CHAPTER 5

Factor Endowments and Trade I: The Specific Factors Model

Countries differ considerably in the range of productive factors located within their borders. Such asymmetries in factor endowments can be expected heavily to influence the pattern of production when international trade is allowed, in a manner not captured in the Ricardian labor-only scenario discussed in the preceding chapter. Links between factor endowments and the pattern of trade, as well as the consequences of international trade on the rewards earned by the various productive factors, are analyzed in this and the succeeding chapter.

In exploring these issues we take a two-step approach. In this chapter we add capital and land to the use of labor in rounding out the classical trinity of productive factors. However, whereas we retain the Ricardian assumption that labor is homogeneous in quality and freely mobile among productive sectors of the economy, we require that capital can only be employed in producing clothing and that land is *specific* in its use in producing food. Thus labor is the only mobile factor of production. An alternative interpretation of this specific-factors model is also considered, one in which the only input in addition to labor is capital, but in the short run the form in which capital is available in one sector (say tractors in the food sector) makes it useless in the other (say the clothing sector needs textile machinery). This opens up the possibility that with sufficient passage of time such factor specificity can be overcome, so one type of capital can be altered to another. This, indeed, is what is assumed in Chapter 6.

As in the Ricardian setting the issue of the effects of international trade on the distribution of income receives prime attention, but now a shift is made to the consequences of trade for the welfare of separate factors *within* a country, as revealed by the effect of international trade on local wage rates and returns to land and capital.

5.1 Diminishing Returns and Factor Hires

One of the earliest concepts encountered in the study of economics is that of *diminishing returns*. As more and more of a variable factor is added in the production process to given amounts of a specific factor, what happens to total output produced? It increases. But the incremental output is not maintained—it falls as more of the variable input is added to a fixed factor. This is a property of production that is perfectly

consistent with our assumption that technology exhibits *constant returns to scale*: Increasing *all* inputs in proportion results in output going up by the same proportion. In the Ricardian model there is only one homogeneous factor of production, labor, so the concept of diminishing returns is not relevant.

Consider the food sector, now assumed to employ both labor and land. Suppose the quantity of land is fixed, and ask how total food output varies as more and more labor is employed in this sector. Food output rises at an ever-decreasing rate. The marginal product of labor in producing food is defined as the extra output of food obtainable if one more unit of labor is added to a fixed supply of land. The law of diminishing returns implies that this marginal product falls as output expands.

How much labor would be hired by a competitive food producer owning a given parcel of land and facing both a given market price for food and a given wage rate at which labor can be hired? The marginal (physical) product of labor depends on the quantity of labor hired in the market, and if this is multiplied by the price of food, the *value of the marginal product of labor* is determined. This is what needs to be compared with the prevailing wage rate. If it is higher than the wage rate, w, it pays the producer to hire more labor; if less, the producer can gain by cutting back on the amount of labor hired. Profits are maximized at the amount of labor hired that equates the value of the marginal product of labor to the wage rate. (The diagrammatic treatment is given in Figure 5.2.) How about the return to land? This is literally in the form of rent—the excess of revenue over the required payment to labor.

We assume here that technology exhibits constant returns to scale: Doubling both inputs serves to double output. This implies that if both the wage rate and rental on land should double, so would the unit cost of production and, in a competitive market, the market price of food. This implies an important relationship among prices:

> *If factor prices change, the percentage change in the commodity price must lie between the percentage changes in factor returns.*

The rationale is simple. Suppose the wage rate increases by 10 percent and the rental on land by 20 percent. Unit costs must rise by at least 10 percent, which would be the exact outcome if the rental had risen by 10 percent instead of 20 percent, but cannot rise by more than 20 percent, which would be the exact result if wages had risen by 20 percent. In competitive markets, prices reflect unit costs, so that the percentage price change must be trapped between the percentage changes in wages and rents.

Similar remarks can be made for the clothing sector, except we now assume that the fixed factor is capital. All revenue earned in the clothing sector will, in competitive markets, either be represented in the wage bill or will be captured as rents to owners of capital equipment.

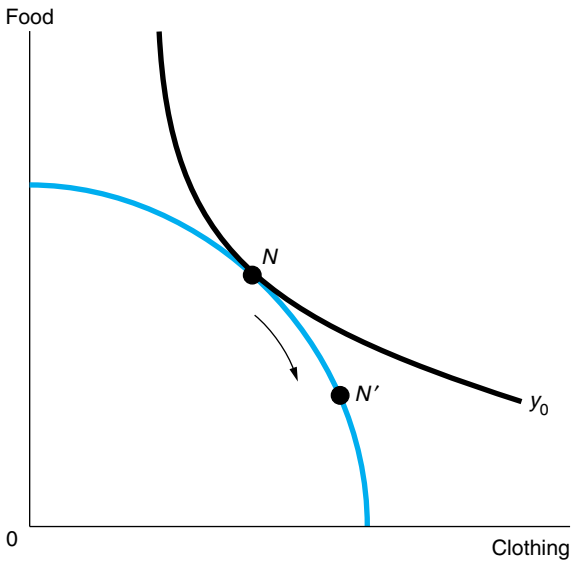
5.2 Outputs and Income Distribution in the Closed Economy

Figure 5.1 illustrates that the economy's production-possibilities schedule no longer has the straight-line shape of the Ricardian model. The reason? Diminishing returns. Consider the movement from point N to N'. The only way in which clothing output can be expanded is by releasing labor from the food sector and putting it to work with cap-

FIGURE 5.1

Production Possibilities with Increasing Opportunity Costs

The closed economy equilibrium is at *N*. The transformation curve is bowed out, reflecting the law of diminishing returns.



ital to produce clothing. But such a transfer alters the marginal productivity of labor in both sectors—in opposite directions. Adding more labor to a fixed quantity of capital in the clothing sector does cause output to increase, but at a diminishing rate. The marginal product of labor in clothing at point N' is smaller than it is at point N. In the food sector the departure of labor serves to *increase* labor's marginal product in producing food because there is now more land used per unit of labor at N' than at N.

The slope of the bowed-out transformation schedule in Figure 5.1 is equal to (minus) the ratio of labor's marginal product in the two sectors. The reasoning is simple: The drop in food output in going from N to N' is (roughly) equal to labor's marginal product in producing food times the quantity of labor lost to the clothing sector. The increase in clothing output is equal to labor's marginal product in producing clothing times the extra labor hired. Because the amount of labor leaving the food sector equals the amount added to clothing production, our assertion is proved:

> *The slope of the transformation schedule equals (minus) labor's marginal product in food divided by its marginal product in producing clothing.*

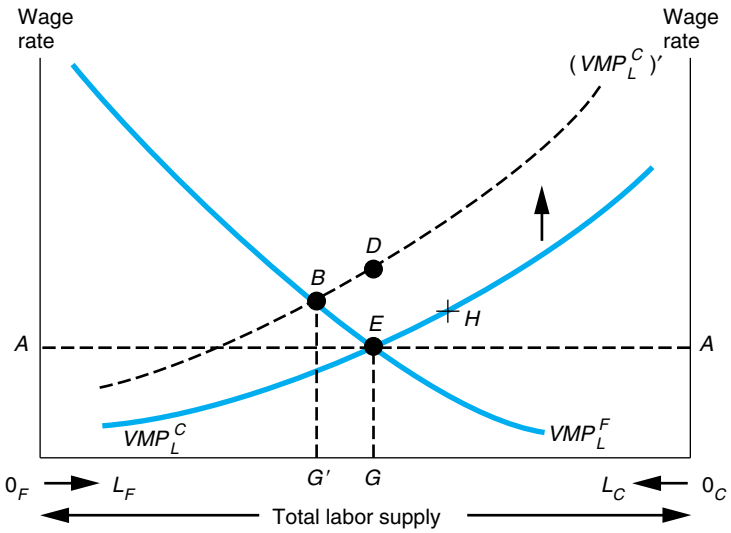
And such a ratio increases as more clothing is produced. The closed-economy equilibrium point (N) is located at the point where indifference curve, y_0, is tangent to the transformation schedule. The common slope at N reflects the relative price of clothing.

The next diagram we consider, Figure 5.2, is extremely useful in examining how price changes and/or alterations in factor endowments bring about a change in the internal distribution of incomes. This diagram focuses on the equilibrium in the country's labor market, a state of affairs in which the value of labor's marginal product in both sectors is equal to the prevailing wage rate and all labor is fully employed. Suppose both commodity prices are given initially. The value of the marginal product of labor in food schedule (the VMP_L^f curve) is declining with increases in the quantity of labor (L_F) used to produce food. In this "back-to-back" diagram, the schedule for

FIGURE 5.2

Wage Rate Determination

Equilibrium wages (at *A*) equate the values of the marginal product of labor in the two sectors by labor allocation at *G*. If free trade raises clothing's price, labor shifts out of food into clothing (from *G* to *G'*). The wage rate rises but not as much as clothing's price.



the value of the marginal product of labor in producing clothing (the VMP_L^C curve) is drawn from right to left, with L_C measured leftward from the "labor in clothing" origin, 0_C. The base of the diagram reflects the total labor supply, so any point on the horizontal axis reveals the allocation of labor between sectors. For example, the initial equilibrium assigns 0_FG units of labor to food production and the remainder to clothing because such an allocation serves to equate the value of labor's marginal product in the two sectors, and thus to determine the equilibrium wage rate (0_FA). Each of the specific factors, land and capital, receives the amount by which total revenue exceeds wage payments in the sector employing that factor.

5.3 Outputs and Income Distribution with Free Trade

When this economy is opened up to trade, which factors of production benefit? Could all benefit? If not, which lose? Is it possible to identify each group unambiguously? We make use of Figures 5.1 and 5.2 in tracing, step by step, the impact on an economy initially in autarky. Suppose clothing is relatively expensive on world markets, so that output responds as shown by the movement from N to N' in Figure 5.1—clothing output expands. (As shown in Chapter 2, a new budget line is tangent at point N', allowing an indifference curve higher than the y_0 curve in Figure 5.1 to be reached with trade.) In Figure 5.2 we have illustrated this country's emergence into the world market by (arbitrarily) keeping the price of food (and thus the VMP_L^F schedule) unchanged and raising the price of clothing. If clothing's price is, say, 40 percent higher in world markets, the VMP_L^C schedule shifts upward by exactly 40 percent. The reason: Any given labor input into clothing (e.g., at an initial level of 0_CG) and the fixed background quantity of capital yield the same marginal *physical* product of labor, but a price increase of 40 percent implies a 40 percent higher *value* of the marginal product of labor.

If, in response to the price changes brought about by free trade, labor could *not* be reallocated between sectors, a 40 percent wage gap (DE) would be created in Figure 5.2. But such a gap serves as a signal to attract labor to clothing and out of the food sector. This process of reallocation alters marginal productivities in each sector, until allocation point G' is reached with the new wage rate $G'B$, representing an increase in nominal wages.

How do landlords, capitalists, and laborers react to the move to free trade?

1. Owners of capital are delighted by the new higher clothing price. As workers move into the clothing sector, the marginal physical product of capital increases. Add to this the price rise for clothing (40 percent) and the return to capital is twice blessed—it goes up by more than 40 percent.

2. Landlords are at the other end of scale. Stuck in the food sector, whose relative price is now lower, they are also forced by the market to pay more for labor as workers decamp for the clothing sector. Thus less labor is available per unit of land and the marginal physical product of land falls. The consequence: Land rentals fall relative to the price of food and even more so compared with the higher price of clothing. Landlords unambiguously lose. Their self-interest would be served by opposing free trade. Not all factors can gain by the move to free trade.

3. The fate of laborers is less extreme. As just seen, the land/labor ratio used to produce food increases as labor leaves the agricultural sector, so that wages rise in terms of food. But the price of clothing has increased more than the wage rate. In Figure 5.2 the price of clothing has risen by 40 percent, the ratio DE/EG. Wages have increased in the move from E to B, but by less than 40 percent. This confirms point 1, that the return to capitalists increases by more than 40 percent, and point 2, that landlords' returns fall, relative to the given price of food, because nominal wages have gone up. In each industry the price (and unit cost) change must be flanked by the relative changes in factor rewards for inputs used in that sector.

The preceding arguments show that changes in relative commodity prices have uneven impacts on the incomes of various categories of productive factors. The factor of production (labor in this setting) that has opportunities for employment in all sectors of the economy and is highly mobile may find its real position not significantly altered by changes in the terms of trade. However, specific factors (land and capital) are severely affected. A specific factor used only in the industry suffering from a fall in relative price has no other outlet for employment. Its low mobility ensures that its real return falls. By contrast, the specific factor in the favored industry (an owner of capital in the clothing sector) finds its return unambiguously increased. It is sheltered from increased competition because no similar factor exists in the other industry (no textile machines are available in the food industry) and benefits from the arrival of the newly attracted other factor (labor) that serves to raise capital's productivity.

Any government policy (for example, a tariff change) that serves to affect relative commodity prices will be viewed differently by various factor groups. Factors used only in the favored sector would strongly support the proposed measure. Factors used only in the rest of the economy would unambiguously lose. In the model there is a third category—a factor (such as labor) that is not affected much one way or the other by such

a policy. This is why political scientists find such a model useful in explaining why some sectors of the population do not bother voting on certain issues whereas others care deeply. Very few policies that have an impact primarily on relative commodity prices can be expected to gain widespread approval.

5.4 Growth in Factor Endowments

A nation's resource base need not remain static. Over time, one can expect the capital stock to rise, and perhaps more (or less) land to be brought into productive use. Population might grow, but this could be offset by shortening the work week or, in the opposite direction, by increased participation of both spouses in the marketplace or by an increase in the retirement age. As well, foreign investment could encourage capital accumulation or immigration might expand supplies of labor. How do such changes alter production choices and factor returns in an economy too small to have these supply changes affect world prices?

First, let us suppose that growth is confined to one of the specific factors. To be precise, consider for this small trading community the consequence of a 50 percent increase in the quantity of land available. The primary impact of such a change is to increase labor's productivity in producing food. At constant commodity prices this will entail a reallocation of labor resources and will bring in its wake a change in all factor returns and an outward shift in the community's production possibilities curve.

Figure 5.3 reproduces the initial equilibrium at E shown in Figure 5.2. Whereas the commodity price rise shown in Figure 5.2 depicts the value of labor's marginal product curve shifting *upward* by a given percentage amount, a rise of 50 percent in the quantity of land available would be illustrated in Figure 5.3 by a *rightward* shift of 50 percent in the schedule showing the value of labor's marginal product in producing food. The reasoning behind this shift is based on the assumption that returns to scale are constant and that commodity prices are being kept fixed. Therefore, if the quantity of labor used in the food sector were to be raised by 50 percent when the land supply is raised 50 percent, the marginal product (and value of the marginal product) of labor would remain unchanged; a 50 percent increase in both labor and land raises output by exactly 50 percent but leaves marginal physical products the same. Such a shift encourages labor to move out of clothing into food, and the equilibrium value of the wage rate is pushed upward to point B in Figure 5.3.

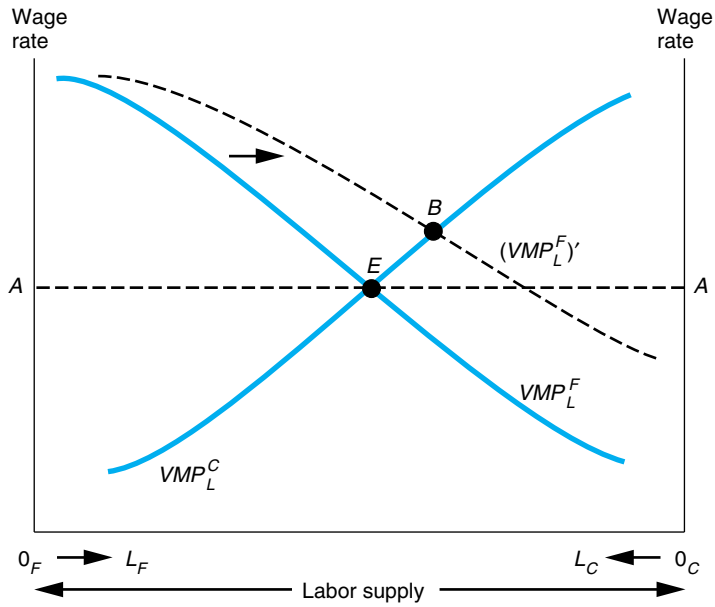
How is this change reflected in the country's transformation schedule? Suppose the economy in initial trade is at point N' in Figure 5.1, and suppose that the relative commodity price there remains constant when its endowment of land increases by 50 percent. The transformation schedule shifts outward but in a biased direction. With prices remaining constant, output of food expands and of clothing shrinks as this sector loses labor. Therefore in Figure 5.1 the new transformation curve (not drawn) would have the same slope as at N' at a point northwest of N'—with more food and less clothing.

Comparable changes occur if the capital supply should grow by 50 percent, with total land and labor supplies constant. The production-possibilities schedule shifts out

FIGURE 5.3

An Increase in Land

An increase of 50% in land shifts the VMP_L^F schedule rightward by 50% to $(VMP_L^F)'$, and increases the wage rate.



such that at constant commodity prices (and thus at a given slope for the transformation schedule) larger quantities of clothing are produced, with a smaller output in the food sector.

Labor growth at constant commodity prices leads to a more balanced expansion of both outputs. The base in Figure 5.3 would have to be enlarged. Keep the VMP_L^F schedule anchored to the 0_F origin, and the VMP_L^C schedule anchored to the 0_C origin. Thus an increase in the labor force would slide these schedules farther apart, serving to decrease the equilibrium wage rate. Each sector would respond by hiring more labor at the lower wage; outputs in both sectors would increase.

The effect of a change in factor endowments on factor prices as of a given set of commodity prices is both clear and not surprising: Any increase in land or capital serves to increase the wage rate and thus to drive down the returns to *both* specific factors. By contrast, an increase only in the economy's labor force serves to lower the wage rate and drive up the returns to both land and capital.

5.5 Consequences for Political Economy

These remarks on the effects of price changes and endowment changes lead to a strong set of results for the effects of trade on the distribution of income, results that have significant consequences for questions of political economy:

1. If factor endowments change (say via immigration) but world commodity prices remain constant, the fortunes of the specific factors (land and capital) rise or fall together and are opposed to those of the mobile factor (labor).

2. By contrast, if commodity price ratios in world markets change (and endowments remain constant), the returns to the specific factors are driven widely apart, whereas the return to mobile labor is relatively unaffected. If the relative price of clothing increases, capitalists unambiguously gain and landlords lose.

The first generality suggests a natural political alliance between landlords and capitalists in small, but growing, communities immersed in a trading world. One would expect a mutual interest of landlords and capitalists in legislation designed to encourage immigration of labor, whereas workers already in the country might oppose immigration. In the 1920s the United States imposed tight immigration restrictions, largely because of pressure from labor unions. In Australia, more liberal immigration policy is supported both by capitalists and by landholders, although trade unions find it in their interests to control such inflows. As Europe boomed in the decades after World War II, the American labor movement was often outspoken in its criticism of U.S. capital flows lured by burgeoning European markets.

The second generality suggests that if the legislation under consideration concerns relative commodity prices, landlords and capitalists would be diametrically opposed. A classic historical example concerns the Corn Laws in nineteenth-century Britain. Parliamentary overrepresentation of the landed gentry allowed laws that prevented the importation of cheap grains. After 1832 and the Reform Bill, parliamentary representation of industrialists (and labor) expanded. By 1846 the movement to freer trade was in full swing. The interests of capitalists were clear. Lower food prices would drive workers off the land and serve to lower the industrial wage, thus leading to greater profits.[1] A current analogy is found in present-day Japan, which has been highly restrictive in its tolerance of agricultural imports. (Japanese rice is over four times as expensive as that found in the world market.) The United States, ever anxious to improve its bilateral trade balance with Japan, has loudly denounced these agricultural trade restrictions. But, perhaps, American manufacturers who compete with Japanese exporters would not be pleased if restrictions were loosened, and thus allowed workers in Japan to receive nominal pay cuts while enjoying higher real wages as food prices fall. Larger agricultural imports into Japan could also lead to greater Japanese exports of manufactures. Japanese landlords and industrialists are at odds over these trade restrictions, and, as in the case of nineteenth-century Britain, major changes may require political reforms to dilute the power of rural areas.

5.6 The Pattern of Trade

In some respects, the pattern of trade in this setting should be easy to predict. Countries with relatively large amounts of land will export food; countries with relatively large amounts of capital will export clothing. The close identification of these two factors, land and capital, with unique outputs, food and clothing, makes obvious the logic

[1]The wage would not fall as much as the price of food.

whereby production patterns are linked to the underlying factor endowment comparison between countries. The setting we examine in Chapter 6 is less obvious because there each factor is utilized at least to some extent in both industries. Nonetheless, the bias imparted to production patterns emanating from inter-country differences in supplies of productive factors will still prevail. However, other features of demand and supply also have a bearing on the equilibrium pattern of trade:

1. *Tastes.* Even if the home country has a relatively large supply of capital and thus a bias to produce relatively large quantities of clothing if home and foreign countries face a common set of commodity prices with free trade, differences in tastes could affect the trade pattern. For example, a strong taste bias for clothing at home could result in the home country being a relatively expensive source of clothing, so that with trade it imports this item.
2. *Technology.* The Ricardian model of Chapter 4 emphasized the role of differences in technology in dictating patterns of trade. The concepts of relative demand and relative supply, as illustrated in Figure 2.9, are appropriate in showing how differences in endowments or technology play a role in determining trade patterns. In that situation, the foreign relative supply curve for food, which lies to the right of the home relative supply curve, could reflect an underlying, higher relative endowment of land compared with capital in the foreign country. Or, it might be the case that foreign food technology is relatively superior; points A and A^* illustrate that for comparable relative output proportions the relative cost of producing food is lower abroad. Endowment differences and technology differences may reinforce each other. Alternatively, they could push costs in opposite directions.

Finally, we have yet to comment on the consequences of one country having a relatively large labor force. Does this bias the likely pattern of trade? The answer to this question is more subtle. We have already shown that an expansion of the labor force shifts the production possibilities schedule outward, such that at the same terms of trade, more of both commodities will be produced. Whether the ratio of their production is altered, however, depends on the manner in which food and clothing technologies differ, both in the intensity with which they require labor and the elasticity of their demand for labor. Details are banished to the supplement to this chapter.

5.7 Alternative Interpretations: Specific Capital or Specific Labor

So far our discussion has portrayed labor as completely mobile between sectors, with capital only used to produce clothing and land an input only in the food sector. But we can depart from this classical trilogy of land, labor, and capital, and suppose that land is an insignificant input into production. This frees us up to consider two alternative interpretations of this simple model.

In the first interpretation, suppose that two different types of capital are used in production—say textile capital in clothing and tractors in production of food, with labor still mobile between these two sectors. In considering the effect of world price changes on income distribution and outputs for a small open economy, contrast the results now

with those we discussed in Chapter 4's Ricardian model. If the relative price of clothing increases in world markets, labor is drawn to this sector from the food industry. The wage rate rises in terms of food, but falls in terms of clothing—the kind of intermediate result we found for mobile labor in Figure 5.2. The return to each kind of capital is much different in the two sectors: The rental on textile machinery rises by more than any price, and the return to tractors used to produce food falls. These *rents* on capital serve as shock absorbers, as seen by the comparison with a Ricardian labor-only model. In the latter case, suppose initially the economy produces both goods before the price of clothing increases. After the price rise the food sector would be completely wiped out, unable to compete at the new world price. In the present case, changes in rents on specific capitals absorb the price shocks so that some food production can still take place. This comment proves relevant to the next section's discussion of the so-called Dutch Disease.

Trade and Unskilled Wage Rates

Consider, now, an alternative scenario—one in which all capital is completely mobile between sectors (e.g., computers), but labor is no longer homogeneous. Suppose some part of the labor force has "skills" while the remainder is unskilled. To nail things down, suppose skilled labor is used to produce clothing and unskilled labor to produce food—with homogeneous and mobile capital used in both sectors. Furthermore, suppose clothing is this country's export industry and that changes in world prices take place such that the price of clothing increases and food's price remains constant. What is the consequence for local income distribution? The real return to capital does not change very much, but the fates of skilled and unskilled labor are vastly different. The real wage for skilled workers goes up, while that for the unskilled falls. This scenario, whereby changing prices on world markets cause grief for a country's unskilled labor force but not for skilled workers, is often invoked in describing the fate of labor in the United States in the past three decades. Of course, other factors may play a key role, such as changes in technology that favor the use of skilled workers relative to the unskilled.

In both of these alternatives there is a time dimension suggested, since specific capital does wear out and new capital can take different forms. That is, specificity may be a short-run state of affairs, whereas in the long run capital is in effect mobile between sectors. As well, with time unskilled labor may be able to acquire skills through education or experience, so that specificity here is also a short-run phenomenon. Chapter 6 builds on this theme.

5.8 Dutch Disease

The several energy crises of the past few decades, along with the associated increases in the prices of some world-traded products and resources, have led to radical internal stresses in the economic sectors producing commodities whose world prices have not changed much. In Europe this kind of phenomenon came to be called the Dutch Disease. The name referred specifically to the rapid development in the Netherlands of the sector producing natural gas and the resulting squeeze put on other traditional

export sectors of the Dutch economy. Similarly, in Norway and Great Britain, rapid exploitation of North Sea oil deposits created severe hardships for manufacturing sectors that competed in world markets. Much less disruption was brought about in the sectors servicing purely local markets—the nontraded sector.[2]

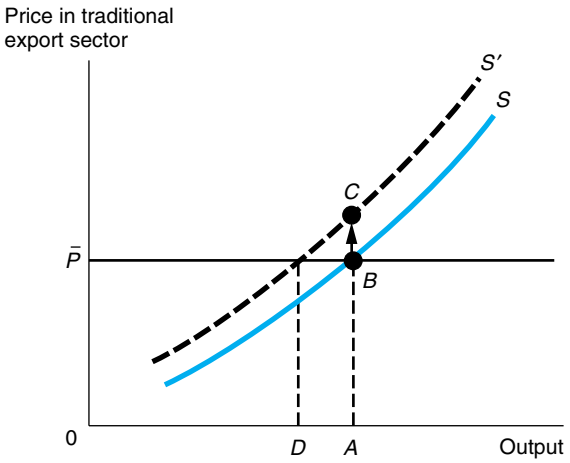
The simple model developed in this chapter can be utilized to reveal strategic features of this phenomenon. Suppose a number of industries are producing for the world market. In each one of these, labor is drawn from a common pool (labor is the mobile factor) and combined with another factor specific to that sector and in fixed supply. Let each sector have its own supply of capital equipment (and managerial expertise) that is uniquely designed for use in that sector. Suppose the world price of the output in one of these sectors increases. As already outlined, the main features of the food-clothing model generalize readily to this multisector case.[3] In particular, returns to factors specifically used in the favored (booming) traded sector increase by more than price. More crucially, the nominal wage rate is bid up, and this increase in wages squeezes all the other traded sectors that have not benefited by a price increase. In Chapter 4's Ricardian model with fixed labor coefficients, a wage rise would cause the complete collapse of any traded sector facing fixed world prices. Here the industry may survive, but only as long as lower returns are accepted by specific factors. Higher wage rates triggered by the rise in price in the booming sector put the squeeze on profits (or returns to specific capital and management) in any other traded sector.

Figure 5.4 illustrates the case of the Dutch Disease. A typical, traditional export sector facing a constant price, $\bar{P}$ on world markets has an upward-sloping supply curve,

FIGURE 5.4

The "Dutch Disease"

A boom in a new export sector raises wages, which shifts costs upward for a traditional export sector. Returns to capital are squeezed and output falls.



[2]An analytic treatment of some aspects of this issue is found in W. M. Corden and J. Peter Neary, "Booming Sector and De-Industrialization in a Small Open Economy," *Economic Journal* (December 1982): 825–848.
[3]Formal extensions are found in R. W. Jones, "Income Distribution and Effective Protection in a Multi-Commodity Trade Model," *Journal of Economic Theory* (August 1975): 1–15.

S, as increases in output are achieved by combining more labor with a fixed quantity of capital. The presumed boom in another export sector pushes up the wage rate and, through this connection, affects costs throughout the rest of the economy. For this traditional export sector, the supply curve shifts up to *S′*, the returns to the specific factor are squeezed, and output is lowered from 0*A* to 0*D* if the sector does not benefit from a rise in price.

The Fate of the Nontraded Sector

The discussion of the Ricardian model concluded with the introduction of the concept of a nontraded sector, an industry producing a commodity that can be neither exported nor imported because of high costs of transport. Suppose such a sector is added here. When one export sector expands, pushing up wage rates, the nontraded sector also experiences a cost increase. However, for nontraded goods the price to consumers can be raised. If there were no shift in demand, these cost increases could be partially passed on to consumers, with output reduced. The situation is further alleviated for nontradables because the demand curve shifts to the right. Why? With an export boom caused by a price rise, the community's real income expands with the favorable movement in the terms of trade. This will partly spill over to increased demand in the nontradable sector. In addition, local demand might increase as a consequence of a direct substitution effect away from the exportable that has risen in price toward other markets.

Much the same story can be told if, instead of a price rise in one traded goods sector, there is technical progress (as illustrated in Chapter 4 for the Ricardian model) or there are new discoveries (such as North Sea oil).

The role of the doctrine of *comparative advantage* is crucial in understanding the phenomenon of the Dutch Disease. A country exports commodities in which it possesses a comparative advantage. It may lose such an advantage in some commodities even if the technology in that sector is unchanged, if in another sector its technology (or price) improves. In the present model the route through which traditional sectors get squeezed is a rise in the wage rate. Although the model is not explicitly geared to handle the phenomenon at this stage, another avenue through which traditional traded sectors can be affected is the exchange rate. British manufacturers of commodities enjoying an export market were hit at the end of the 1970s by a strengthening of the British pound, caused in part by anticipation of future oil revenues from North Sea discoveries. These same discoveries caused concern in Norway that wages might rise and threaten the competitive position of other Norwegian industries. The Dutch were not alone in their concerns.

5.9 Summary

This chapter presents one of the classic models of production—a model in which diminishing returns describe the attempt of any sector to increase output by applying more labor to a fixed quantity of another factor specific to that sector. Commodities

differ in their factor demands, clothing makes no use of land and food does not require capital. That is, factors of production differ in their degree of mobility: Labor is costlessly transferable from sector to sector at a common wage, whereas land and capital are each specific.

This description of an economy is rich in its conclusions for a community engaged in international trade:

1. The internal distribution of income is vitally affected by any change in relative commodity prices. A productive factor specifically tied to some occupation (e.g., land in the production of food) unambiguously gains by an increase in the relative price of the commodity in whose production it is employed. This price increase will cause other specific factors to lose in real terms. This feature of the model, by itself, predicts that any political decision within a community that threatens to affect commodity prices (such as tariff legislation) will arouse ardent support on the part of some and strong opposition from others, as well as fairly widespread apathy from groups not vitally concerned. The mobile factor is less affected by commodity price changes because it can move from sector to sector. This discrepancy in interests can be read in the historical record of almost any significant move concerning trade. Changes in trade policy are apt to prove divisive, and this chapter shows the lines of division running along the characteristics that distinguish one productive factor from another.

2. Income distribution is also affected by growth. Not surprisingly, greater supplies of a factor tend to depress its return. If commodity prices are largely determined by world markets, there is a natural alliance among specific factors (landlords and capitalists) to raise their own returns by encouraging immigration of nonspecific labor.

3. The composition of outputs is quite sensitive to changes in a community's underlying factor endowment base. This is especially true for changes in specific factors. A community relatively heavily endowed with land will tend to have a comparative advantage in producing land-using food; equally, a community heavily endowed with capital will tend to have a comparative advantage in producing capital-intensive clothing. The pattern of world trade is closely linked to wide differences in resource endowments.

4. Trade encourages resources to move into sectors in which an economy enjoys a comparative advantage. Unlike the Ricardian model of Chapter 4, a country may nonetheless still support import-competing industries. The law of diminishing returns helps explain how a small amount of production may prove competitive, even though the community relies on imports to provide the bulk of its consumption of some items.

5. All the essential features of the two-commodity model remain for economies characterized by a wide variety of productive activities if in each industry use is made of some factor of production available in nationwide markets (e.g., labor) as well as other productive factors specifically tied to that industry. In particular, any

change in relative prices of traded commodities or change in technology or discoveries of new resources is apt to have radical repercussions in various sectors of the economy.

The Dutch Disease describes how a favorable change in conditions affecting one tradable sector can adversely affect other tradable sectors by squeezing their profits (or returns to specific factors). For a small, open economy, cost increases may successfully be passed on to consumers in sectors protected from foreign competition by high costs of transport, even though such relief is not available in traditional export- or import-competing sectors.

Finally, note that all the changes discussed in this chapter, whether in commodity prices, endowments, or technology, create losers as well as winners within countries. This is what is absent in Chapter 4, where the focus instead was on inter-country gains and losses. The specific-factors model yields many realistic responses of internal income distribution to the forces of globalization. As we see in the next chapter, a somewhat different scenario is similar in suggesting that disturbances in international markets are capable of creating both winners and losers and an attendant disharmony in opinions about trade policy.

CHAPTER PROBLEMS

1. The discussion of the Ricardian model in Chapter 4 introduced the concept of an input-output coefficient, a_{Lj}. The reciprocal of this ($1/a_{LF}$ in the food sector, for example) referred to the average product of labor. In a diagram that shows the marginal product of labor, draw in a curve showing the *average* product of labor. How can land rents as well as total wages be shown in such a diagram?
2. With reference to Figures 5.2 and 5.3 it was suggested that a 10 percent increase in the price of food would shift the VMP_L^F curve upward by 10 percent, and a 10 percent increase in the supply of land would (at constant food and clothing prices) shift the VMP_L^F curve rightward by 10 percent. Do these have equivalent effects on the wage rate? Which kind of change would workers prefer? Which would capitalists prefer?
3. Explain why Australian capitalists and landlords probably favor the same policy toward immigration. Given the traditional export position of Australian wool in world markets, how might owners of sheep stations be expected to react to an increase in domestic prices of manufactures brought about by a tariff? Through what mechanism might land rents be disturbed?
4. Contrast the effect on land rents of an increase in a nation's supply of land coupled simultaneously with a reduction in its supply of capital if:
   a. The country cannot engage in world trade.
   b. The country does trade freely with a much larger world market.
   Answer the same two-part question if the nation's supply of land remains constant while its supply of capital increases.

SUGGESTIONS FOR FURTHER READING

Jones, Ronald W. "A Three-Factor Model in Theory, Trade, and History." In J. Bhagwati, R. Jones, R. Mundell, and J. Vanek, eds., *Trade, Balance of Payments and Growth* (Amsterdam: North-Holland, 1971), Chapter 1, reprinted in R. W. Jones, *International Trade: Essays in Theory* (Amsterdam: North-Holland, 1979). Sets out the basic model and explores some applications to trade and economic theory.

Mayer, Wolfgang. "Short-Run and Long-Run Equilibrium for a Small Open Economy," *Journal of Political Economy,* 82 (September/October 1974): 955–968. Interpretation of the specific-factors model as a short-run version of the Heckscher-Ohlin model in Chapter 6.

APPENDIX

The Transformation Schedule

A four-quadrant diagram can fill in details for the shape of the transformation schedule for an economy possessing fixed overall amounts of three distinct productive factors: labor, land, and capital. Labor is used to produce both food and clothing; land is used only in food; and capital is specific to the clothing sector. These assumptions suffice to rule out the phenomenon associated with the Ricardian model, whereby an industry could expand by hiring more labor without driving up unit costs. Instead, production possibilities reflect increasing costs.

The bowed-out production possibilities curve is displayed in quadrant I of Figure 5.A.1, using the relationships drawn in quadrants II, III, and IV. Note especially:

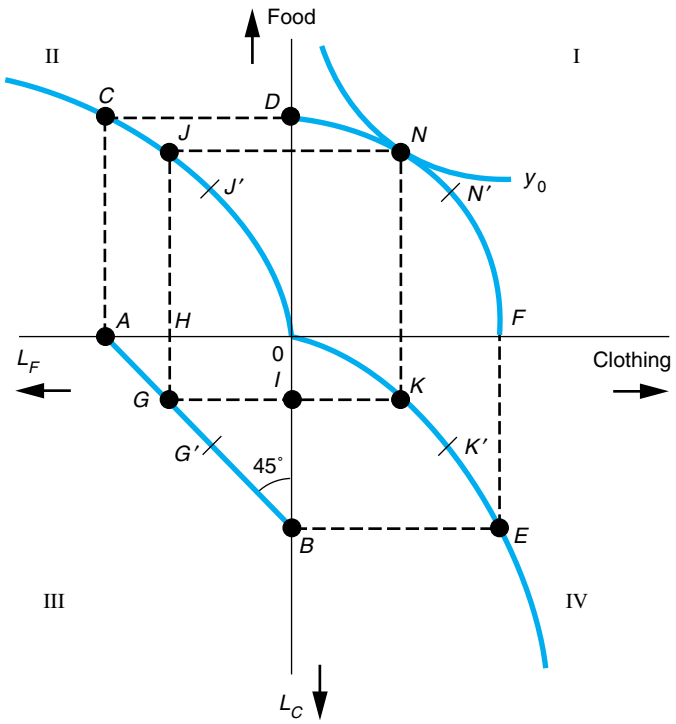
1. Quadrant III shows a downward-sloping 45° line to illustrate the full employment of the economy's total (fixed) labor resources, either to produce food (shown leftward from the origin) or to produce clothing (measured downward from the origin).
2. The curves showing total labor productivity for the two industries (quadrants II and IV) illustrate diminishing returns to labor as more is applied to the fixed amount of the cooperating factor (land in the case of food and capital in the case of clothing).

The production possibilities schedule in quadrant I reflects increasing opportunity costs. Endpoint *D* shows the maximum amount of food that could be produced if all the economy's labor force were employed in food. (0*D* also is shown by *AC* in quadrant II.) Similarly, endpoint *F* is the maximum clothing output, obtainable if labor force 0*B* is used to produce *BE* units of clothing (quadrant IV). Any intermediate labor allocation, such as *G* in quadrant III, results in food output (*HJ*, quadrant II) and in clothing output (*IK*, quadrant IV), which is shown as point *N* on the transformation schedule

FIGURE 5.A.1

Production Possibilities with Diminishing Returns and Increasing Opportunity Costs

The production possibilities curve in quadrant I is derived by picking a labor allocation along the full-employment line (quadrant III) and displaying the outputs of food (quadrant II) and clothing (quadrant IV) obtainable in quadrant I. Diminishing returns lead to increasing opportunity costs.



(quadrant I). Other points can be derived in similar fashion (e.g., labor allocation G' yields output bundle N'—just complete the rectangle). Consider the movement from N to N' that accompanies the labor reallocation from G to G'. As extra labor is poured into the clothing sector, diminishing returns decrease labor's productivity (in clothing) at the margin. Meanwhile, the departure of labor from the food industry serves to raise the productivity of the remaining food workers. On both counts, the relative cost of producing clothing increases (the transformation schedule becomes steeper). The transformation schedule bows out because labor is subject to diminishing returns in each sector, and the cooperating inputs (land for food, capital for clothing) are fixed in supply.