marginal product of labor in cloth multiplied by the price of one unit of cloth: $MPL_C \times P_C$. If w is the wage rate of labor, employers will therefore hire workers up to the point where

$$MPL_C \times P_C = w. \tag{4-4}$$

But the marginal product of labor in cloth, already illustrated in Figure 4-2, slopes downward because of diminishing returns. So for any given price of cloth P_C, the value of that marginal product, $MPL_C \times P_C$, will also slope down. We can therefore think of equation (4-4) as defining the demand curve for labor in the cloth sector: If the wage rate falls, other things equal, employers in the cloth sector will want to hire more workers.

Similarly, the value of an additional person-hour in food is $MPL_F \times P_F$. The demand curve for labor in the food sector may therefore be written

$$MPL_F \times P_F = w. \tag{4-5}$$

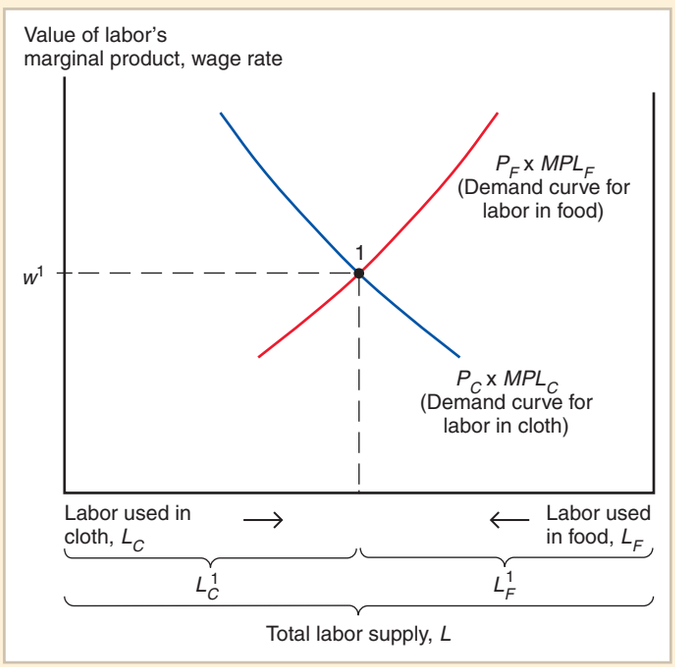
The wage rate w must be the same in both sectors, because of the assumption that labor is freely mobile between sectors. That is, because labor is a mobile factor, it will move from the low-wage sector to the high-wage sector until wages are equalized. The wage rate, in turn, is determined by the requirement that total labor demand (total employment) equals total labor supply. This equilibrium condition for labor is represented in equation (4-3).

By representing these two labor demand curves in a diagram (Figure 4-4), we can see how the wage rate and employment in each sector are determined given the prices of food and cloth. Along the horizontal axis of Figure 4-4 we show the total labor supply L. Measuring from the left of the diagram, we show the value of the marginal product of labor in cloth, which is simply the MPL_C curve from Figure 4-2 multiplied by P_C. This is the demand curve for labor in the cloth sector. Measuring from the right, we show the value of the marginal product of labor in food, which is the demand for labor in food. The equilibrium wage rate and allocation of labor between the two sectors is represented by point 1. At the wage rate w^1, the sum of labor demanded in the cloth (L_C^1) and food (L_F^1) sectors just equals the total labor supply L.

Figure 4-4

The Allocation of Labor

Labor is allocated so that the value of its marginal product ($P \times MPL$) is the same in the cloth and food sectors. In equilibrium, the wage rate is equal to the value of labor's marginal product.



There is a useful relationship between relative prices and output that emerges clearly from this analysis of labor allocation; this relationship applies to more general situations than that described by the specific factors model. Equations (4-4) and (4-5) imply that

$$MPL_C \times P_C = MPL_F \times P_F = w$$

or, rearranging, that

$$-MPL_F/MPL_C = -P_C/P_F. \tag{4-6}$$

The left side of equation (4-7) is the slope of the production possibility frontier at the actual production point; the right side is minus the relative price of cloth. This result tells us that *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.* As we will see in the following chapters, this is a very general result that characterizes production responses to changes in relative prices along a production possibility frontier. It is illustrated in Figure 4-5: If the relative price of cloth is $(P_C/P_F)^1$, the economy produces at point 1.

What happens to the allocation of labor and the distribution of income when the prices of food and cloth change? Notice that any price change can be broken into two parts: an equal-proportional change in both P_C and P_F, and a change in only one price. For example, suppose that the price of cloth rises 17 percent and the price of food rises 10 percent. We can analyze the effects of this by first asking what happens if cloth and food prices both rise by 10 percent, and then by finding out what happens if only cloth prices rise by 7 percent. This allows us to separate the effect of changes in the overall price level from the effect of changes in relative prices.

An Equal-Proportional Change in Prices Figure 4-6 shows the effect of an equal-proportional increase in P_C and P_F. P_C rises from P_C^1 to P_C^2; P_F rises from P_F^1 to P_F^2. If the prices of both goods increase by 10 percent, the labor demand curves will both shift up by 10 percent as well. As you can see from the diagram, these shifts lead to a 10 percent increase in the wage rate from w^1 (point 1) to w^2 (point 2). However, the allocation of labor between the sectors and the outputs of the two goods does not change.

Figure 4-5

Production in the Specific Factors Model

The economy produces at the point on its production possibility frontier (*PP*) where the slope of that frontier equals minus the relative price of cloth.

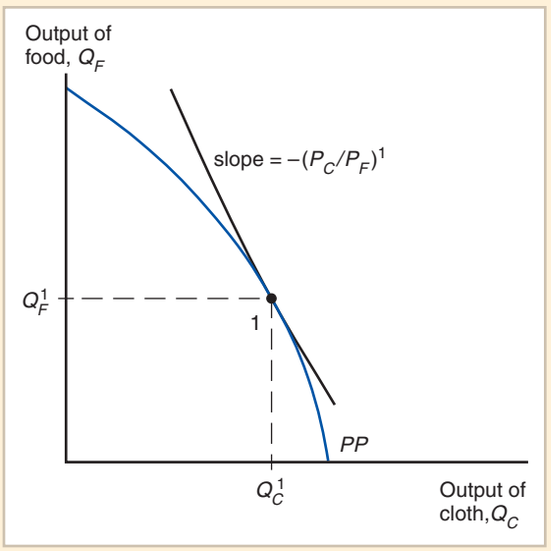
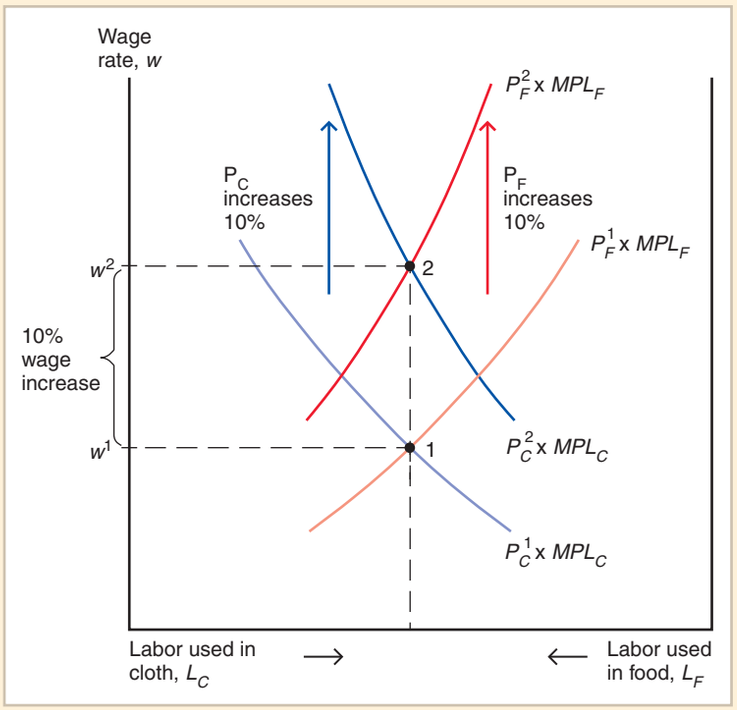


Figure 4-6

An Equal-Proportional Increase in the Prices of Cloth and Food

The labor demand curves in cloth and food both shift up in proportion to the rise in P_C from P_C^1 to P_C^2 and the rise in P_F from P_F^1 to P_F^2. The wage rate rises in the same proportion, from w^1 to w^2, but the allocation of labor between the two sectors does not change.



In fact, when P_C and P_F change in the same proportion, no real changes occur. The wage rate rises in the same proportion as the prices, so *real* wage rates, the ratios of the wage rate to the prices of goods, are unaffected. *With the same amount of labor employed in each sector, receiving the same real wage rate, the real incomes of capital owners and landowners also remain the same. So everyone is in exactly the same position as before.* This illustrates a general principle: Changes in the overall price level have no real effects, that is, do not change any physical quantities in the economy. Only changes in relative prices—which in this case means the price of cloth relative to the price of food, P_C/P_F—affect welfare or the allocation of resources.

A Change in Relative Prices Consider the effect of a price change that *does* affect relative prices. Figure 4-7 shows the effect of a change in the price of only one good, in this case a 7 percent rise in P_C from P_C^1 to P_C^2. The increase in P_C shifts the cloth labor demand curve in the same proportion as the price increase and shifts the equilibrium from point 1 to point 2. Notice two important facts about the results of this shift. First, although the wage rate rises, it rises by *less* than the increase in the price of cloth. If wages had risen in the same proportion as the price of cloth (7 percent increase), then wages would have risen from w^1 to $w^{2'}$. Instead, wages rise by a smaller proportion, from w^1 to w^2.

Second, when only P_C rises, in contrast to a simultaneous rise in P_C and P_F, labor shifts from the food sector to the cloth sector and the output of cloth rises while that of food falls. (This is why w does not rise as much as P_C: Because cloth employment rises, the marginal product of labor in that sector falls.)

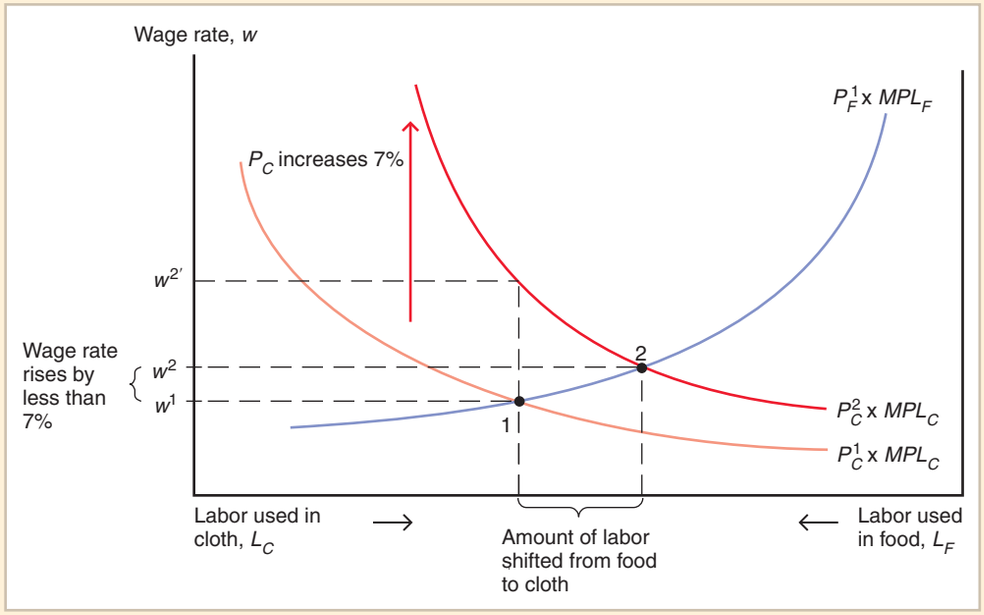


Figure 4-7

A Rise in the Price of Cloth

The cloth labor demand curve rises in proportion to the 7 percent increase in P_C, but the wage rate rises less than proportionately. Labor moves from the food sector to the cloth sector. Output of cloth rises; output of food falls.

The effect of a rise in the relative price of cloth can also be seen directly by looking at the production possibility curve. In Figure 4-8, we show the effects of the same rise in the price of cloth, which raises the *relative* price of cloth from $(P_C/P_F)^1$ to $(P_C/P_F)^2$. The production point, which is always located where the slope of *PP* equals minus the relative price, shifts from 1 to 2. Food output falls and cloth output rises as a result of the rise in the relative price of cloth.

Since higher relative prices of cloth lead to a higher output of cloth relative to that of food, we can draw a relative supply curve showing Q_C/Q_F as a function of P_C/P_F. This relative supply curve is shown as *RS* in Figure 4-9. As we showed in Chapter 3, we can also draw a relative demand curve, which is illustrated by the downward-sloping line *RD*. In the absence of international trade, the equilibrium relative price $(P_C/P_F)^1$ and output $(Q_C/Q_F)^1$ are determined by the intersection of relative supply and demand.

Relative Prices and the Distribution of Income

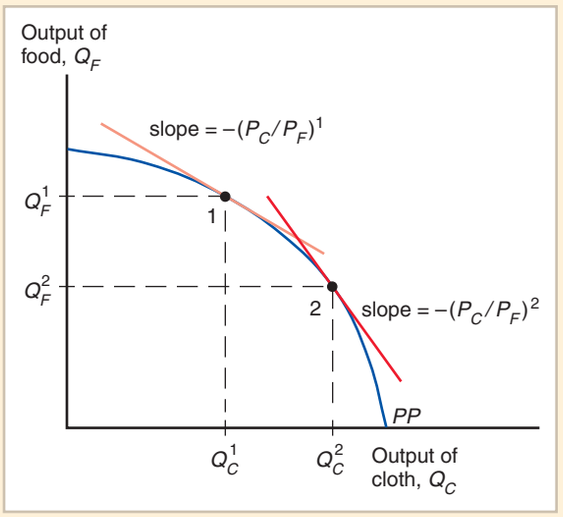
So far we have examined the following aspects of the specific factors model: (1) the determination of production possibilities given an economy's resources and technology and (2) the determination of resource allocation, production, and relative prices in a market economy. Before turning to the effects of international trade, we must consider the effect of changes in relative prices on the distribution of income.

Look again at Figure 4-7, which shows the effect of a rise in the price of cloth. We have already noted that the demand curve for labor in the cloth sector will shift upward in proportion to the rise in P_C, so that if P_C rises by 7 percent, the curve defined by $P_C \times MPL_C$ also rises by 7 percent. We have also seen that unless the price of food also rises by at least

Figure 4-8

The Response of Output to a Change in the Relative Price of Cloth

The economy always produces at the point on its production possibility frontier (*PP*) where the slope of *PP* equals minus the relative price of cloth. Thus an increase in P_C/P_F causes production to move down and to the right along the production possibility frontier corresponding to higher output of cloth and lower output of food.



7 percent, w will rise by *less* than P_C. Thus, if only cloth prices rise by 7 percent, we would expect the wage rate to rise by only, say, 3 percent.

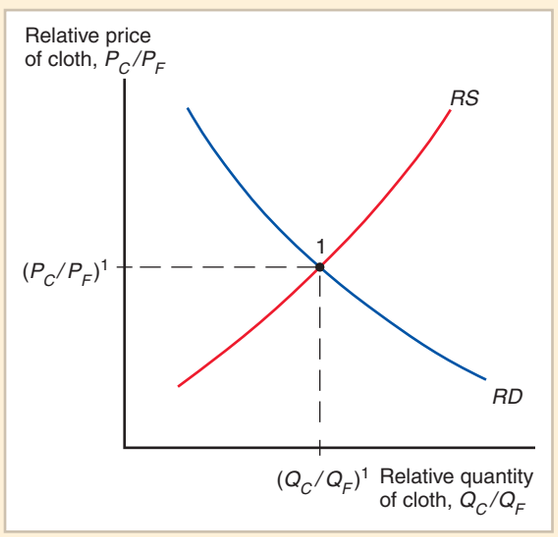
Let's look at what this outcome implies for the incomes of three groups: workers, owners of capital, and owners of land. Workers find that their wage rate has risen, but less than in proportion to the rise in P_C. Thus their real wage in terms of cloth (the amount of cloth they can buy with their wage income), w/P_C, falls, while their real wage in terms of food, w/P_F, rises. Given this information, we cannot say whether workers are better or worse off; this depends on the relative importance of cloth and food in workers' consumption (determined by the workers' preferences), a question that we will not pursue further.

Owners of capital, however, are definitely better off. The real wage rate in terms of cloth has fallen, so the profits of capital owners in terms of what they produce (cloth) rises. That is, the income of capital owners will rise more than proportionately with the rise in P_C. Since P_C in turn rises relative to P_F, the income of capitalists clearly goes up in terms of

Figure 4-9

Determination of Relative Prices

In the specific factors model, a higher relative price of cloth will lead to an increase in the output of cloth relative to that of food. Thus the relative supply curve *RS* is upward sloping. Equilibrium relative quantities and prices are determined by the intersection of *RS* with the relative demand curve *RD*.



both goods. Conversely, landowners are definitely worse off. They lose for two reasons: The real wage in terms of food (the good they produce) rises, squeezing their income, and the rise in cloth price reduces the purchasing power of any given income. The chapter appendix describes the welfare changes of capitalists and landowners in further detail.

If the relative price had moved in the opposite direction and the relative price of cloth had *decreased*, then the predictions would be reversed: Capital owners would be worse off, and landowners would be better off. The change in the welfare of workers would again be ambiguous because their real wage in terms of cloth would rise, but their real wage in terms of food would fall. The effect of a relative price change on the distribution of income can be summarized as follows:

- The factor specific to the sector whose relative price increases is definitely better off.
- The factor specific to the sector whose relative price decreases is definitely worse off.
- The change in welfare for the mobile factor is ambiguous.

International Trade in the Specific Factors Model

We just saw how changes in relative prices have strong repercussions for the distribution of income, creating both winners and losers. We now want to link this relative price change with international trade, and match up the predictions for winners and losers with the trade orientation of a sector.

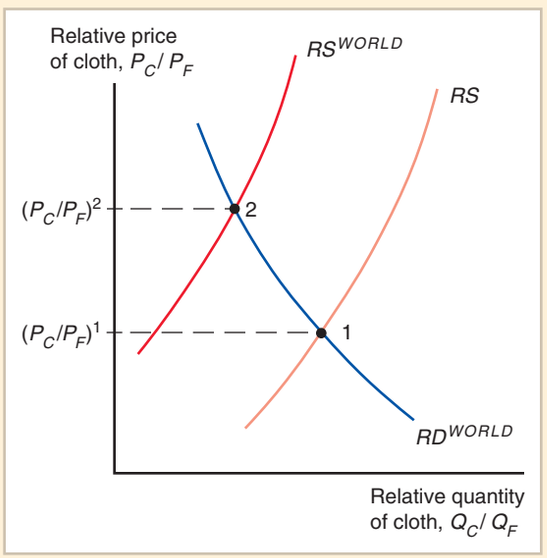
For trade to take place, a country must face a world relative price that is different from the relative price that would prevail in the absence of trade. Figure 4-9 shows how this relative price was determined for our specific factors economy. In Figure 4-10, we also add a relative supply curve for the world.

Why might the relative supply curve for the world be different from that for our specific factors economy? The other countries in the world could have different technologies, as in the Ricardian model. Now that our model has more than one factor of production, however, the other countries could also differ in their resources: the total amounts of land, capital, and labor available. What is important here is that the economy faces a different relative price when it is open to international trade.

Figure 4-10

Trade and Relative Prices

The figure shows the relative supply curve for the specific factors economy along with the world relative supply curve. The differences between the two relative supply curves can be due to either technology or resource differences across countries. There are no differences in relative demand across countries. Opening up to trade induces an increase in the relative price from $(P_C/P_F)^1$ to $(P_C/P_F)^2$.



The change in relative price is shown in Figure 4-10. When the economy is open to trade, the relative price of cloth is determined by the relative supply and demand for the world; this corresponds to the relative price $(P_C/P_F)^2$. If the economy could not trade, then the relative price would be lower, at $(P_C/P_F)^1$.[3] The increase in the relative price from $(P_C/P_F)^1$ to $(P_C/P_F)^2$ induces the economy to produce relatively more cloth. (This is also shown as the move from point 1 to point 2 along the economy's production possibility frontier in Figure 4-8.) At the same time, consumers respond to the higher relative price of cloth by demanding relatively more food. At the higher relative price $(P_C/P_F)^2$, the economy thus exports cloth and imports food.

If opening up to trade had been associated with a decrease in the relative price of cloth, then the changes in relative supply and demand would be reversed, and the economy would become a food exporter and a cloth importer. We can summarize both cases with the intuitive prediction that—when opening up to trade—an economy exports the good whose relative price has increased and imports the good whose relative price has decreased.[4]

Income Distribution and the Gains from Trade

We have seen how production possibilities are determined by resources and technology; how the choice of what to produce is determined by the relative price of cloth; how changes in the relative price of cloth affect the real incomes of different factors of production; and how trade affects both relative prices and the economy's response to those price changes. Now we can ask the crucial question: Who gains and who loses from international trade? We begin by asking how the welfare of particular groups is affected, and then how trade affects the welfare of the country as a whole.

To assess the effects of trade on particular groups, the key point is that international trade shifts the relative price of the goods that are traded. We just saw in the previous section that opening to trade will increase the relative price of the good in the new export sector. We can link this prediction with our results regarding how relative price changes translate into changes in the distribution of income. More specifically, we saw that the specific factor in the sector whose relative price increases will gain, and that the specific factor in the other sector (whose relative price decreases) will lose. We also saw that the welfare changes for the mobile factor are ambiguous.

The general outcome, then, is simple: *Trade benefits the factor that is specific to the export sector of each country but hurts the factor specific to the import-competing sectors, with ambiguous effects on mobile factors.*

Do the gains from trade outweigh the losses? One way to try to answer this question would be to sum up the gains of the winners and the losses of the losers and compare them. The problem with this procedure is that we are comparing welfare, an inherently subjective thing. A better way to assess the overall gains from trade is to ask a different question: Could those who gain from trade compensate those who lose and still be better off themselves? If so, then trade is *potentially* a source of gain to everyone.

In order to show that there are aggregate gains from trade, we need to state some basic relationships among prices, production, and consumption. In a country that cannot trade, the output of a good must equal its consumption. If D_C is consumption of cloth and D_F consumption of food, then in a closed economy, $D_C = Q_C$ and $D_F = Q_F$. International trade makes it possible for the mix of cloth and food consumed to differ from the mix

[3] In the figure, we assumed that there were no differences in preferences across countries, so we have a single relative demand curve for each country and the world as a whole.

[4] We describe how changes in relative prices affect a country's pattern of trade in more detail in Chapter 6.

produced. While the amounts of each good that a country consumes and produces may differ, however, a country cannot spend more than it earns: The *value* of consumption must be equal to the value of production. That is,

$$P_C \times D_C + P_F \times D_F = P_C \times Q_C + P_F \times Q_F. \quad (4\text{-}7)$$

Equation (4-8) can be rearranged to yield the following:

$$D_F - Q_F = (P_C/P_F) \times (Q_C - D_C). \quad (4\text{-}8)$$

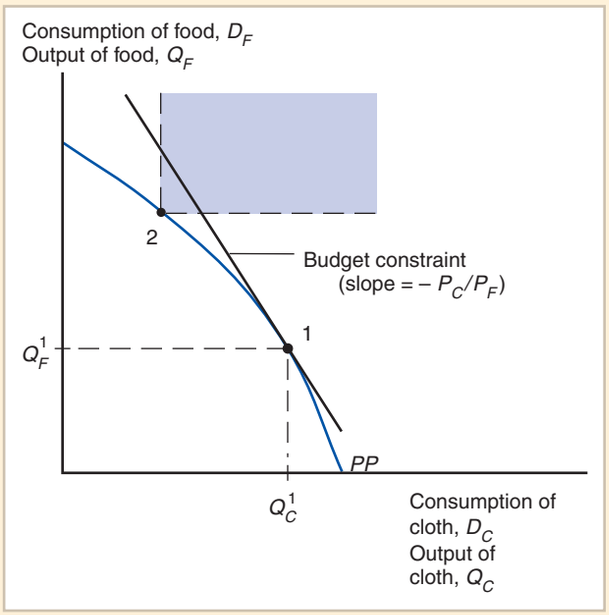
$D_F - Q_F$ is the economy's food *imports*, the amount by which its consumption of food exceeds its production. The right-hand side of the equation is the product of the relative price of cloth and the amount by which production of cloth exceeds consumption, that is, the economy's *exports* of cloth. The equation, then, states that imports of food equal exports of cloth times the relative price of cloth. While it does not tell us how much the economy will import or export, the equation does show that the amount the economy can afford to import is limited, or constrained, by the amount it exports. Equation (4-9) is therefore known as a **budget constraint**.[5]

Figure 4-11 illustrates two important features of the budget constraint for a trading economy. First, the slope of the budget constraint is minus P_C/P_F, the relative price of cloth. The reason is that consuming one less unit of cloth saves the economy P_C; this is enough to purchase P_C/P_F extra units of food. In other words, one unit of cloth can be exchanged on world markets for P_C/P_F units of food. Second, the budget constraint is tangent to the production possibility frontier at the chosen production point (shown as point 1 here and in Figure 4-5). Thus, the economy can always afford to consume what it produces.

Figure 4-11

Budget Constraint for a Trading Economy and Gains from Trade

Point 1 represents the economy's production. The economy can choose its consumption point along its budget constraint (a line that passes through point 1 and has a slope equal to minus the relative price of cloth). Before trade, the economy must consume what it produces, such as point 2 on the production possibility frontier (*PP*). The portion of the budget constraint in the colored region consists of feasible post-trade consumption choices, with consumption of both goods higher than at pretrade point 2.



[5] The constraint that the value of consumption equals that of production (or, equivalently, that imports equal exports in value) may not hold when countries can borrow from other countries or lend to them. For now we assume that these possibilities are not available and that the budget constraint (equation (4-9)) therefore holds. International borrowing and lending are examined in Chapter 6, which shows that an economy's consumption *over time* is still constrained by the necessity of paying its debts to foreign lenders.

To illustrate that trade is a source of potential gain for everyone, we proceed in three steps:

1. First, we notice that in the absence of trade, the economy would have to produce what it consumed, and vice versa. Thus the *consumption* of the economy in the absence of trade would have to be a point on the *production* possibility frontier. In Figure 4-11, a typical pretrade consumption point is shown as point 2.
2. Next, we notice that it is possible for a trading economy to consume more of *both* goods than it would have in the absence of trade. The budget constraint in Figure 4-11 represents all the possible combinations of food and cloth that the country could consume given the world relative price of cloth. Part of that budget constraint—the part in the colored region—represents situations in which the economy consumes more of both cloth and food than it could in the absence of trade. Notice that this result does not depend on the assumption that pretrade production and consumption is at point 2; unless pretrade production is at point 1, so that trade has no effect on production at all, there is always a part of the budget constraint that allows the consumption of more of both goods.
3. Finally, observe that if the economy as a whole consumes more of both goods, then it is possible in principle to give each *individual* more of both goods. This would make everyone better off. This shows, then, that it is possible to ensure that everyone is better off as a result of trade. Of course, everyone might be even better off if they had less of one good and more of the other, but this only reinforces the conclusion that everyone has the potential to gain from trade.

The fundamental reason why trade potentially benefits a country is that it *expands the economy's choices.* This expansion of choice means that it is always possible to redistribute income in such a way that everyone gains from trade.[6]

That everyone *could* gain from trade unfortunately does not mean that everyone actually does. In the real world, the presence of losers as well as winners from trade is one of the most important reasons why trade is not free.

The Political Economy of Trade: A Preliminary View

Trade often produces losers as well as winners. This insight is crucial to understanding the considerations that actually determine trade policy in the modern world economy. Our specific factors model informs us that those who stand to lose most from trade are the immobile factors in the import-competing sector. In the real world, this includes not only the owners of capital, but also a portion of the labor force in those importing-competing sectors. Some of those workers have a hard time transitioning from the import-competing sectors (where trade induces reductions in employment) to export sectors (where trade induces increases in employment). Some suffer unemployment spells as a result. In the United States, workers in the import-competing sectors earn wages that are substantially below the average wage. (For example, the average wage in the apparel sector in 2009 was 36 percent below the average wage across all manufacturing sectors.) One result of this disparity in wages is widespread sympathy for the plight of those workers and, consequently, for restrictions on apparel imports. The gains that more affluent consumers would realize if more imports were allowed and the associated increases in employment in the export sectors (which hire, on average, relatively higher-skilled workers) do not matter as much.

[6]The argument that trade is beneficial because it enlarges an economy's choices is much more general than this specific example. For a thorough discussion, see Paul Samuelson, "The Gains from International Trade Once Again," *Economic Journal* 72 (1962), pp. 820–829.

Does this mean that trade should be allowed only if it doesn't hurt lower-income people? Few international economists would agree. In spite of the real importance of income distribution, most economists remain strongly in favor of more or less free trade. There are three main reasons why economists do *not* generally stress the income distribution effects of trade:

1. Income distribution effects are not specific to international trade. Every change in a nation's economy, including technological progress, shifting consumer preferences, exhaustion of old resources and discovery of new ones, and so on, affects income distribution. Why should an apparel worker, who suffers an unemployment spell due to increased import competition, be treated differently from an unemployed printing machine operator (whose newspaper employer shuts down due to competition from Internet news providers) or an unemployed construction worker laid off due to a housing slump?
2. It is always better to allow trade and compensate those who are hurt by it than to prohibit the trade. All modern industrial countries provide some sort of "safety net" of income support programs (such as unemployment benefits and subsidized retraining and relocation programs) that can cushion the losses of groups hurt by trade. Economists would argue that if this cushion is felt to be inadequate, more support rather than less trade is the answer. (This support can also be extended to all those in need, instead of indirectly assisting only those workers affected by trade.)
3. Those who stand to lose from increased trade are typically better organized than those who stand to gain (because the former are more concentrated within regions and industries). This imbalance creates a bias in the political process that requires a counterweight, especially given the aggregate gains from trade. Many trade restrictions tend to favor the most organized groups, which are often not the most in need of income support (in many cases, quite the contrary).

Most economists, while acknowledging the effects of international trade on income distribution, believe that it is more important to stress the overall potential gains from trade than the possible losses to some groups in a country. Economists do not, however, often have the deciding voice in economic policy, especially when conflicting interests are at stake. Any realistic understanding of how trade policy is determined must look at the actual motivations of that policy.

Case Study

Trade and Unemployment

Opening to trade shifts jobs from import-competing sectors to export sectors. As we have discussed, this process is not instantaneous and imposes some very real costs: Some workers in the import-competing sectors become unemployed and have difficulty finding new jobs in the growing export sectors. We have argued in this chapter that the best policy response to this serious concern is to provide an adequate safety net to unemployed workers, without discriminating based on the economic force that induced their involuntary unemployment (whether due to trade or, say, technological change). Here, we quantify the extent of unemployment that can be traced back to trade. Plant closures due to import competition or overseas plant relocations are highly publicized, but they account for a very small proportion of involuntary worker displacements. The U.S. Bureau of Labor Statistics reports that from 1996 to 2008, those closures accounted for only 2.5 percent of total involuntary displacements. Many of the same factors that we mentioned as also affecting income distribution, such as technological change, shifts in consumer tastes, etc., play a larger role.

Figure 4-12 shows that, over the last 50 years in the United States, there is no obvious correlation between the unemployment rate and imports (relative to U.S. GDP).

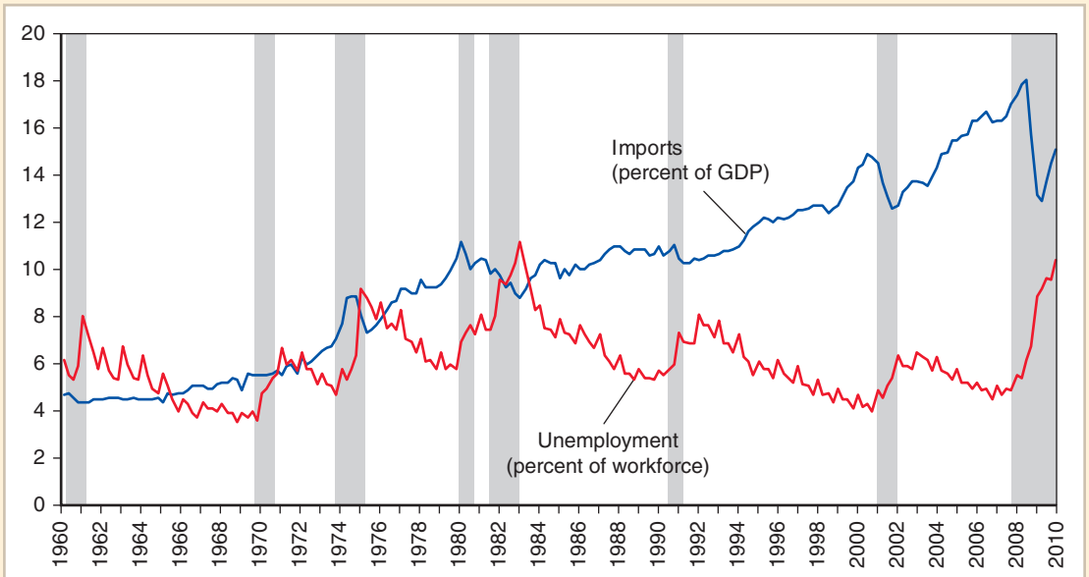


Figure 4-12

Unemployment and Import Penetration in the U.S.

The highlighted years are recession years, as determined by the National Bureau of Economic Research.

Source: US Bureau of Economic Analysis for imports and US Bureau of Labor Studies for unemployment. Data from Douglas Irwin's *Free Trade Under Fire*.

On the other hand, the figure clearly shows how unemployment is a macroeconomic phenomenon that responds to overall economic conditions: Unemployment peaks during the highlighted recession years. Thus, economists recommend the use of macroeconomic policy, rather than trade policy, to address concerns regarding unemployment.

Still, because changes in trade regimes—as opposed to other forces affecting the income distribution—are driven by policy decisions, there is also substantial pressure to bundle those decisions with special programs that benefit those who are adversely affected by trade. The **U.S. Trade Adjustment Assistance program** provides extended unemployment coverage (for an additional year) to workers who are displaced by a plant closure due to import competition or an overseas relocation to a country receiving preferential access to the United States. While this program is important, to the extent that it can influence political decisions regarding trade, it unfairly discriminates against workers who are displaced due to economic forces other than trade.[7]

[7] See Lori G. Kletzer, "Trade-related Job Loss and Wage Insurance: A Synthetic Review," *Review of International Economics* 12 (November 2004), pp. 724–748; and Grant D. Aldonas, Robert Z. Lawrence, and Matthew J. Slaughter, *Succeeding in the Global Economy: A New Policy Agenda for the American Worker* (Washington, D.C.: Financial Services Forum, 2007) for additional details on the U.S. TAA program and proposals to extend the same type of insurance coverage to all workers.

Income Distribution and Trade Politics

It is easy to see why groups that lose from trade lobby their governments to restrict trade and protect their incomes. You might expect that those who gain from trade would lobby as strongly as those who lose from it, but this is rarely the case. In the United States and most other countries, those who want trade limited are more effective politically than those who want it extended. Typically, those who gain from trade in any particular product are a much less concentrated, informed, and organized group than those who lose.

A good example of this contrast between the two sides is the U.S. sugar industry. The United States has limited imports of sugar for many years; over the past 25 years, the average price of sugar in the U.S. market has been more than twice the average price on the world market. Most estimates put the cost to U.S. consumers of this import limitation at about $2 billion a year (according to the U.S. General Accounting Office)—that is, about $7 a year for every man, woman, and child. The gains to producers are much smaller, probably less than half as large.[8]

If producers and consumers were equally able to get their interests represented, this policy would never have been enacted. In absolute terms, however, each consumer suffers very little. Seven dollars a year is not much; furthermore, most of the cost is hidden, because most sugar is consumed as an ingredient in other foods rather than purchased directly. As a result, most consumers are unaware that the import quota even exists, let alone that it reduces their standard of living. Even if they were aware, $7 is not a large enough sum to provoke people into organizing protests and writing letters to their congressional representatives.

The situation of the sugar producers (those who would lose from increased trade) is quite different. The higher profits from the import quota are highly concentrated in a small number of producers. (Seventeen sugar cane farms generate more than half of the profits for the whole sugar cane industry.) Those producers are organized in trade associations that actively lobby on their members' behalf, and make large campaign contributions. (The sugar cane and sugar beet political action committees contributed $3.3 million in the 2006 election cycle.)

As one would expect, most of the gains from the sugar import restrictions go to that small group of sugar cane farm owners and not to their employees. Of course, the trade restrictions do prevent job losses for those workers; but the consumer cost per job saved amounts to $826,000 per year, nearly 30 times the average pay of those workers. In addition, the sugar import restrictions also reduce employment in other sectors that rely on large quantities of sugar in their production processes. In response to the high sugar prices in the United States, for example, candy-making firms have shifted their production sites to Canada, where sugar prices are substantially lower. (There are no sugar farmers in Canada, and hence no political pressure for restrictions on sugar imports.)

As we will see in Chapters 9 through 12, the politics of import restriction in the sugar industry is an extreme example of a kind of political process that is common in international trade. That world trade in general became steadily freer from 1945 to 1980 depended, as we will see in Chapter 10, on a special set of circumstances that controlled what is probably an inherent political bias against international trade.

[8] See Chapter 3 of Douglas Irwin, *Free Trade under Fire*, 3rd edition (Princeton, NJ: Princeton University Press, 2009) for a detailed description of the effects of sugar import restrictions in the United States.

International Labor Mobility

In this section, we will show how the specific factors model can be adapted to analyze the effects of labor mobility. In the modern world, restrictions on the flow of labor are legion—just about every country imposes restrictions on immigration. Thus labor mobility is less prevalent in practice than capital mobility. However, the analysis of physical capital movements is more complex, as it is embedded along with other factors in a multinational's decision to invest abroad (see Chapter 8). Still, it is important to understand the international economic forces that drive *desired* migration of workers across borders, and the short-run consequences of those migration flows whenever they are realized. We will also explore the long-run consequences of changes in a country's labor and capital endowments in the next chapter.

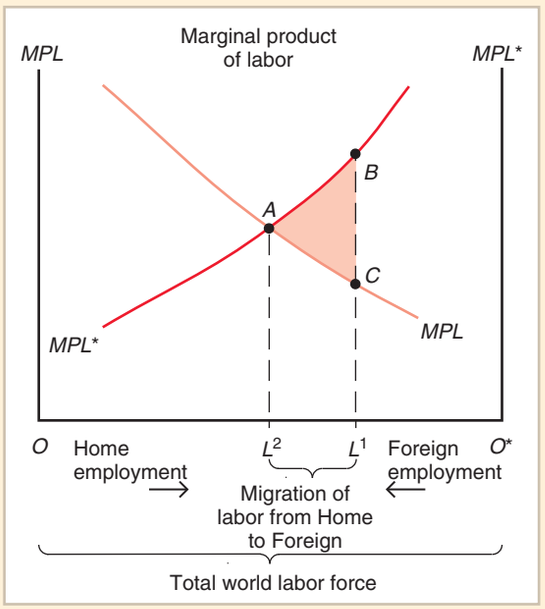
In the previous sections, we saw how workers move between the cloth and food sectors within one country until the wages in the two sectors are equalized. Whenever international migration is possible, workers will also want to move from the low-wage to the high-wage country.[9] To keep things simple and to focus on international migration, let's assume that two countries produce a single good with labor and an immobile factor, land. Since there is only a single good, there is no reason to trade it; however, there will be "trade" in labor services when workers move in search of higher wages. In the absence of migration, wage differences across countries can be driven by technology differences, or alternatively, by differences in the availability of land relative to labor.

Figure 4-13 illustrates the causes and effects of international labor mobility. It is very similar to Figure 4-4, except that the horizontal axis now represents the total world labor force (instead of the labor force in a given country). The two marginal product curves now represent production of the same good in different countries (instead of the production of two different goods in the same country). We do not multiply those curves by the prices of

Figure 4-13

Causes and Effects of International Labor Mobility

Initially OL^1 workers are employed in Home, while L^1O^* workers are employed in Foreign. Labor migrates from Home to Foreign until OL^2 workers are employed in Home, L^2O^* in Foreign, and wages are equalized.



[9] We assume that workers' tastes are similar so that location decisions are based on wage differentials. Actual wage differentials across countries are very large—large enough that, for many workers, they outweigh personal tastes for particular countries.

the good; instead we assume that the wages measured on the vertical axis represent real wages (the wage divided by the price of the unique good in each country). Initially, we assume that there are OL^1 workers in Home and L^1O^* workers in Foreign. Given those employment levels, technology and land endowment differences are such that real wages are higher in Foreign (point *B*) than in Home (point *C*).

Now suppose that workers are able to move between these two countries. Workers will move from Home to Foreign. This movement will reduce the Home labor force and thus raise the real wage in Home, while increasing the labor force and reducing the real wage in Foreign. If there are no obstacles to labor movement, this process will continue until the real wage rates are equalized. The eventual distribution of the world's labor force will be one with OL^2 workers in Home and L^2O^* workers in Foreign (point *A*).

Three points should be noted about this redistribution of the world's labor force.

1. It leads to a convergence of real wage rates. Real wages rise in Home and fall in Foreign.
2. It increases the world's output as a whole. Foreign's output rises by the area under its marginal product curve from L^1 to L^2, while Home's falls by the corresponding area under its marginal product curve. (See appendix for details.) We see from the figure that Foreign's gain is larger than Home's loss, by an amount equal to the colored area *ABC* in the figure.
3. Despite this gain, some people are hurt by the change. Those who would originally have worked in Home receive higher real wages, but those who would originally have worked in Foreign receive lower real wages. Landowners in Foreign benefit from the larger labor supply, but landowners in Home are made worse off.

As in the case of the gains from international trade, then, international labor mobility, while allowing everyone to be made better off in principle, leaves some groups worse off in practice. This main result would not change in a more complex model where countries produce and trade different goods, so long as some factors of production are immobile in the short run. However, we will see in the following chapter that this result need not hold in the long run, when all factors are mobile across sectors. We will see how changes in a country's labor endowment, so long as the country is integrated into world markets through trade, can leave the welfare of all factors unchanged. This has very important implications for immigration in the long run, and has been shown to be empirically relevant in cases where countries experience large immigration increases.

Case Study

Wage Convergence in the Age of Mass Migration

Although there are substantial movements of people between countries in the modern world, the truly heroic age of labor mobility—when immigration was a major source of population growth in some countries, while emigration caused population in other countries to decline—was in the late 19th and early 20th centuries. In a global economy newly integrated by railroads, steamships, and telegraph cables, and not yet subject to many legal restrictions on migration, tens of millions of people moved long distances in search of a better life. Chinese people moved to Southeast Asia and California, while Indian people moved to Africa and the Caribbean; in addition, a substantial number of Japanese people moved to Brazil. However, the greatest migration involved people from the periphery of Europe—from Scandinavia, Ireland, Italy,

and Eastern Europe—who moved to places where land was abundant and wages were high: the United States, Canada, Argentina, and Australia.

Did this process cause the kind of real wage convergence that our model predicts? Indeed it did. Table 4-1 shows real wages in 1870, and the change in these wages up to the eve of World War I, for four major "destination" countries and for four important "origin" countries. As the table shows, at the beginning of the period, real wages were much higher in the destination than in the origin countries. Over the next four decades real wages rose in all countries, but (except for a surprisingly large increase in Canada) they increased much more rapidly in the origin than in the destination countries, suggesting that migration actually did move the world toward (although not by any means all the way to) wage equalization.

As documented in the Case Study on the U.S. economy, legal restrictions put an end to the age of mass migration after World War I. For that and other reasons (notably a decline in world trade, and the direct effects of two world wars), convergence in real wages came to a halt and even reversed itself for several decades, only to resume in the postwar years.

TABLE 4-1

	Real Wage, 1870 (U.S. = 100)	Percentage Increase in Real Wage, 1870–1913
Destination Countries		
Argentina	53	51
Australia	110	1
Canada	86	121
United States	100	47
Origin Countries		
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.

Case Study

Immigration and the U.S. Economy

As Figure 4-14 shows, the share of immigrants in the U.S. population has varied greatly over the past century. In the early 20th century, the number of foreign-born U.S. residents increased dramatically due to vast immigration from Eastern and Southern Europe. Tight restrictions on immigration imposed in the 1920s brought an end to this era, and by the 1960s immigrants were a minor factor on the American scene. A new wave of immigration began around 1970, this time with most immigrants coming from Latin America and Asia.

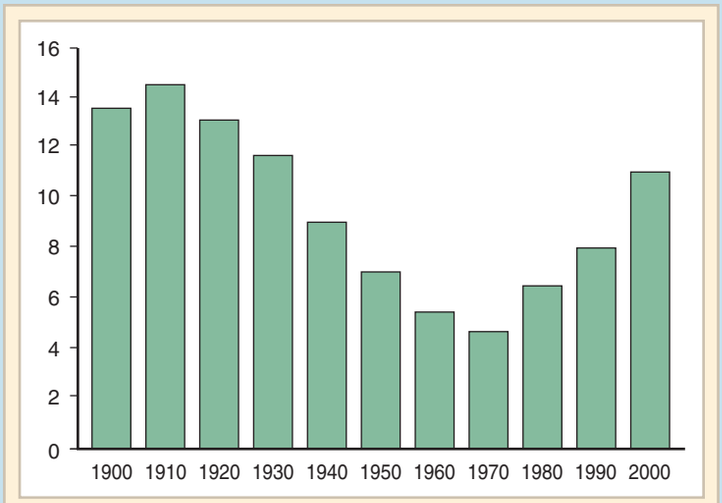


Figure 4-14

Immigrants as a Percentage of the U.S. Population

Restrictions on immigration in the 1920s led to a sharp decline in the foreign-born population in the mid-20th century, but immigration has risen sharply again in recent decades.

How has this new wave of immigration affected the U.S. economy? The most direct effect is that immigration has expanded the work force. As of 2006, foreign-born workers make up 15.3 percent of the U.S. labor force—that is, without immigrants the United States would have 15 percent fewer workers.

Other things equal, we would expect this increase in the work force to reduce wages. One widely cited estimate is that average wages in the United States are 3 percent lower than they would be in the absence of immigration.[10] However, comparisons of average wages can be misleading. Immigrant workers are much more likely than native-born workers to have low levels of education: In 2006, 28 percent of the immigrant labor force had not completed high school or its equivalent, compared with only 6 percent of native-born workers. As a result, most estimates suggest that immigration has actually raised the wages of native-born Americans with a college education or above. Any negative effects on wages fall on less-educated Americans. There is, however, considerable dispute among economists about how large these negative wage effects are, with estimates ranging from an 8 percent decline to much smaller numbers.

What about the overall effects on America's income? America's gross domestic product—the total value of all goods and services produced here—is clearly larger because of immigrant workers. However, much of this increase in the value of production is used to pay wages to the immigrants themselves. Estimates of the "immigration surplus"—the difference between the gain in GDP and the cost in wages paid to immigrants—are generally small, on the order of 0.1 percent of GDP.[11]

[10] George Borjas, "The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market," *Quarterly Journal of Economics* 118 (November 2003), pp. 1335–1374.

[11] See Gordon Hanson, "Challenges for Immigration Policy," in C. Fred Bergsten, ed., *The United States and the World Economy: Foreign Economic Policy for the Next Decade*, Washington, D.C.: Institute for International Economics, 2005, pp. 343–372.

There's one more complication in assessing the economic effects of immigration: the effects on tax revenue and government spending. On one side, immigrants pay taxes, helping cover the cost of government. On the other side, they impose costs on the government, because their cars need roads to drive on, their children need schools to study in, and so on. Because many immigrants earn low wages and hence pay low taxes, some estimates suggest that immigrants cost more in additional spending than they pay in. However, estimates of the net fiscal cost, like estimates of the net economic effects, are small, again on the order of 0.1 percent of GDP.

Immigration is, of course, an extremely contentious political issue. The economics of immigration, however, probably doesn't explain this contentiousness. Instead, it may be helpful to recall what the Swiss author Max Frisch once said about the effects of immigration into his own country, which at one point relied heavily on workers from other countries: "We asked for labor, but people came." And it's the fact that immigrants are people that makes the immigration issue so difficult.

SUMMARY

1. International trade often has strong effects on the distribution of income within countries, so that it often produces losers as well as winners. Income distribution effects arise for two reasons: Factors of production cannot move instantaneously and costlessly from one industry to another, and changes in an economy's output mix have differential effects on the demand for different factors of production.
2. A useful model of income distribution effects of international trade is the *specific factors* model, which allows for a distinction between general-purpose factors that can move between sectors and factors that are specific to particular uses. In this model, differences in resources can cause countries to have different relative supply curves, and thus cause international trade.
3. 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 limited sense that those who gain could in principle compensate those who lose while still remaining better off than before.
5. Most economists do not regard the effects of international trade on income distribution a good reason to limit this trade. In its distributional effects, trade is no different from many other forms of economic change, which are not normally regulated. Furthermore, economists would prefer to address the problem of income distribution directly, rather than by interfering with trade flows.
6. Nonetheless, in the actual politics of trade policy, income distribution is of crucial importance. This is true in particular because those who lose from trade are usually a much more informed, cohesive, and organized group than those who gain.
7. International factor movements can sometimes substitute for trade, so it is not surprising that international migration of labor is similar in its causes and effects to international trade. Labor moves from countries where it is abundant to countries where it is scarce. This movement raises total world output, but it also generates strong income distribution effects, so that some groups are hurt as a result.

KEY TERMS

budget constraint, p. 64
diminishing returns, p. 53
marginal product of labor, p. 53
mobile factor, p. 51
production function, p. 52
production possibility frontier, p. 53
specific factor, p. 51
specific factors model, p. 51
U.S. Trade Adjustment Assistance program, p. 67

PROBLEMS

1. In 1986, the price of oil on world markets dropped sharply. Since the United States is an oil-importing country, this was widely regarded as good for the U.S. economy. Yet in Texas and Louisiana, 1986 was a year of economic decline. Why?
2. An economy can produce good 1 using labor and capital and good 2 using labor and land. The total supply of labor is 100 units. Given the supply of capital, the outputs of the two goods depend on labor input as follows:

Labor Input to Good 1	Output of Good 1	Labor Input to Good 2	Output of Good 2
0	0.0	0	0.0
10	25.1	10	39.8
20	38.1	20	52.5
30	48.6	30	61.8
40	57.7	40	69.3
50	66.0	50	75.8
60	73.6	60	81.5
70	80.7	70	86.7
80	87.4	80	91.4
90	93.9	90	95.9
100	100	100	100

   a. Graph the production functions for good 1 and good 2.
   b. Graph the production possibility frontier. Why is it curved?
3. The marginal product of labor curves corresponding to the production functions in problem 2 are as follows:

Workers Employed	MPL in Sector 1	MPL in Sector 2
10	1.51	1.59
20	1.14	1.05
30	0.97	0.82
40	0.87	0.69
50	0.79	0.61
60	0.74	0.54
70	0.69	0.50
80	0.66	0.46
90	0.63	0.43
100	0.60	0.40

   a. Suppose that the price of good 2 relative to that of good 1 is 2. Determine graphically the wage rate and the allocation of labor between the two sectors.

b. Using the graph drawn for problem 2, determine the output of each sector. Then confirm graphically that the slope of the production possibility frontier at that point equals the relative price.
c. Suppose that the relative price of good 2 falls to 1. Repeat (a) and (b).
d. Calculate the effects of the price change from 2 to 1 on the income of the specific factors in sectors 1 and 2.

4. Consider two countries (Home and Foreign) that produce goods 1 (with labor and capital) and 2 (with labor and land) according to the production functions described in problems 2 and 3. Initially, both countries have the same supply of labor (100 units each), capital, and land. The capital stock in Home then grows. This change shifts out both the production curve for good 1 as a function of labor employed (described in problem 2) and the associated marginal product of labor curve (described in problem 3). Nothing happens to the production and marginal product curves for good 2.
a. Show how the increase in the supply of capital for Home affects its production possibility frontier.
b. On the same graph, draw the relative supply curve for both the Home and the Foreign economy.
c. If those two economies open up to trade, what will be the pattern of trade (i.e., which country exports which good)?
d. Describe how opening up to trade affects all three factors (labor, capital, land) in both countries.

5. In Home and Foreign there are two factors each of production, land, and labor used to produce only one good. The land supply in each country and the technology of production are exactly the same. The marginal product of labor in each country depends on employment as follows:

Number of Workers Employed	Marginal Product of Last Worker
1	20
2	19
3	18
4	17
5	16
6	15
7	14
8	13
9	12
10	11
11	10

Initially, there are 11 workers employed in Home, but only 3 workers in Foreign.

Find the effect of free movement of labor from Home to Foreign on employment, production, real wages, and the income of landowners in each country.

6. Using the numerical example in problem 5, assume now that Foreign limits immigration so that only 2 workers can move there from Home. Calculate how the movement of these two workers affects the income of five different groups:
a. Workers who were originally in Foreign
b. Foreign landowners
c. Workers who stay in Home
d. Home landowners
e. The workers who do move

7. Studies of the effects of immigration into the United States from Mexico tend to find that the big winners are the immigrants themselves. Explain this result in terms of the example in the question above. How might things change if the border were open, with no restrictions on immigration?

FURTHER READINGS

Avinash Dixit and Victor Norman. *Theory of International Trade.* Cambridge: Cambridge University Press, 1980. The problem of establishing gains from trade when some people may be made worse off has been the subject of a long debate. Dixit and Norman show it is always possible in principle for a country's government to use taxes and subsidies to redistribute income in such a way that everyone is better off with free trade than with no trade.

Douglas A. Irwin, *Free Trade under Fire,* 3rd edition. Princeton, NJ: Princeton University Press, 2009. An accessible book that provides numerous details and supporting data for the argument that freer trade generates overall welfare gains. Chapter 4 discusses the connection between trade and unemployment in detail (an issue that was briefly discussed in this chapter).

Charles P. Kindleberger. *Europe's Postwar Growth: The Role of Labor Supply.* Cambridge: Harvard University Press, 1967. A good account of the role of labor migration during its height in Europe.

Robert A. Mundell. "International Trade and Factor Mobility." *American Economic Review* 47 (1957), pp. 321–335. The paper that first laid out the argument that trade and factor movement can substitute for each other.

Michael Mussa. "Tariffs and the Distribution of Income: The Importance of Factor Specificity, Substitutability, and Intensity in the Short and Long Run." *Journal of Political Economy* 82 (1974), pp. 1191–1204. An extension of the specific factors model that relates it to the factor proportions model of Chapter 5.

J. Peter Neary. "Short-Run Capital Specificity and the Pure Theory of International Trade." *Economic Journal* 88 (1978), pp. 488–510. A further treatment of the specific factors model that stresses how differing assumptions about mobility of factors between sectors affect the model's conclusions.

Mancur Olson. *The Logic of Collective Action.* Cambridge: Harvard University Press, 1965. A highly influential book that argues the proposition that in practice, government policies favor small, concentrated groups over large ones.

David Ricardo. *The Principles of Political Economy and Taxation.* Homewood, IL: Irwin, 1963. While Ricardo's *Principles* emphasizes the national gains from trade at one point, elsewhere in his book the conflict of interest between landowners and capitalists is a central issue.

APPENDIX TO CHAPTER 4

Further Details on Specific Factors

The specific factors model developed in this chapter is such a convenient tool of analysis that we take the time here to spell out some of its details more fully. We give a fuller treatment of two related issues: (1) the relationship between marginal and total product within each sector; (2) the income distribution effects of relative price changes.

Marginal and Total Product

In the text we illustrated the production function of cloth in two different ways. In Figure 4-1 we showed total output as a function of labor input, holding capital constant. We then observed that the slope of that curve is the marginal product of labor and illustrated that marginal product in Figure 4-2. We now want to demonstrate that the total output is measured by the area under the marginal product curve. (Students who are familiar with calculus will find this obvious: Marginal product is the derivative of total, so total is the integral of marginal. Even for these students, however, an intuitive approach can be helpful.)

In Figure 4A-1 we show once again the marginal product curve in cloth production. Suppose that we employ L_C person-hours. How can we show the total output of cloth? Let's approximate this using the marginal product curve. First, let's ask what would happen if we used slightly fewer person-hours, say dL_C fewer. Then output would be less. The fall in output would be approximately

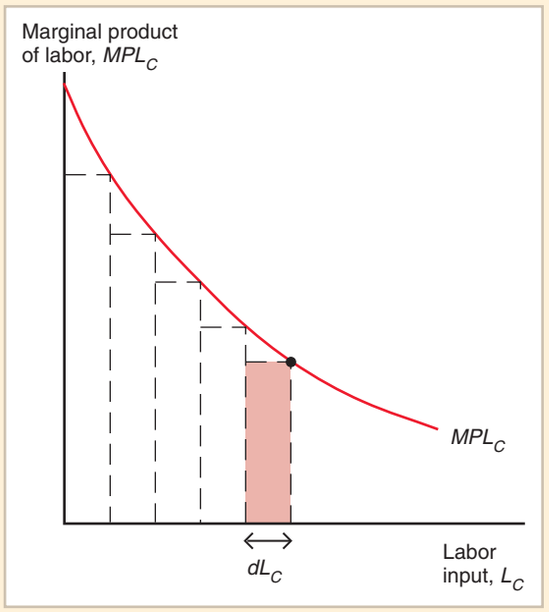
$$dL_C \times MPL_C,$$

that is, the reduction in the work force times the marginal product of labor at the initial level of employment. This reduction in output is represented by the area of the colored

Figure 4A-1

Showing that Output Is Equal to the Area Under the Marginal Product Curve

By approximating the marginal product curve with a series of thin rectangles, one can show that the total output of cloth is equal to the area under the curve.



rectangle in Figure 4A-1. Now subtract another few person-hours; the output loss will be another rectangle. This time the rectangle will be taller, because the marginal product of labor rises as the quantity of labor falls. If we continue this process until all the labor is gone, our approximation of the total output loss will be the sum of all the rectangles shown in the figure. When no labor is employed, however, output will fall to zero. So we can approximate the total output of the cloth sector by the sum of the areas of all the rectangles under the marginal product curve.

This is, however, only an approximation, because we used the marginal product of only the first person-hour in each batch of labor removed. We can get a better approximation if we take smaller groups—the smaller the better. As the groups of labor removed get infinitesimally small, however, the rectangles get thinner and thinner, and we approximate ever more closely the total area under the marginal product curve. In the end, then, we find that the total output of cloth produced with labor L_C, Q_C, is equal to the area under the marginal product of labor curve MPL_C up to L_C.

Relative Prices and the Distribution of Income

Figure 4A-2 uses the result we just found to show the distribution of income within the cloth sector. We saw that cloth employers hire labor L_C until the value of the workers' marginal product, $P_C \times MPL_C$, is equal to the wage w. We can rewrite this in terms of the real wage of cloth as $MPL_C = w/P_C$. Thus, at a given real wage, say $(w/P_C)^1$, the marginal product curve in Figure 4A-2 tells us that L_C^1 worker-hours will be employed. The total output produced with those workers is given by the area under the marginal product curve up to L_C^1. This output is divided into the real income (in terms of cloth) of workers and capital owners. The portion paid to workers is the real wage $(w/P_C)^1$ times the employment level L_C^1, which is the area of the rectangle shown. The remainder is the real income of the capital owners. We can determine the distribution of food production between labor and landowners in the same way, as a function of the real wage in terms of food, w/P_F.

Suppose the relative price of cloth now rises. We saw in Figure 4-7 that a rise in P_C/P_F lowers the real wage in terms of cloth (because the wage rises by less than P_C) while raising it in terms of food. The effects of this on the income of capitalists and landowners can

Figure 4A-2

The Distribution of Income Within the Cloth Sector

Labor income is equal to the real wage times employment. The rest of output accrues as income to the owners of capital.

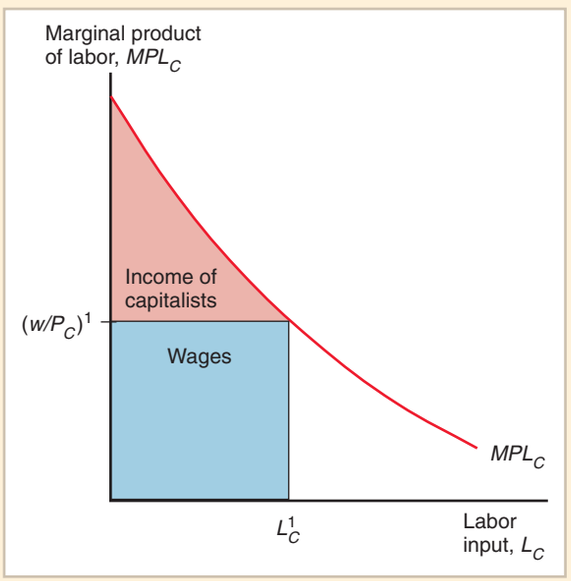


Figure 4A-3

A Rise in P_C Benefits the Owners of Capital

The real wage in terms of cloth falls, leading to a rise in the income of capital owners.

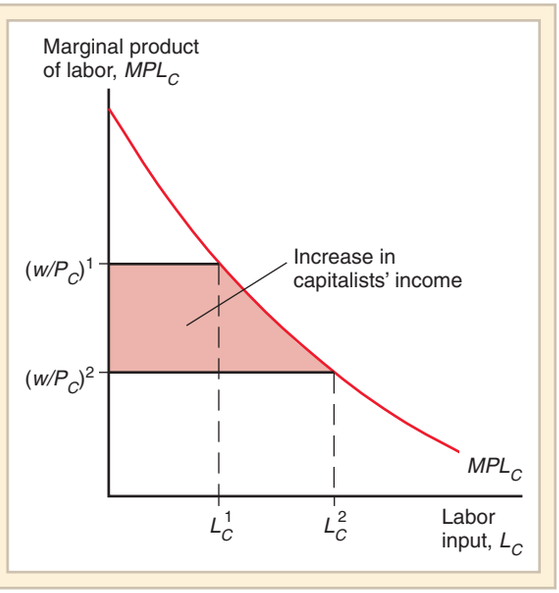
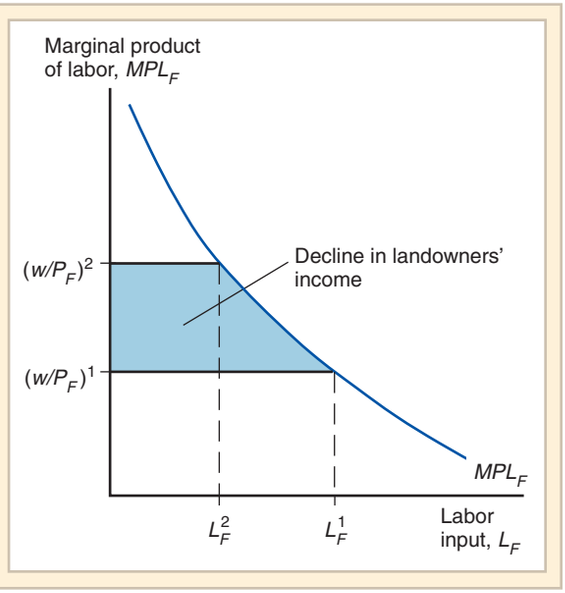


Figure 4A-4

A Rise in P_C Hurts Landowners

The real wage in terms of food rises, reducing the income of land.



be seen in Figures 4A-3 and 4A-4. In the cloth sector, the real wage falls from $(w/P_C)^1$ to $(w/P_C)^2$; as a result, capitalists receive increased real income in terms of cloth. In the food sector, the real wage rises from $(w/P_F)^1$ to $(w/P_F)^2$, and landowners receive less real income in terms of food.

This effect on real incomes is reinforced by the change in P_C/P_F itself. The real income of capital owners in terms of food rises by more than their real income in terms of cloth—because food is now relatively cheaper than cloth. Conversely, the real income of landowners in terms of cloth drops by more than their real income in terms of food—because cloth is now relatively more expensive.