CHAPTER 6

The Standard Trade Model

Previous chapters developed several different models of international trade, each of which makes different assumptions about the determinants of production possibilities. To bring out important points, each of these models leaves out aspects of reality that the others stress. These models are:

- *The Ricardian model.* Production possibilities are determined by the allocation of a single resource, labor, between sectors. This model conveys the essential idea of comparative advantage but does not allow us to talk about the distribution of income.
- *The specific factors model.* This model includes multiple factors of production, but some are specific to the sectors in which they are employed. It also captures the short-run consequences of trade on the distribution of income.
- *The Heckscher-Ohlin model.* The multiple factors of production in this model can move across sectors. Differences in resources (the availability of those factors at the country level) drive trade patterns. This model also captures the long-run consequences of trade on the distribution of income.

When we analyze real problems, we want to base our insights on a mixture of these models. For example, in the last two decades one of the central changes in world trade was the rapid growth in exports from newly industrializing economies. These countries experienced rapid productivity growth; to discuss the implications of this productivity growth, we may want to apply the Ricardian model of Chapter 3. The changing pattern of trade has differential effects on different groups in the United States; to understand the effects of increased trade on the U.S. income distribution, we may want to apply the specific factors (for the short-run effects) or the Heckscher-Ohlin (for the long-run effects) models of Chapters 4 and 5.

In spite of the differences in their details, our models share a number of features:

1. The productive capacity of an economy can be summarized by its production possibility frontier, and differences in these frontiers give rise to trade.
2. Production possibilities determine a country's relative supply schedule.
3. World equilibrium is determined by world relative demand and a *world* relative supply schedule that lies between the national relative supply schedules.

Because of these common features, the models we have studied may be viewed as special cases of a more general model of a trading world economy. There are many important issues in international economics whose analysis can be conducted in terms of this general model, with only the details depending on which special model you choose. These issues include the effects of shifts in world supply resulting from economic growth and simultaneous shifts in supply and demand resulting from tariffs and export subsidies.

This chapter stresses those insights from international trade theory that are not strongly dependent on the details of the economy's supply side. We develop a standard model of a trading world economy, of which the models of Chapters 3 through 5 can be regarded as special cases, and use this model to ask how a variety of changes in underlying parameters affect the world economy.

LEARNING GOALS

After reading this chapter, you will be able to:

- Understand how the components of the standard trade model, production possibilities frontiers, isovalue lines, and indifference curves fit together to illustrate how trade patterns are established by a combination of supply-side and demand-side factors.
- Recognize how changes in the terms of trade and economic growth affect the welfare of nations engaged in international trade.
- Understand the effects of tariffs and subsidies on trade patterns and the welfare of trading nations and on the distribution of income within countries.
- Relate international borrowing and lending to the standard trade model, where goods are exchanged over time.

A Standard Model of a Trading Economy

The **standard trade model** is built on four key relationships: (1) the relationship between the production possibility frontier and the relative supply curve; (2) the relationship between relative prices and relative demand; (3) the determination of world equilibrium by world relative supply and world relative demand; and (4) the effect of the **terms of trade**—the price of a country's exports divided by the price of its imports—on a nation's welfare.

Production Possibilities and Relative Supply

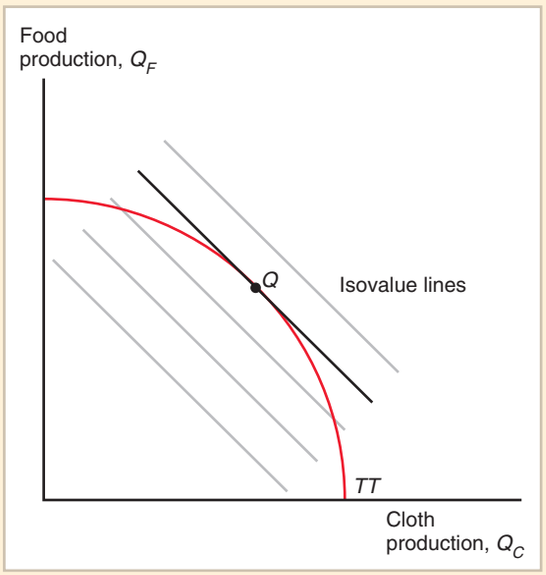
For the purposes of our standard model, we assume that each country produces two goods, food (F) and cloth (C), and that each country's production possibility frontier is a smooth curve like that illustrated by TT in Figure 6-1.[1] The point on its production possibility frontier at which an economy actually produces depends on the price of cloth relative to food, P_C/P_F. At given market prices, a market economy will choose production levels that

[1] We have seen that when there is only one factor of production, as in Chapter 3, the production possibility frontier is a straight line. For most models, however, it will be a smooth curve, and the Ricardian result can be viewed as an extreme case.

Figure 6-1

Relative Prices Determine the Economy's Output

An economy whose production possibility frontier is *TT* will produce at *Q*, which is on the highest possible isovalue line.



maximize the value of its output $P_C Q_C + P_F Q_F$, where Q_C is the quantity of cloth produced and Q_F is the quantity of food produced.

We can indicate the market value of output by drawing a number of **isovalue lines**—that is, lines along which the value of output is constant. Each of these lines is defined by an equation of the form $P_C Q_C + P_F Q_F = V$, or, by rearranging, $Q_F = V/P_F - (P_C/P_F)Q_C$, where V is the value of output. The higher V is, the farther out an isovalue line lies; thus isovalue lines farther from the origin correspond to higher values of output. The slope of an isovalue line is $-P_C/P_F$. In Figure 6-1, the highest value of output is achieved by producing at point Q, where TT is just tangent to an isovalue line.

Now suppose that P_C/P_F were to rise (cloth becomes more valuable relative to food). Then the isovalue lines would be steeper than before. In Figure 6-2a the highest isovalue line the economy could reach before the change in P_C/P_F is shown as VV^1; the highest line after the price change is VV^2, the point at which the economy produces shifts from Q^1 to Q^2. Thus, as we might expect, a rise in the relative price of cloth leads the economy to produce more cloth and less food. The relative supply of cloth will therefore rise when the relative price of cloth rises. This relationship between relative prices and relative production is reflected in the economy's relative supply curve shown in Figure 6-2b.

Relative Prices and Demand

Figure 6-3 shows the relationship among production, consumption, and trade in the standard model. As we pointed out in Chapter 5, the value of an economy's consumption equals the value of its production:

$$P_C Q_C + P_F Q_F = P_C D_C + P_F D_F = V,$$

where D_C and D_F are the consumption of cloth and food, respectively. The equation above says that production and consumption must lie on the same isovalue line.

The economy's choice of a point on the isovalue line depends on the tastes of its consumers. For our standard model, we assume that the economy's consumption

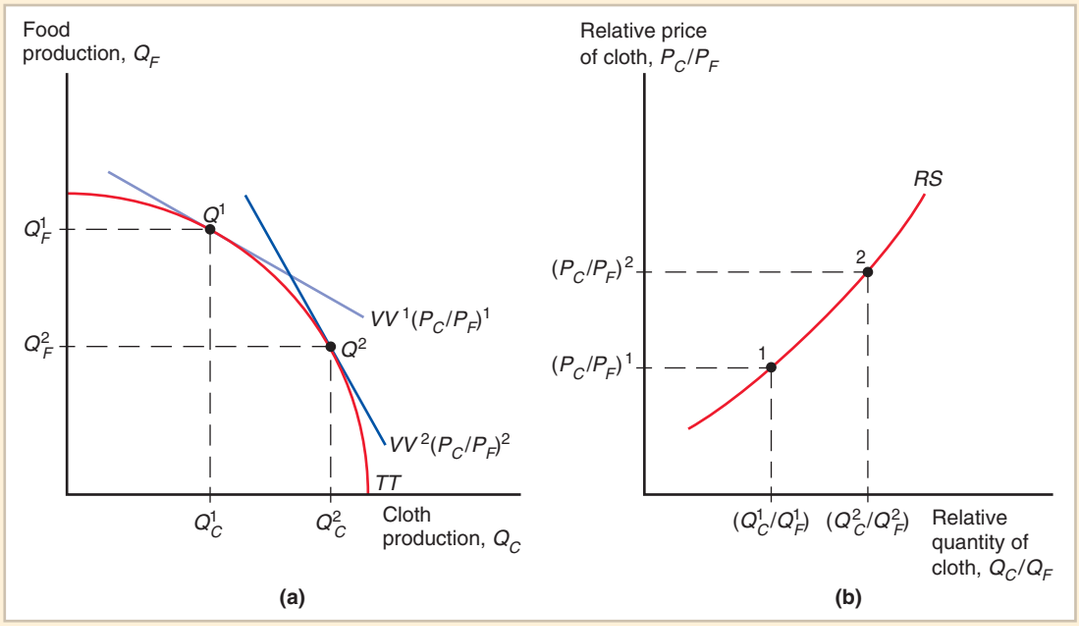


Figure 6-2

How an Increase in the Relative Price of Cloth Affects Relative Supply

In panel (a), the isovalue lines become steeper when the relative price of cloth rises from $(P_C/P_F)^1$ to $(P_C/P_F)^2$ (shown by the rotation from VV^1 to VV^2). As a result, the economy produces more cloth and less food and the equilibrium output shifts from Q^1 to Q^2. Panel (b) shows the relative supply curve associated with the production possibilities frontier TT. The rise from $(P_C/P_F)^1$ to $(P_C/P_F)^2$ leads to an increase in the relative production of cloth from Q_C^1/Q_F^1 to Q_C^2/Q_F^2.

decisions may be represented as if they were based on the tastes of a single representative individual.[2]

The tastes of an individual can be represented graphically by a series of **indifference curves**. An indifference curve traces a set of combinations of cloth (C) and food (F) consumption that leave the individual equally well off. As illustrated in Figure 6-3, indifference curves have three properties:

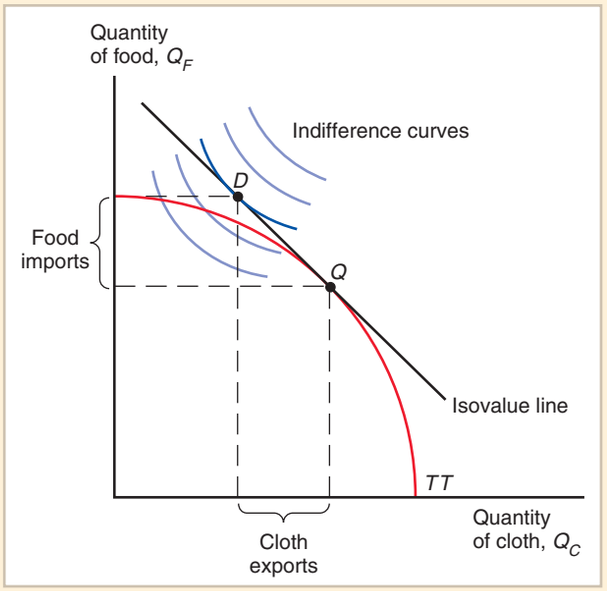
1. They are downward sloping: If an individual is offered less food (F), then to be made equally well off, she must be given more cloth (C).
2. The farther up and to the right an indifference curve lies, the higher the level of welfare to which it corresponds: An individual will prefer having more of both goods to less.
3. Each indifference curve gets flatter as we move to the right (they are bowed-out to the origin): The more C and the less F an individual consumes, the more valuable a unit of F is at the margin compared with a unit of C, so more C will have to be provided to compensate for any further reduction in F.

[2]There are several sets of circumstances that can justify this assumption. One is that all individuals have the same tastes and the same share of all resources. Another is that the government redistributes income so as to maximize its view of overall social welfare. Essentially, the assumption requires that effects of changing income distribution on demand not be too important.

Figure 6-3

Production, Consumption, and Trade in the Standard Model

The economy produces at point *Q*, where the production possibility frontier is tangent to the highest possible isovalue line. It consumes at point *D*, where that isovalue line is tangent to the highest possible indifference curve. The economy produces more cloth than it consumes and therefore exports cloth; correspondingly, it consumes more food than it produces and therefore imports food.



As you can see in Figure 6-3, the economy will choose to consume at the point on the isovalue line that yields the highest possible welfare. This point is where the isovalue line is tangent to the highest reachable indifference curve, shown here as point *D*. Notice that at this point, the economy exports cloth (the quantity of cloth produced exceeds the quantity of cloth consumed) and imports food.

Now consider what happens when P_C/P_F increases. Figure 6-4a shows the effects. First, the economy produces more *C* and less *F*, shifting production from Q^1 to Q^2. This shifts, from VV^1, to VV^2, the isovalue line on which consumption must lie. The economy's consumption choice therefore also shifts, from D^1 to D^2.

The move from D^1 to D^2 reflects two effects of the rise in P_C/P_F. First, the economy has moved to a higher indifference curve, meaning that it is better off. The reason is that this economy is an exporter of cloth. When the relative price of cloth rises, the economy can trade a given amount of cloth for a larger amount of food imports. Thus the higher relative price of its export good represents an advantage. Second, the change in relative prices leads to a shift along the indifference curve, toward food and away from cloth (since cloth is now relatively more expensive).

These two effects are familiar from basic economic theory. The rise in welfare is an *income effect*; the shift in consumption at any given level of welfare is a *substitution effect.* The income effect tends to increase consumption of both goods, while the substitution effect acts to make the economy consume less *C* and more *F.*

Figure 6-4b shows the relative supply and demand curves associated with the production possibilities frontier and the indifference curves.[3] The graph shows how the increase in the relative price of cloth induces an increase in the relative production of cloth (move from point 1 to 2) as well as a decrease in the relative consumption of cloth (move from

[3]For general preferences, the relative demand curve will depend on the country's total income. We assume throughout this chapter that the relative demand curve is independent of income. This is the case for a widely used type of preferences called homothetic preferences.

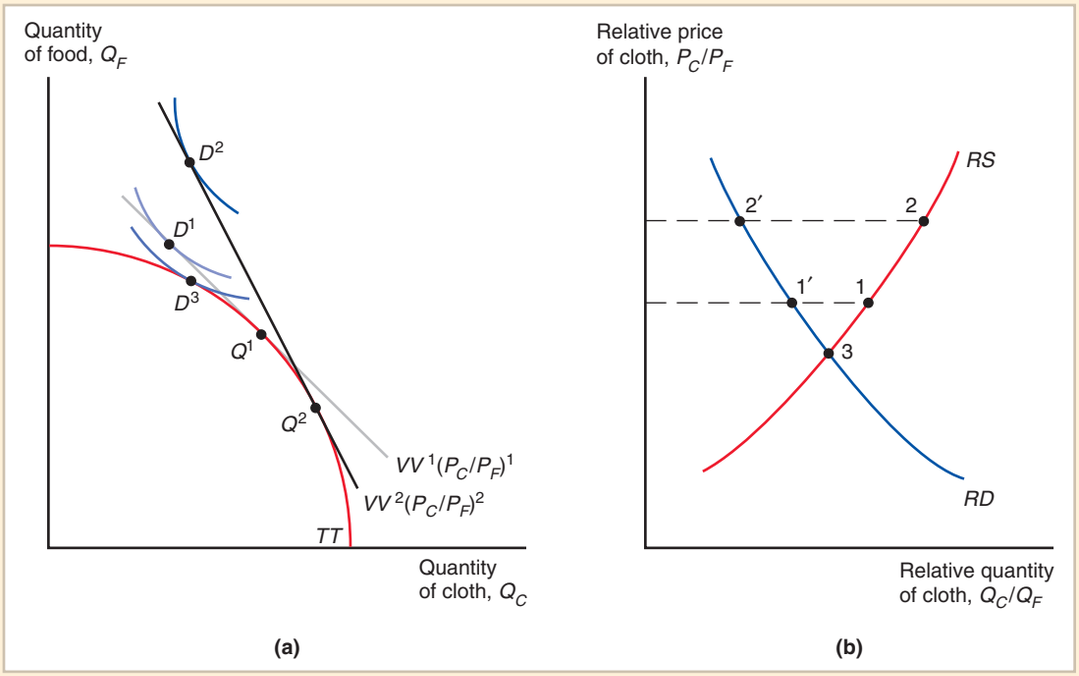


Figure 6-4

Effects of a Rise in the Relative Price of Cloth and Gains from Trade

In panel (a), the slope of the isovalue lines is equal to minus the relative price of cloth, P_C/P_F. As a result, when that relative price rises, all isovalue lines become steeper. In particular, the maximum-value line rotates from VV^1 to VV^2. Production shifts from Q^1 to Q^2 and consumption shifts from D^1 to D^2. If the economy cannot trade, then it produces and consumes at point D^3. Panel (b) shows the effects of the rise in the relative price of cloth on relative production (move from 1 to 2) and relative demand (move from 1′ to 2′. If the economy cannot trade, then it consumes and produces at point 3.

point 1′ to 2′). This change in relative consumption captures the substitution effect of the price change. If the income effect of the price change were large enough, then consumption levels of both goods could rise (D_C and D_F both increase); but the substitution effect of demand dictates that the *relative* consumption of cloth, D_C/D_F, decrease. If the economy cannot trade, then it consumes and produces at point 3 (associated with the relative price $(P_C/P_F)^3$).

The Welfare Effect of Changes in the Terms of Trade

When P_C/P_F increases, a country that initially exports cloth is made better off, as illustrated by the movement from D^1 to D^2 in Figure 6-4a. Conversely, if P_C/P_F were to decline, the country would be made worse off; for example, consumption might move back from D^2 to D^1.

If the country were initially an exporter of food instead of cloth, the direction of this effect would be reversed. An increase in P_C/P_F would mean a fall in P_C/P_F, and the country would be worse off: The relative price of the good it exports (food) would drop. We cover all these cases by defining the terms of trade as the price of the good a country initially exports divided by the price of the good it initially imports. The general statement, then, is that *a rise in the terms of trade increases a country's welfare, while a decline in the terms of trade reduces its welfare.*

Note, however, that changes in a country's terms of trade can never decrease the country's welfare below its welfare level in the absence of trade (represented by consumption at D^3). The gains from trade mentioned in Chapters 3, 4, and 5 still apply to this more general approach. The same disclaimers previously discussed also apply: Aggregate gains are rarely evenly distributed, leading to both gains and losses for individual consumers.

Determining Relative Prices

Let's now suppose that the world economy consists of two countries once again named Home (which exports cloth) and Foreign (which exports food). Home's terms of trade are measured by P_C/P_F, while Foreign's are measured by P_F/P_C. We assume that these trade patterns are induced by differences in Home's and Foreign's production capabilities, as represented by the associated relative supply curves in Figure 6.5a. We also assume that the two countries share the same preferences and hence have the same relative demand curve. At any given relative price P_C/P_F, Home will produce quantities of cloth and food Q_C and Q_F, while Foreign produces quantities Q_C^* and Q_F^*, where $Q_C/Q_F > Q_C^*/Q_F^*$. The relative supply for the world is then obtained by summing those production levels for both cloth and food and taking the ratio: $(Q_C + Q_C^*)/(Q_F + Q_F^*)$. By construction, this relative supply curve for the world must lie in between the relative supply curves for both countries.[4] Relative demand for the world also aggregates the demands for cloth and food across the two countries: $(D_C + D_C^*)/(D_F + D_F^*)$. Since there are no differences in preferences across the two countries, the relative demand curve for the world overlaps with the same relative demand curve for each country.

The equilibrium relative price for the world (when Home and Foreign trade) is then given by the intersection of world relative supply and demand at point 1. This relative price determines how many units of Home's cloth exports are exchanged for Foreign's food exports. At the equilibrium relative price, Home's desired exports of cloth, $Q_C - D_C$, match up with Foreign's desired imports of cloth, $D_C^* - Q_C^*$. The food market is also in equilibrium so that Home's desired imports of food, $D_F - Q_F$, match up with Foreign's desired food exports, $Q_F^* - D_F^*$. The production possibility frontiers for Home and Foreign, along with the budget constraints and associated production and consumption choices at the equilibrium relative price $(P_C/P_F)^1$, are illustrated in Figure 6-5b.

Now that we know how relative supply, relative demand, the terms of trade, and welfare are determined in the standard model, we can use it to understand a number of important issues in international economics.

Economic Growth: A Shift of the *RS* Curve

The effects of economic growth in a trading world economy are a perennial source of concern and controversy. The debate revolves around two questions. First, is economic growth in other countries good or bad for our nation? Second, is growth in a country more or less valuable when that nation is part of a closely integrated world economy?

In assessing the effects of growth in other countries, commonsense arguments can be made on either side. On one side, economic growth in the rest of the world may be good for our economy because it means larger markets for our exports and lower prices for our imports. On the other side, growth in other countries may mean increased competition for our exporters and domestic producers, who need to compete with foreign exporters.

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[4] For any positive numbers X_1, X_2, Y_1, Y_2, if $X_1/Y_1 < X_2/Y_2$, then $X_1/Y_1 < (X_1 + X_2)/(Y_1 + Y_2) < X_2/Y_2$.

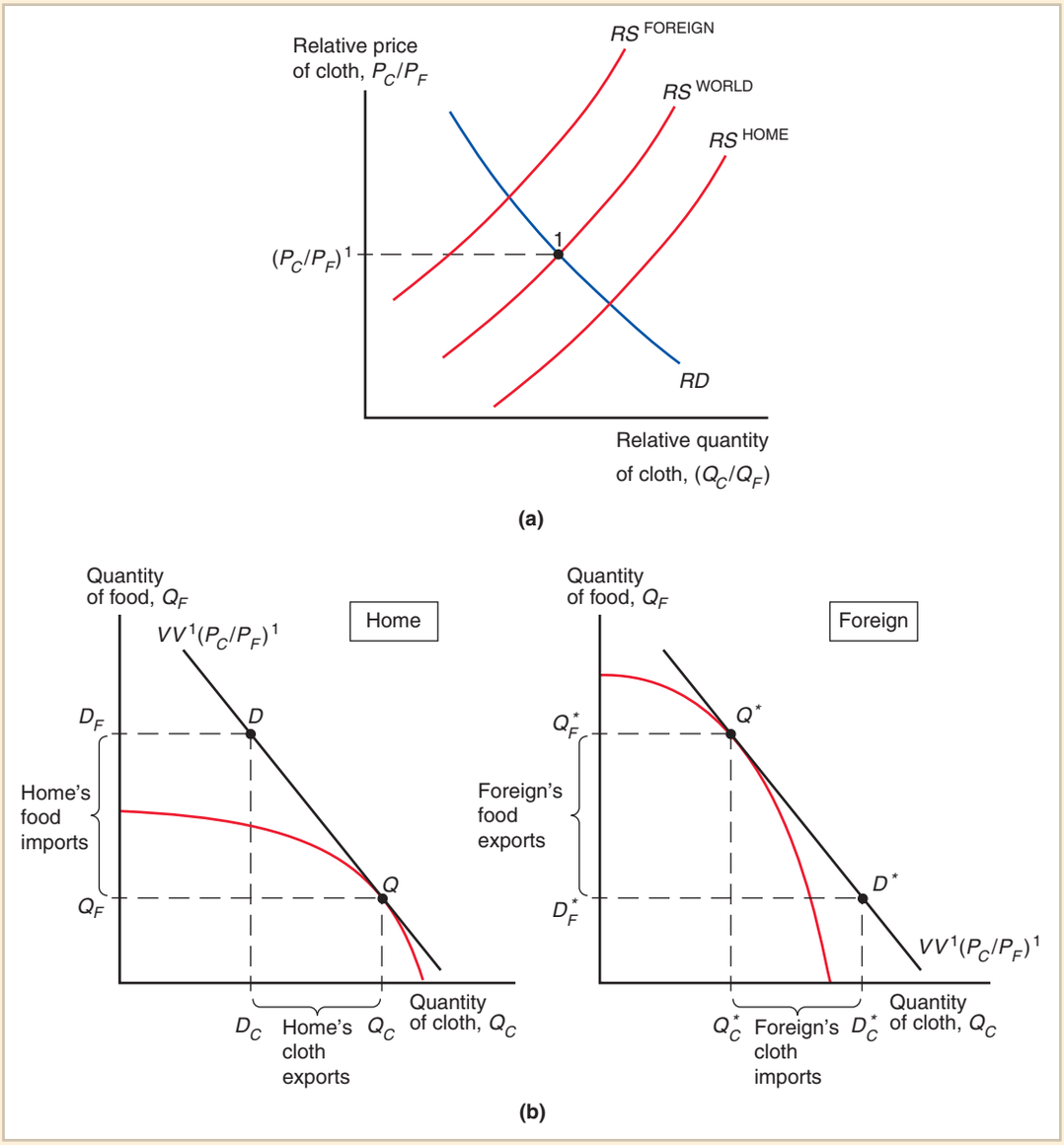


Figure 6-5

Equilibrium Relative Price with Trade and Associated Trade Flows

Home, Foreign, and world supply of cloth relative to food. Home and Foreign have the same relative demand, which is also the relative demand for the world. Panel (a) shows how the equilibrium relative price (here, $(P_C/P_F)^1$) is determined by the intersection of the world relative supply and demand curves. Panel (b) shows the associated equilibrium trade flows between Home and Foreign. At the equilibrium relative price $(P_C/P_F)^1$, Home's exports of cloth equals Foreign's imports of cloth; and Home's imports of food equals Foreign's exports of food.

We can find similar ambiguities when we look at the effects of growth at home. On one hand, growth in an economy's production capacity should be more valuable when that country can sell some of its increased production to the world market. On the other hand, the benefits of growth may be passed on to foreigners in the form of lower prices for the country's exports rather than retained at home.

The standard model of trade developed in the last section provides a framework that can cut through these seeming contradictions and clarify the effects of economic growth in a trading world.

Growth and the Production Possibility Frontier

Economic growth means an outward shift of a country's production possibility frontier. This growth can result either from increases in a country's resources or from improvements in the efficiency with which these resources are used.

The international trade effects of growth result from the fact that such growth typically has a *bias*. **Biased growth** takes place when the production possibility frontier shifts out more in one direction than in the other. Figure 6-6a illustrates growth biased toward cloth (shift from TT^1 to TT^2), while Figure 6-6b shows growth biased toward food (shift from TT^1 to TT^3).

Growth may be biased for two main reasons:

1. The Ricardian model of Chapter 3 shows that technological progress in one sector of the economy will expand the economy's production possibilities more in the direction of that sector's output than in the direction of the other sector's output.
2. The Heckscher-Ohlin model of Chapter 5 showed that an increase in a country's supply of a factor of production—say, an increase in the capital stock resulting from saving and investment—will produce biased expansion of production possibilities. The bias will be in the direction of either the good to which the factor is specific or the good whose production is intensive in the factor whose supply has increased. Thus the same considerations that give rise to international trade will also lead to biased growth in a trading economy.

The biases of growth in Figure 6-6a and 6-6b are strong. In each case the economy is able to produce more of both goods. However, at an unchanged relative price of cloth, the output of food actually falls in Figure 6-6a, while the output of cloth actually falls in Figure 6-6b. Although growth is not always as strongly biased as it is in these examples, even growth that is more mildly biased toward cloth will lead, *for any given relative price of cloth*, to a rise in the output of cloth *relative* to that of food. In other words, the country's relative supply curve shifts to the right. This change is represented in Figure 6.6c as the transition from RS^1 to RS^2. When growth is biased toward food, the relative supply curve shifts to the left, as shown by the transition from RS^1 to RS^3.

World Relative Supply and the Terms of Trade

Suppose now that Home experiences growth strongly biased toward cloth, so that its output of cloth rises at any given relative price of cloth, while its output of food declines (as shown in Figure 6-6a). Then the output of cloth relative to food will rise at any given price for the world as a whole, and the world relative supply curve will shift to the right, just like the relative supply curve for Home. This shift in the world relative supply is shown in Figure 6-7a as a shift from RS^1 to RS^2. It results in a decrease in the relative price of cloth from $(P_C/P_F)^1$ to $(P_C/P_F)^2$, a worsening of Home's terms of trade and an improvement in Foreign's terms of trade.

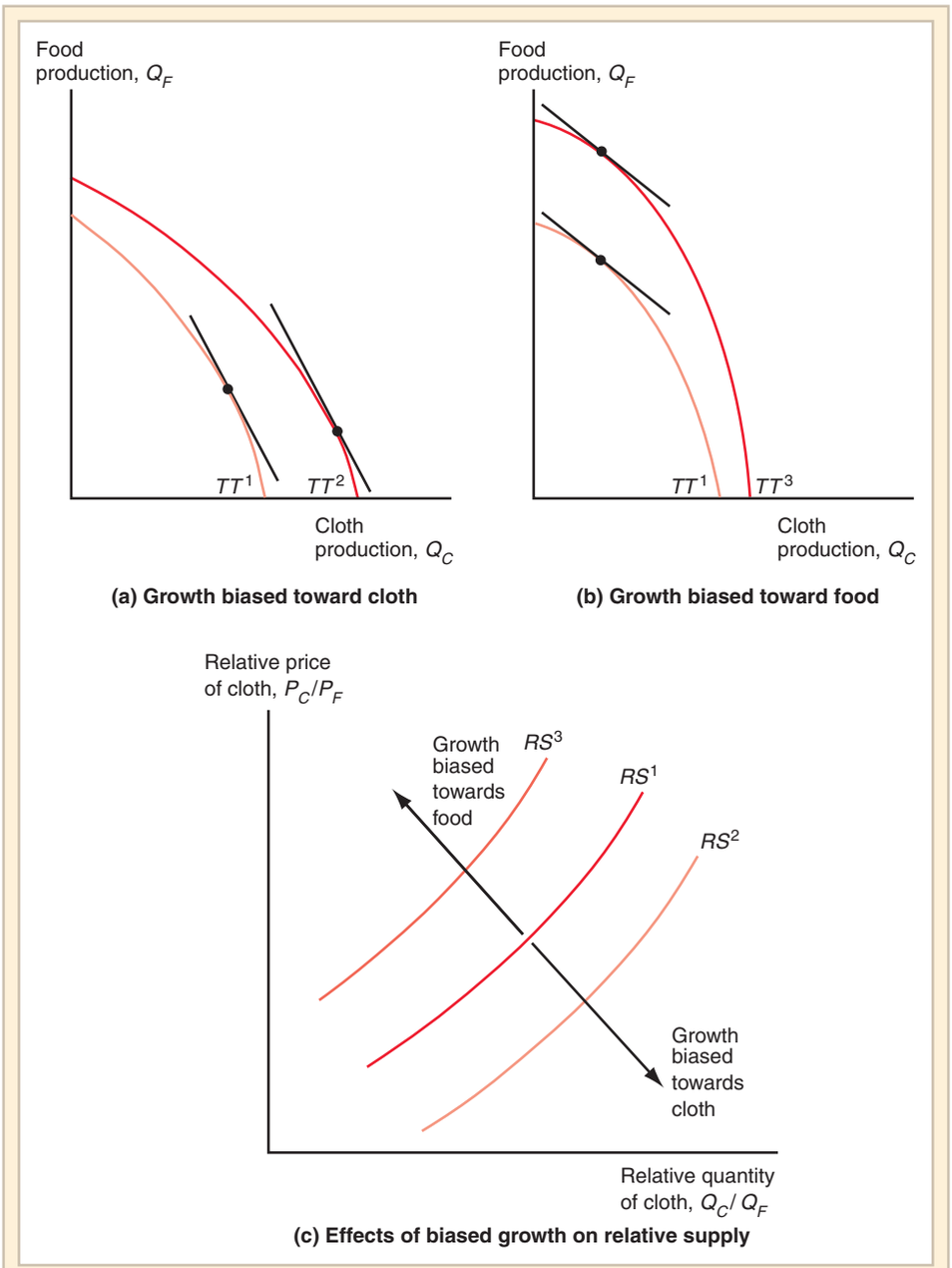


Figure 6-6

Biased Growth

Growth is biased when it shifts production possibilities out more toward one good than toward another. In case (a), growth is biased toward cloth (shift from TT^1 to TT^2), while in case (b), growth is biased toward food (shift from $TT^1$to TT^3). The associated shifts in the relative supply curve are shown in panel (c): shift to the right (from RS^1 to RS^2) when growth is biased toward cloth, and shift to the left (from RS^1 to RS^3) when growth is biased toward food.

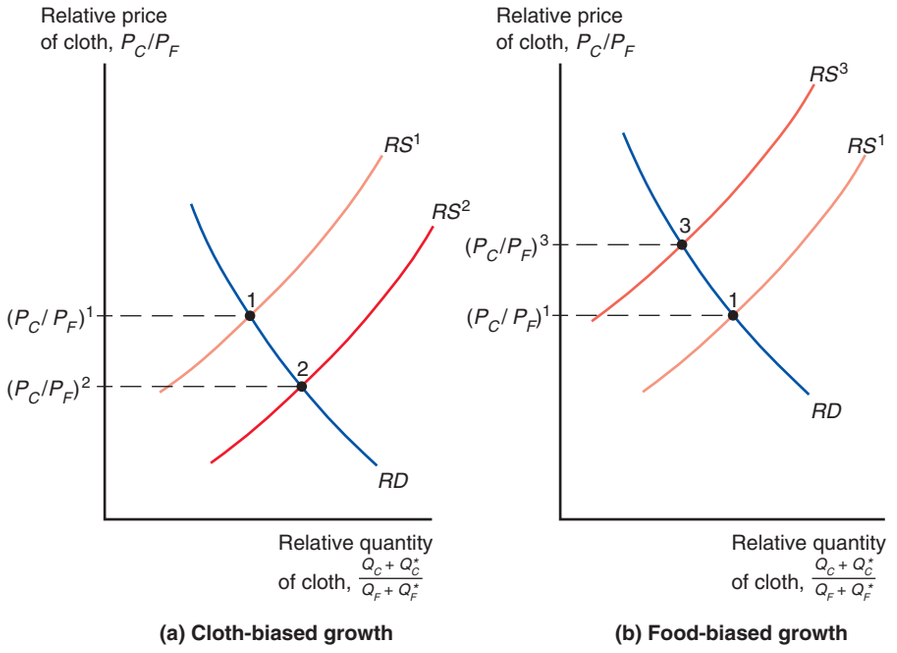


Figure 6-7

Growth and World Relative Supply

Growth biased toward cloth shifts the *RS* curve for the world to the right (a), while growth biased toward food shifts it to the left (b).

Notice that the important consideration here is not *which* economy grows but rather the bias of that growth. If Foreign had experienced growth strongly biased toward cloth, the effect on the world relative supply curve and thus on the terms of trade would have been similar. On the other hand, either Home or Foreign growth strongly biased toward food (as shown in Figure 6-6b) will lead to a *leftward* shift of the *RS* curve (RS^1 to RS^3) for the *world* and thus to a rise in the relative price of cloth from $(P_C/P_F)^1$ to $(P_C/P_F)^3$ (as shown in Figure 6-7b). This relative price increase is an improvement in Home's terms of trade, but a worsening of Foreign's.

Growth that disproportionately expands a country's production possibilities in the direction of the good it exports (cloth in Home, food in Foreign) is **export-biased growth**. Similarly, growth biased toward the good a country imports is **import-biased growth**. Our analysis leads to the following general principle: *Export-biased growth tends to worsen a growing country's terms of trade, to the benefit of the rest of the world; import-biased growth tends to improve a growing country's terms of trade at the rest of the world's expense.*

International Effects of Growth

Using this principle, we are now in a position to resolve our questions about the international effects of growth. Is growth in the rest of the world good or bad for our country? Does the fact that our country is part of a trading world economy increase or decrease the benefits of growth? In each case the answer depends on the *bias* of the growth. Export-biased growth in

the rest of the world is good for us, improving our terms of trade, while import-biased growth abroad worsens our terms of trade. Export-biased growth in our own country worsens our terms of trade, reducing the direct benefits of growth, while import-biased growth leads to an improvement of our terms of trade, a secondary benefit.

During the 1950s, many economists from poorer countries believed that their nations, which primarily exported raw materials, were likely to experience steadily declining terms of trade over time. They believed that growth in the industrial world would be marked by an increasing development of synthetic substitutes for raw materials, while growth in the poorer nations would take the form of a further extension of their capacity to produce what they were already exporting rather than a move toward industrialization. That is, the growth in the industrial world would be import-biased, while that in the less-developed world would be export-biased.

Some analysts even suggested that growth in the poorer nations would actually be self-defeating. They argued that export-biased growth by poor nations would worsen their terms of trade so much that they would be worse off than if they had not grown at all. This situation is known to economists as the case of **immiserizing growth**.

In a famous paper published in 1958, economist Jagdish Bhagwati of Columbia University showed that such perverse effects of growth can in fact arise within a rigorously specified economic model.[5] However, the conditions under which immiserizing growth can occur are extreme: Strongly export-biased growth must be combined with very steep *RS* and *RD* curves, so that the change in the terms of trade is large enough to offset the direct favorable effects of an increase in a country's productive capacity. Most economists now regard the concept of immiserizing growth as more a theoretical point than a real-world issue.

While growth at home normally raises our own welfare even in a trading world, this is by no means true of growth abroad. Import-biased growth is not an unlikely possibility, and whenever the rest of the world experiences such growth, it worsens our terms of trade. Indeed, as we point out below, it is possible that the United States has suffered some loss of real income because of foreign growth over the postwar period.

Case Study

Has the Growth of Newly Industrializing Countries Hurt Advanced Nations?

In the early 1990s, many observers began warning that the growth of newly industrializing economies would pose a threat to the prosperity of advanced nations. In the Case Study in Chapter 5 on North-South trade, we addressed one way in which that growth might prove to be a problem: It might aggravate the growing gap in incomes between high-skilled and low-skilled workers in advanced nations. Some alarmists, however, believed that the threat was still broader—that the overall real income of advanced nations, as opposed to its distribution, had been or would be reduced by the appearance of new competitors. For example, a 1993 report released by the European Commission (the administrative arm of the European Union), in listing reasons for Europe's economic difficulties, emphasized the fact that "other countries are becoming industrialized and competing with us—even in our own markets—at cost levels which we simply cannot match." Another report by an influential private organization

[5] "Immiserizing Growth: A Geometrical Note," *Review of Economic Studies* 25 (June 1958), pp. 201–205.

went even further, arguing that the rising productivity of low-wage countries would put immense pressure on high-wage nations, to such an extent that "the *raison d'etre* of many countries is at stake."[6]

These concerns appeared to gain some intellectual support from a 2004 paper by Paul Samuelson, who created much of the modern theory of international trade. In that paper, Samuelson, using a Ricardian model, offered an example of how technological progress in developing countries can hurt advanced countries.[7] His analysis was simply a special case of the analysis we have just described: Growth in the rest of the world can hurt you if it takes place in sectors that compete with your exports. Samuelson took this to its logical conclusion: If China becomes sufficiently good at producing goods it currently imports, comparative advantage disappears—and the United States loses the gains from trade.

The popular press seized on this result, treating it as if it were somehow revolutionary. "The central question Samuelson and others raise is whether unfettered trade is always still as good for the U.S. as they have long believed," wrote *Business Week*, which went on to suggest that such results might "completely derail comparative advantage theory."[8]

But the proposition that growth abroad can hurt your economy isn't a new idea, and it says nothing about whether free trade is better than protection. Also, it's an empirical question whether the growth of newly industrializing countries such as China has actually hurt advanced countries. And the facts don't support the claim.

Bear in mind that the channel through which growth abroad can hurt a country is via the terms of trade. So if the claim that competition from newly industrializing countries hurts advanced economies were true, we should see large negative numbers for the terms of trade of advanced countries and large positive numbers for the terms of trade of the new competitors. In the Mathematical Postscript to this chapter, we show that the percentage real income effect of a change in the terms of trade is approximately equal to the percent change in the terms of trade, multiplied by the share of imports in income. Since advanced countries on average spend about 25 percent of their income on imports (the United States' import share of GDP is lower than this average), a 1 percent decline in the terms of trade would reduce real income by only about 0.25 percent. So the terms of trade would have to decline by several percent a year to be a noticeable drag on economic growth.

Table 6-1 shows how the terms of trade for both the United States and China have changed over the last 30 years (average annual percentage change over the period). The magnitude of the fluctuations in the terms of trade for the United States is small, with no clear trend from decade to decade. The U.S. terms of trade in 2008 were essentially at the same level they were at in 1980. Thus, there is no evidence that the United States has suffered any kind of sustained loss from a long-term deterioration in its terms of trade. Additionally, there is no evidence that China's terms of trade have steadily appreciated as it has become increasingly integrated into the world economy. If anything, its terms of trade over the last 30 years have deteriorated somewhat.

One final point: In Samuelson's example, Chinese technological progress makes the United States worse off by eliminating trade between the two countries! Since what we

6Commission of the European Communities, *Growth, Competitiveness, Employment*, Brussels 1993; World Economic Forum, *World Competitiveness Report 1994.*

7Paul Samuelson, "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization," *Journal of Economic Perspectives*, Summer 2004.

8"Shaking up Trade Theory," *Business Week*, December 6, 2004.

TABLE 6-1 Average Annual Percent Changes in Terms of Trade for the United States and China

	1980–89	1990–99	2000–08	1980–2008
U.S.	1.6%	0.4%	−1.0%	0.1%
China	−1.4%	0.2%	−3.3%	−1.3%

actually see is rapidly growing China–U.S. trade, it's hard to find much of a relationship between the model and today's reality.

Most countries tend to experience mild swings in their terms of trade, around 1 percent or less a year, as illustrated in Table 6-1. However, some developing countries' exports are heavily concentrated in mineral and agricultural sectors. The prices of those goods on world markets are very volatile, leading to large swings in the terms of trade. These swings in turn translate into substantial changes in welfare (because trade is concentrated in a small number of sectors, and also represents a substantial percentage of GDP). In fact, some studies show that most of the fluctuations in GDP in several developing countries (where GDP fluctuations are quite large relative to the GDP fluctuations in developed countries) can be attributed to fluctuations in their terms of trade.[9] For example, Argentina suffered a 6 percent deterioration in its terms of trade in 1999 (due to declining agricultural prices), which induced a 1.4 percent drop in GDP. (The actual GDP loss was higher, but other factors contributed to this deterioration.) On the other hand, Ecuador enjoyed an 18 percent increase in its terms of trade in 2000 (due to increases in oil prices), which added 1.6 percent to the GDP growth rate for that year.[10]

Tariffs and Export Subsidies: Simultaneous Shifts in *RS* and *RD*

Import tariffs (taxes levied on imports) and **export subsidies** (payments given to domestic producers who sell a good abroad) are not usually put in place to affect a country's terms of trade. These government interventions in trade usually take place for income distribution, for the promotion of industries thought to be crucial to the economy, or for balance of payments. (Note that we will examine these motivations in Chapters 10, 11, and 12.) Whatever the motive for tariffs and subsidies, however, they *do* have effects on terms of trade that can be understood by using the standard trade model.

The distinctive feature of tariffs and export subsidies is that they create a difference between prices at which goods are traded on the world market and prices at which those goods can be purchased within a country. The direct effect of a tariff is to make imported goods more expensive inside a country than they are outside the country. An export subsidy gives producers an incentive to export. It will therefore be more profitable to sell

[9] See A. Rose, "Explaining Business Cycles in Small Open Economies: How Much Do World Prices Matter?". *Journal of International Economics.* 2002.

[10] See Broda and Tille. "Coping with Terms-of-Trade Shocks in Developing Countries". *Current Issues in Economics and Finance.* Federal Reserve Bank of New-York. 2003.

abroad than at home unless the price at home is higher, so such a subsidy raises the prices of exported goods inside a country. Note that this is very different from the effects of a production subsidy, which also lowers domestic prices for the affected goods (since the production subsidy does not discriminate based on the sales destination of the goods).

When countries are big exporters or importers of a good (relative to the size of the world market), the price changes caused by tariffs and subsidies change both relative supply and relative demand on world markets. The result is a shift in the terms of trade, both of the country imposing the policy change and of the rest of the world.

Relative Demand and Supply Effects of a Tariff

Tariffs and subsidies drive a wedge between the prices at which goods are traded internationally (**external prices**) and the prices at which they are traded within a country (**internal prices**). This means that we have to be careful in defining the terms of trade, which are intended to measure the ratio at which countries exchange goods; for example, how many units of food can Home import for each unit of cloth that it exports? This means that the terms of trade correspond to external, rather than internal, prices. When analyzing the effects of a tariff or export subsidy, therefore, we want to know how that tariff or subsidy affects relative supply and demand *as a function of external prices.*

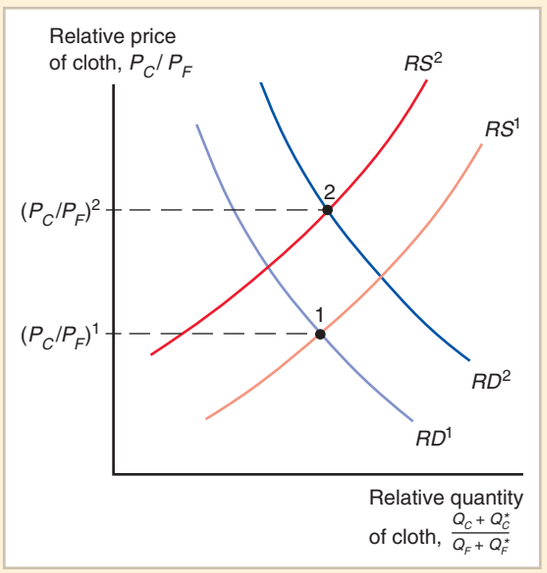
If Home imposes a 20 percent tariff on the value of food imports, for example, the internal price of food relative to cloth faced by Home producers and consumers will be 20 percent higher than the external relative price of food on the world market. Equivalently, the internal relative price of cloth on which Home residents base their decisions will be lower than the relative price on the external market.

At any given world relative price of cloth, then, Home producers will face a lower relative cloth price and therefore will produce less cloth and more food. At the same time, Home consumers will shift their consumption toward cloth and away from food. From the point of view of the world as a whole, the relative supply of cloth will fall (from RS^1 to RS^2 in Figure 6-8) while the relative demand for cloth will rise (from RD^1 to RD^2). Clearly, the world relative price of cloth rises from $((P_C/P_F)^1$ to $(P_C/P_F)^2$, and thus Home's terms of trade improve at Foreign's expense.

Figure 6-8

Effects of a Food Tariff on the Terms of Trade

An import tariff on food imposed by Home both reduces the relative supply of cloth (from RS^1 to RS^2) and increases the relative demand (from RD^1 to RD^2). As a result, the relative price of cloth must rise from $(P_C/P_F)^1$ to $(P_C/P_F)^2$.



The extent of this terms of trade effect depends on how large the country imposing the tariff is relative to the rest of the world: If the country is only a small part of the world, it cannot have much effect on world relative supply and demand and therefore cannot have much effect on relative prices. If the United States, a very large country, were to impose a 20 percent tariff, some estimates suggest that the U.S. terms of trade might rise by 15 percent. That is, the price of U.S. imports relative to exports might fall by 15 percent on the world market, while the relative price of imports would rise only 5 percent inside the United States. On the other hand, if Luxembourg or Paraguay were to impose a 20 percent tariff, the terms of trade effect would probably be too small to measure.

Effects of an Export Subsidy

Tariffs and export subsidies are often treated as similar policies, since they both seem to support domestic producers, but they have opposite effects on the terms of trade. Suppose that Home offers a 20 percent subsidy on the value of any cloth exported. For any given world prices, this subsidy will raise Home's internal price of cloth relative to that of food by 20 percent. The rise in the relative price of cloth will lead Home producers to produce more cloth and less food, while leading Home consumers to substitute food for cloth. As illustrated in Figure 6-9, the subsidy will increase the world relative supply of cloth (from RS^1 to RS^2) and decrease the world relative demand for cloth (from RD^1 to RD^2), shifting equilibrium from point 1 to point 2. A Home export subsidy worsens Home's terms of trade and improves Foreign's.

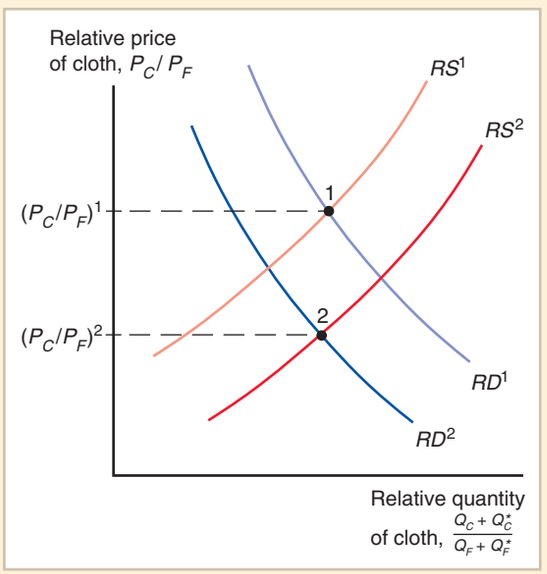
Implications of Terms of Trade Effects: Who Gains and Who Loses?

If Home imposes a tariff, it improves its terms of trade at Foreign's expense. Thus tariffs hurt the rest of the world. The effect on Home's welfare is not quite as clear-cut. The terms of trade improvement benefits Home; however, a tariff also imposes costs by distorting production and consumption incentives within Home's economy (see Chapter 9). The terms of trade gains will outweigh the losses from distortion only as long as the tariff is

Figure 6-9

Effects of a Cloth Subsidy on the Terms of Trade

An export subsidy on cloth has the opposite effects on relative supply and demand than the tariff on food. Relative supply of cloth rises, while relative demand falls. Home's terms of trade decline as the relative price of cloth falls from $(P_C/P_F)^1$ to $(P_C/P_F)^2$.



not too large. We will see later how to define an optimum tariff that maximizes net benefit. (For small countries that cannot have much impact on their terms of trade, the optimum tariff is near zero.)

The effects of an export subsidy are quite clear. Foreign's terms of trade improve at Home's expense, leaving it clearly better off. At the same time, Home loses from terms of trade deterioration *and* from the distorting effects of its policy.

This analysis seems to show that export subsidies never make sense. In fact, it is difficult to come up with situations where export subsidies would serve the national interest. The use of export subsidies as a policy tool usually has more to do with the peculiarities of trade politics than with economic logic.

Are foreign tariffs always bad for a country and foreign export subsidies always beneficial? Not necessarily. Our model is of a two-country world, where the other country exports the good we import and vice versa. In the real, multination world, a foreign government may subsidize the export of a good that competes with U.S. exports; this foreign subsidy will obviously hurt the U.S. terms of trade. A good example of this effect is European subsidies to agricultural exports (see Chapter 9). Alternatively, a country may impose a tariff on something the United States also imports, lowering its price and benefiting the United States. We thus need to qualify our conclusions from a two-country analysis: Subsidies to exports of things *the United States imports* help us, while tariffs *against U.S. exports* hurt us.

The view that subsidized foreign sales to the United States are good for us is not a popular one. When foreign governments are charged with subsidizing sales in the United States, the popular and political reaction is that this is unfair competition. Thus when a Commerce Department study determined that European governments were subsidizing exports of steel to the United States, our government demanded that they raise their prices. The standard model tells us that lower steel prices are a good thing for the U.S. economy (which is a net steel importer). On the other hand, some models based on imperfect competition and increasing returns to scale in production point to some potential welfare losses from the European subsidy. Nevertheless, the subsidy's biggest impact falls on the distribution of income within the United States. If Europe subsidizes exports of steel to the United States, most U.S. residents gain from cheaper steel. However, steelworkers, the owners of steel company stock, and industrial workers in general may not be so lucky.

International Borrowing and Lending

Up to this point, all of the trading relationships we have described were not referenced by a time dimension: One good, say cloth, is exchanged for a different good, say food. In this section, we show how the standard model of trade we have developed can also be used to analyze another very important kind of trade between countries that occurs over time: international borrowing and lending. Any international transaction that occurs over time has a financial aspect, and this aspect is one of the main topics we address in the second half of this book. However, we can also abstract from those financial aspects and think of borrowing and lending as just another kind of trade: Instead of trading one good for another at a point in time, we exchange goods today in return for some goods in the future. This kind of trade is known as **intertemporal trade;** we will have much more to say about it later in this text, but for now we will analyze it using a variant of our standard trade model with a time dimension.[11]

[11] As previously discussed for Figure 6-5a, the world relative supply is a weighted average of the two national relative supply curves.

Intertemporal Production Possibilities and Trade

Even in the absence of international capital movements, any economy faces a trade-off between consumption now and consumption in the future. Economies usually do not consume all of their current output; some of their output takes the form of investment in machines, buildings, and other forms of productive capital. The more investment an economy undertakes now, the more it will be able to produce and consume in the future. To invest more, however, an economy must release resources by consuming less (unless there are unemployed resources, a possibility we temporarily disregard). Thus there is a trade-off between current and future consumption.

Let's imagine an economy that consumes only one good and will exist for only two periods, which we will call present and future. Then there will be a trade-off between present and future production of the consumption good, which we can summarize by drawing an **intertemporal production possibility frontier**. Such a frontier is illustrated in Figure 6-10. It looks just like the production possibility frontiers between two goods at a point in time that we have been drawing.

The shape of the intertemporal production possibility frontier will differ among countries. Some countries will have production possibilities that are biased toward present output, while others are biased toward future output. We will ask in a moment what real differences these biases correspond to, but first let's simply suppose that there are two countries, Home and Foreign, with different intertemporal production possibilities. Home's possibilities are biased toward current consumption, while Foreign's are biased toward future consumption.

Reasoning by analogy, we already know what to expect. In the absence of international borrowing and lending, we would expect the relative price of future consumption to be higher in Home than in Foreign, and thus if we open the possibility of trade over time, we would expect Home to export present consumption and import future consumption.

This may, however, seem a little puzzling. What is the relative price of future consumption, and how does one trade over time?

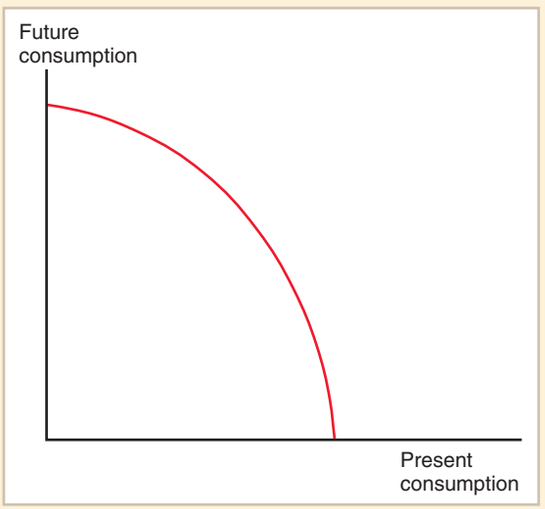
The Real Interest Rate

How does a country trade over time? Like an individual, a country can trade over time by borrowing or lending. Consider what happens when an individual borrows: She is initially

Figure 6-10

The Intertemporal Production Possibility Frontier

A country can trade current consumption for future consumption in the same way that it can produce more of one good by producing less of another.



able to spend more than her income or, in other words, to consume more than her production. Later, however, she must repay the loan with interest, and therefore in the future she consumes *less* than she produces. By borrowing, then, she has in effect traded future consumption for current consumption. The same is true of a borrowing country.

Clearly the price of future consumption in terms of present consumption has something to do with the interest rate. As we will see in the second half of this book, in the real world the interpretation of interest rates is complicated by the possibility of changes in the overall price level. For now, we bypass that problem by supposing that loan contracts are specified in "real" terms: When a country borrows, it gets the right to purchase some quantity of consumption at present in return for repayment of some larger quantity in the future. Specifically, the quantity of repayment in the future will be $(1+r)$ times the quantity borrowed in the present, where r is the **real interest rate** on borrowing. Since the trade-off is one unit of consumption in the present for $(1+r)$ units in the future, the relative price of future consumption is $1/(1+r)$.

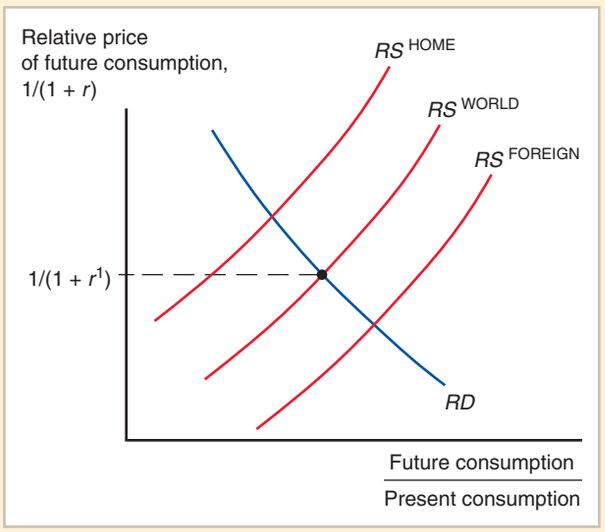
When this relative price of future consumption rises (that is, the real interest rate r falls), a country responds by investing more; this increases the supply of future consumption relative to present consumption (a leftward movement along the intertemporal production possibility frontier in Figure 6-10) and implies an upward-sloping relative supply curve for future consumption. We previously saw how a consumer's preferences for cloth and food could be represented by a relative demand curve relating relative consumption to the relative prices of those goods. Similarly, a consumer will also have preferences over time that capture the extent to which she is willing to substitute between current and future consumption. Those substitution effects are also captured by an intertemporal relative demand curve that relates the relative demand for future consumption (the ratio of future consumption to present consumption) to its relative price $1/(1 + r)$.

The parallel with our standard trade model is now complete. If borrowing and lending are allowed, the relative price of future consumption, and thus the world real interest rate, will be determined by the world relative supply and demand for future consumption. The determination of the equilibrium relative price $1/(1 + r^1)$ is shown in Figure 6-11 (notice the parallel with trade in goods and Figure 6-5a). The intertemporal relative supply curves for Home and Foreign reflect how Home's production possibilities are biased toward present consumption

Figure 6-11

Equilibrium Interest Rate with Borrowing and Lending

Home, Foreign, and world supply of future consumption relative to present consumption. Home and Foreign have the same relative demand for future consumption, which is also the relative demand for the world. The equilibrium interest rate $1/(1 + r^1)$ is determined by the intersection of world relative supply and demand.



whereas Foreign's production possibilities are biased toward future consumption. In other words, Foreign's relative supply for future consumption is shifted out relative to Home's relative supply. At the equilibrium real interest rate, Home will export present consumption in return for imports of future consumption. That is, Home will lend to Foreign in the present and receive repayment in the future.

Intertemporal Comparative Advantage

We have assumed that Home's intertemporal production possibilities are biased toward present production. But what does this mean? The sources of intertemporal comparative advantage are somewhat different from those that give rise to ordinary trade.

A country that has a comparative advantage in future production of consumption goods is one that in the absence of international borrowing and lending would have a low relative price of future consumption, that is, a high real interest rate. This high real interest rate corresponds to a high return on investment, that is, a high return to diverting resources from current production of consumption goods to production of capital goods, construction, and other activities that enhance the economy's future ability to produce. So countries that borrow in the international market will be those where highly productive investment opportunities are available relative to current productive capacity, while countries that lend will be those where such opportunities are not available domestically.

SUMMARY

1. The standard trade model derives a world relative supply curve from production possibilities and a world relative demand curve from preferences. The price of exports relative to imports, a country's terms of trade, is determined by the intersection of the world relative supply and demand curves. Other things equal, a rise in a country's terms of trade increases its welfare. Conversely, a decline in a country's terms of trade will leave the country worse off.
2. Economic growth means an outward shift in a country's production possibility frontier. Such growth is usually biased; that is, the production possibility frontier shifts out more in the direction of some goods than in the direction of others. The immediate effect of biased growth is to lead, other things equal, to an increase in the world relative supply of the goods toward which the growth is biased. This shift in the world relative supply curve in turn leads to a change in the growing country's terms of trade, which can go in either direction. If the growing country's terms of trade improve, this improvement reinforces the initial growth at home but hurts the growth in the rest of the world. If the growing country's terms of trade worsen, this decline offsets some of the favorable effects of growth at home but benefits the rest of the world.
3. The direction of the terms of trade effects depends on the nature of the growth. Growth that is export-biased (growth that expands the ability of an economy to produce the goods it was initially exporting more than it expands the economy's ability to produce goods that compete with imports) worsens the terms of trade. Conversely, growth that is import-biased, disproportionately increasing the ability to produce import-competing goods, improves a country's terms of trade. It is possible for import-biased growth abroad to hurt a country.
4. Import tariffs and export subsidies affect both relative supply and relative demand. A tariff raises relative supply of a country's import good while lowering relative demand. A tariff unambiguously improves the country's terms of trade at the rest of the world's expense. An export subsidy has the reverse effect, increasing the relative supply and reducing the relative demand for the country's export good, and thus worsening the terms of trade. The terms of trade effects of an export subsidy hurt the subsidizing

country and benefit the rest of the world, while those of a tariff do the reverse. This suggests that export subsidies do not make sense from a national point of view and that foreign export subsidies should be welcomed rather than countered. Both tariffs and subsidies, however, have strong effects on the distribution of income within countries, and these effects often weigh more heavily on policy than the terms of trade concerns.

5. International borrowing and lending can be viewed as a kind of international trade, but one that involves trade of present consumption for future consumption rather than trade of one good for another. The relative price at which this intertemporal trade takes place is 1 plus the real rate of interest.

KEY TERMS

biased growth, p. 119
export-biased growth, p. 121
export subsidy, p. 124
external price, p. 125
immiserizing growth, p. 122
import-biased growth, p. 121
import tariff, p. 124
indifference curves, p. 114
internal price, p. 125
intertemporal production possibility frontier, p. 128
intertemporal trade, p. 127
isovalue lines, p. 113
real interest rate, p. 129
standard trade model, p. 112
terms of trade, p. 112

PROBLEMS

1. Assume that Norway and Sweden trade with each other, with Norway exporting fish to Sweden, and Sweden exporting Volvos (automobiles) to Norway. Illustrate the gains from trade between the two countries using the standard trade model, assuming first that tastes for the goods are the same in both countries, but that the production possibility frontiers differ: Norway has a long coast that borders on the north Atlantic, making it relatively more productive in fishing. Sweden has a greater endowment of capital, making it relatively more productive in automobiles.
2. In the trade scenario in problem 1, due to overfishing, Norway becomes unable to catch the quantity of fish that it could in previous years. This change causes both a reduction in the potential quantity of fish that can be produced in Norway and an increase in the relative world price for fish, P_f/P_a.
   a. Show how the overfishing problem can result in a decline in welfare for Norway.
   b. Also show how it is possible that the overfishing problem could result in an *increase* in welfare for Norway.
3. In some economies relative supply may be unresponsive to changes in prices. For example, if factors of production were completely immobile between sectors, the production possibility frontier would be right-angled, and output of the two goods would not depend on their relative prices. Is it still true in this case that a rise in the terms of trade increases welfare? Analyze graphically.
4. The counterpart to immobile factors on the supply side would be lack of substitution on the demand side. Imagine an economy where consumers always buy goods in rigid proportions—for example, one yard of cloth for every pound of food—regardless of the prices of the two goods. Show that an improvement in the terms of trade benefits this economy as well.
5. Japan primarily exports manufactured goods, while importing raw materials such as food and oil. Analyze the impact on Japan's terms of trade of the following events:
   a. A war in the Middle East disrupts oil supply.
   b. Korea develops the ability to produce automobiles that it can sell in Canada and the United States.

c. U.S. engineers develop a fusion reactor that replaces fossil fuel electricity plants.
d. A harvest failure in Russia.
e. A reduction in Japan's tariffs on imported beef and citrus fruit.

6. The Internet has allowed for increased trade in services such as programming and technical support, a development that has lowered the prices of such services relative to those of manufactured goods. India in particular has been recently viewed as an "exporter" of technology-based services, an area in which the United States had been a major exporter. Using manufacturing and services as tradable goods, create a standard trade model for the U.S. and Indian economies that shows how relative price declines in exportable services that lead to the "outsourcing" of services can reduce welfare in the United States and increase welfare in India.

7. Countries A and B have two factors of production, capital and labor, with which they produce two goods, *X* and *Y.* Technology is the same in the two countries. *X* is capital-intensive; A is capital-abundant.
Analyze the effects on the terms of trade and on the two countries' welfare of the following:
a. An increase in A's capital stock.
b. An increase in A's labor supply.
c. An increase in B's capital stock.
d. An increase in B's labor supply.

8. Economic growth is just as likely to worsen a country's terms of trade as it is to improve them. Why, then, do most economists regard immiserizing growth, where growth actually hurts the growing country, as unlikely in practice?

9. From an economic point of view, India and China are somewhat similar: Both are huge, low-wage countries, probably with similar patterns of comparative advantage, which until recently were relatively closed to international trade. China was the first to open up. Now that India is also opening up to world trade, how would you expect this to affect the welfare of China? Of the United States? (Hint: Think of adding a new economy identical to that of China to the world economy.)

10. Suppose that Country X subsidizes its exports and Country Y imposes a "countervailing" tariff that offsets the subsidy's effect, so that in the end, relative prices in Country Y are unchanged. What happens to the terms of trade? What about welfare in the two countries? Suppose, on the other hand, that Country Y retaliates with an export subsidy of its own. Contrast the result.

11. Explain the analogy between international borrowing and lending and ordinary international trade.

12. Which of the following countries would you expect to have intertemporal production possibilities biased toward current consumption goods, and which biased toward future consumption goods?
a. A country like Argentina or Canada in the last century that has only recently been opened for large-scale settlement and is receiving large inflows of immigrants.
b. A country like the United Kingdom in the late 19th century or the United States today that leads the world technologically but is seeing that lead eroded as other countries catch up.

c. A country like Saudi Arabia that has discovered large oil reserves that can be exploited with little new investment.

d. A country that has discovered large oil reserves that can be exploited only with massive investment, such as Norway, whose oil lies under the North Sea.

e. A country like South Korea that has discovered the knack of producing industrial goods and is rapidly gaining on advanced countries.

FURTHER READINGS

Rudiger Dornbusch, Stanley Fischer, and Paul Samuelson. "Comparative Advantage, Trade, and Payments in a Ricardian Model with a Continuum of Goods." *American Economic Review* 67 (1977). This paper, cited in Chapter 3, also gives a clear exposition of the role of nontraded goods in establishing the presumption that a transfer improves the recipient's terms of trade.

Irving Fisher. *The Theory of Interest.* New York: Macmillan, 1930. The "intertemporal" approach described in this chapter owes its origin to Fisher.

J. R. Hicks. "The Long Run Dollar Problem." *Oxford Economic Papers* 2 (1953), pp. 117–135. The modern analysis of growth and trade has its origins in the fears of Europeans, in the early years after World War II, that the United States had an economic lead that could not be overtaken. (This sounds dated today, but many of the same arguments have now resurfaced about Japan.) The paper by Hicks is the most famous exposition.

Harry G. Johnson. "Economic Expansion and International Trade." *Manchester School of Social and Economic Studies* 23 (1955), pp. 95–112. The paper that laid out the crucial distinction between export- and import-biased growth.

Paul Krugman. "Does Third World Growth Hurt First World Prosperity?" *Harvard Business Review* 72 (July–August 1994), pp. 113–121. An analysis that attempts to explain why growth in developing countries need not hurt advanced countries in principle and probably does not do so in practice.

Jeffrey Sachs. "The Current Account and Macroeconomic Adjustment in the 1970s." *Brookings Papers on Economic Activity*, 1981. A study of international capital flows that views such flows as intertemporal trade.

John Whalley. *Trade Liberalization Among Major World Trading Areas.* Cambridge: MIT Press, 1985. The impact of tariffs on the international economy has been the subject of extensive study. Most impressive are the huge "computable general equilibrium" models, numerical models based on actual data that allow computation of the effects of changes in tariffs and other trade policies. Whalley's book presents one of the most carefully constructed of these.

APPENDIX TO CHAPTER 6

More on Intertemporal Trade

This appendix contains a more detailed examination of the two-period intertemporal trade model described in the chapter. First consider Home, whose intertemporal production possibility frontier is shown in Figure 6A-1. Recall that the quantities of present and future consumption goods produced at Home depend on the amount of present consumption goods invested to produce future goods. As currently available resources are diverted from present consumption to investment, production of present consumption, Q_P, falls and production of future consumption, Q_F, rises. Increased investment therefore shifts the economy up and to the left along the intertemporal production possibility frontier.

The chapter showed that the price of future consumption in terms of present consumption is $1/(1 + r)$, where r is the real interest rate. Measured in terms of present consumption, the value of the economy's total production over the two periods of its existence is therefore

$$V = Q_P + Q_F/(1 + r).$$

Figure 6A-1 shows the isovalue lines corresponding to the relative price $1/(1 + r)$ for different values of V. These are straight lines with slope $-(1+r)$ (because future consumption is on the vertical axis). As in the standard trade model, firms' decisions lead to a production pattern that maximizes the value of production at market prices $Q_P + Q_F/(1+r)$. Production therefore occurs at point Q. The economy invests the amount shown, leaving Q_P available for present consumption and producing an amount Q_F of future consumption when the first-period investment pays off.

Notice that at point Q, the extra future consumption that would result from investing an additional unit of present consumption just equals $(1 + r)$. It would be inefficient to push investment beyond point Q because the economy could do better by

Figure 6A-1

Determining Home's Intertemporal Production Pattern

At a world real interest rate of r, Home's investment level maximizes the value of production over the two periods that the economy exists.

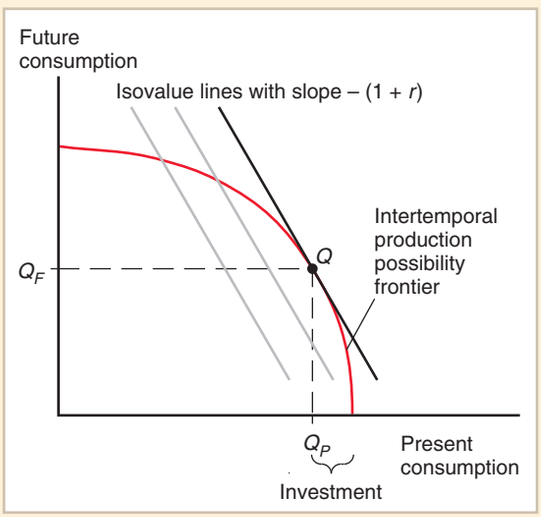
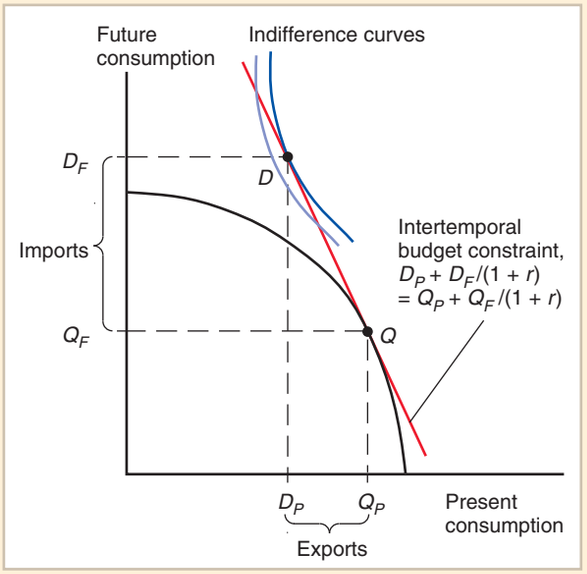


Figure 6A-2

Determining Home's Intertemporal Consumption Pattern

Home's consumption places it on the highest indifference curve touching its intertemporal budget constraint. The economy exports $Q_P - D_P$ units of present consumption and imports $D_F - Q_F = (1 + r) \times (Q_P - D_P)$ units of future consumption.



lending additional present consumption to foreigners instead. Figure 6A-1 implies that a rise in the world real interest rate r, which steepens the isovalue lines, causes investment to fall.

Figure 6A-2 shows how Home's consumption pattern is determined for a given world interest rate. Let D_P and D_F represent the demands for present and future consumption goods, respectively. Since production is at point Q, the economy's consumption possibilities over the two periods are limited by the *intertemporal budget constraint*:

$$D_P + D_F/(1+r) = Q_P + Q_F/(1+r).$$

This constraint states that the value of Home's consumption over the two periods (measured in terms of present consumption) equals the value of consumption goods produced in the two periods (also measured in present consumption units). Put another way, production and consumption must lie on the same isovalue line.

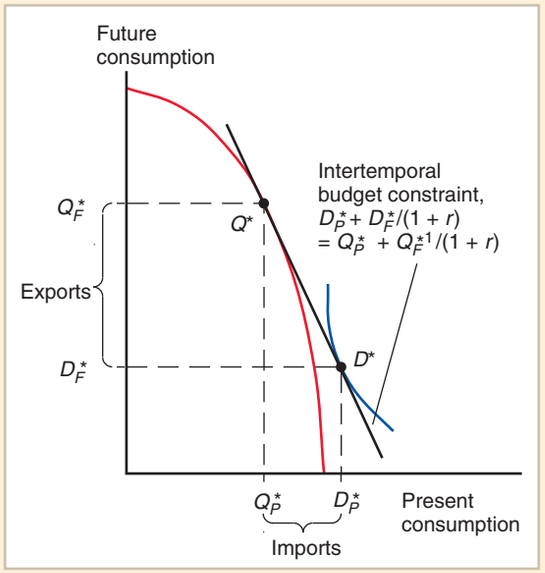
Point D, where Home's budget constraint touches the highest attainable indifference curve, shows the present and future consumption levels chosen by the economy. Home's demand for present consumption, D_P, is smaller than its production of present consumption, Q_P, so it exports (that is, lends) $Q_P - D_P$ units of present consumption to Foreigners. Correspondingly, Home imports $D_F - Q_F$ units of future consumption from abroad when its first-period loans are repaid to it with interest. The intertemporal budget constraint implies that $D_F - Q_F = (1 + r) \times (Q_P - D_P)$, so trade is *intertemporally* balanced.

Figure 6A-3 shows how investment and consumption are determined in Foreign. Foreign is assumed to have a comparative advantage in producing *future* consumption goods. The diagram shows that at a real interest rate of r, Foreign borrows consumption goods in the first period and repays this loan using consumption goods produced in the second period. Because of its relatively rich domestic investment opportunities and its relative preference for present consumption, Foreign is an importer of present consumption and an exporter of future consumption.

Figure 6A-3

Determining Foreign's Intertemporal Production and Consumption Patterns

Foreign produces at point Q^* and consumes at point D^*, importing $D_P^* - Q_P^*$ units of present consumption and exporting $Q_F^* - D_F^* = (1 + r) \times (D_P^* - Q_P^*)$ units of future consumption.



The differences between Home and Foreign's production possibility frontiers lead to the differences in the relative supply curves depicted in Figure 6-11. At the equilibrium interest rate $1/(1 + r^1)$, Home's desired export of present consumption equals Foreign's desired import of present consumption. Put another way, at that interest rate, Home's desired first-period lending equals Foreign's desired first-period borrowing. Supply and demand are therefore equal in both periods.