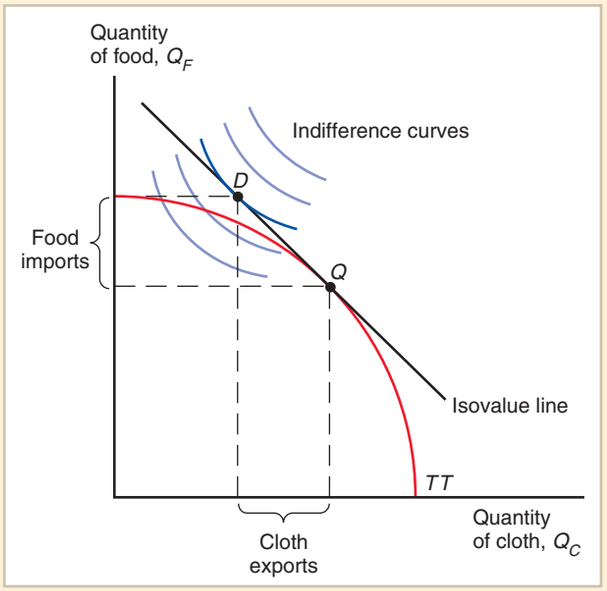
Figure 6-3

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. Panel (a) in Figure 6-4 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*.

Panel (b) in Figure 6-4 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.

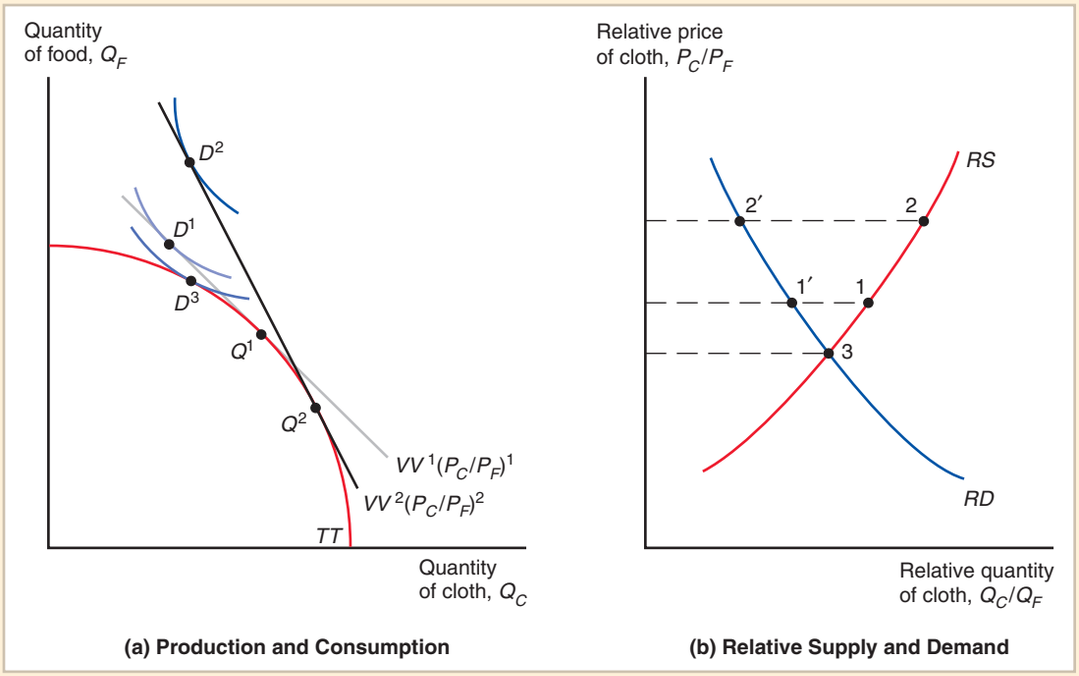


Figure 6-4

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 panel (a) of Figure 6-4. 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 panel (a) of Figure 6.5. 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 panel (b).

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.

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

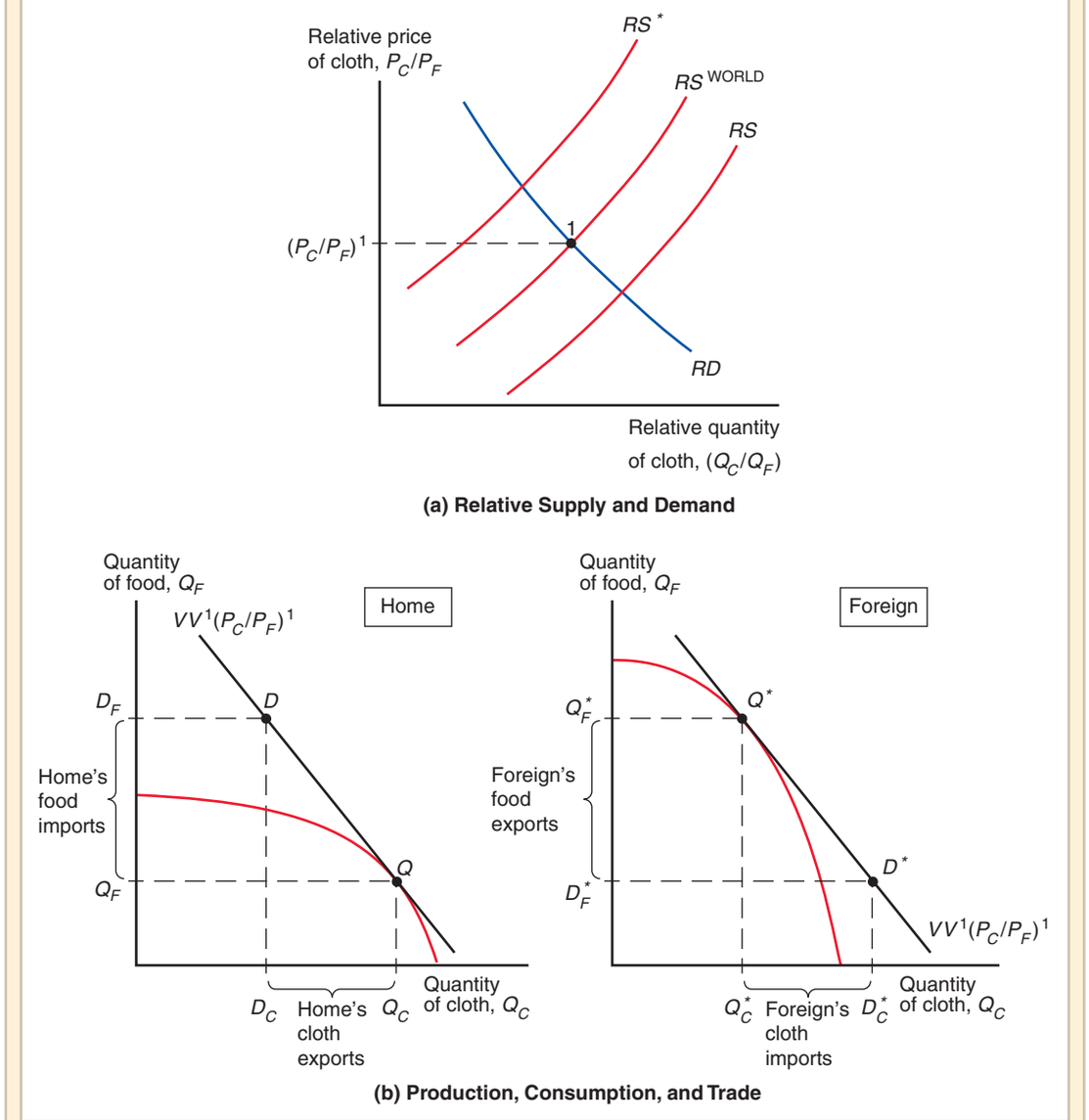


Figure 6-5

Equilibrium Relative Price with Trade and Associated Trade Flows

Panel (a) shows the relative supply of cloth in Home (RS), in Foreign (RS^*), and for the world. Home and Foreign have the same relative demand, which is also the relative demand for the world. The equilibrium relative price $(P_C/P_F)^1$ 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. Panel (a) of Figure 6-6 illustrates growth biased toward cloth (shift from TT^1 to TT^2), while panel (b) 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 panels (a) and (b) 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 panel (a), while the output of cloth actually falls in panel (b). 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 panel (c) 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 panel (a) of Figure 6-6). 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 panel (a) of Figure 6-7 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.

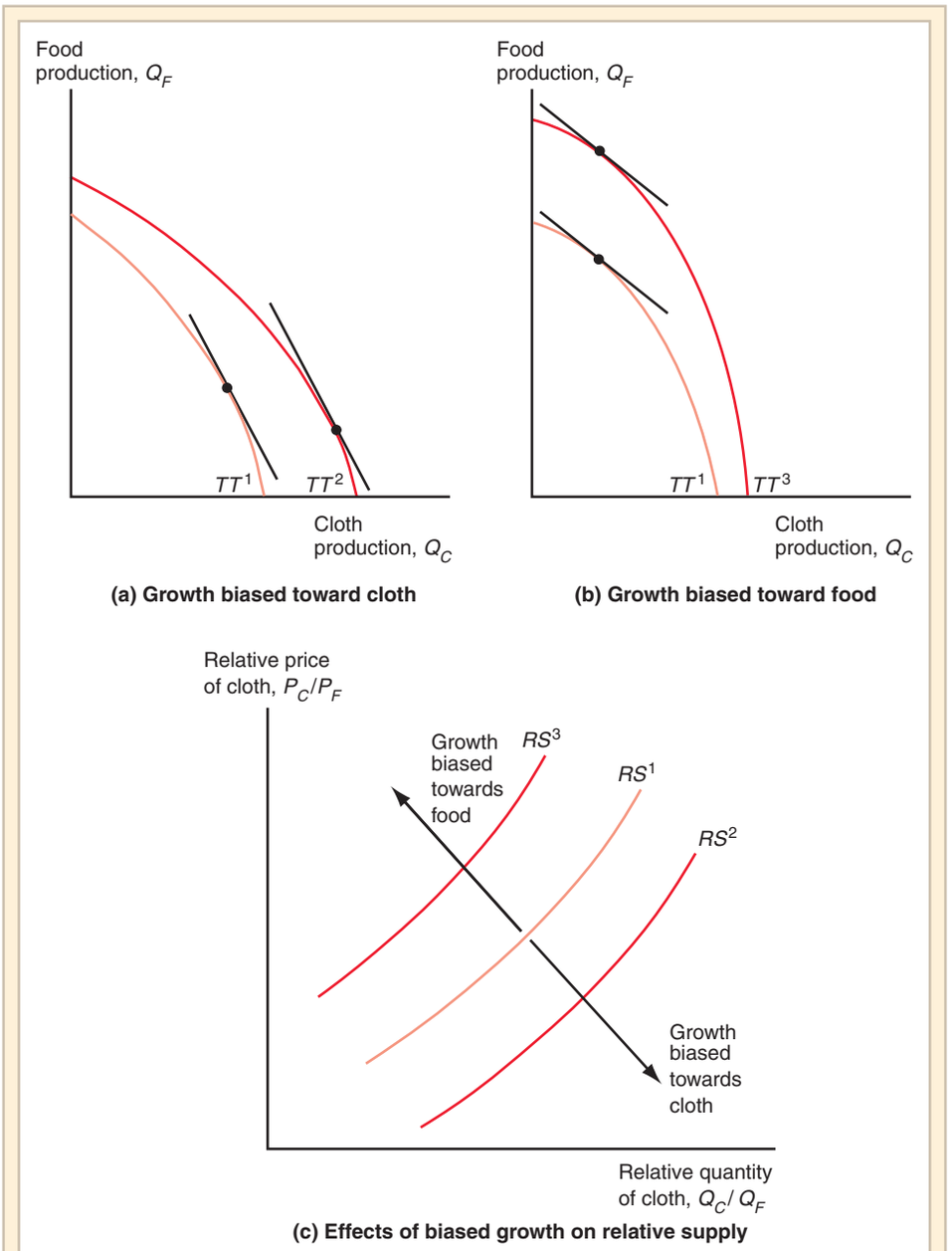


Figure 6-6

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.

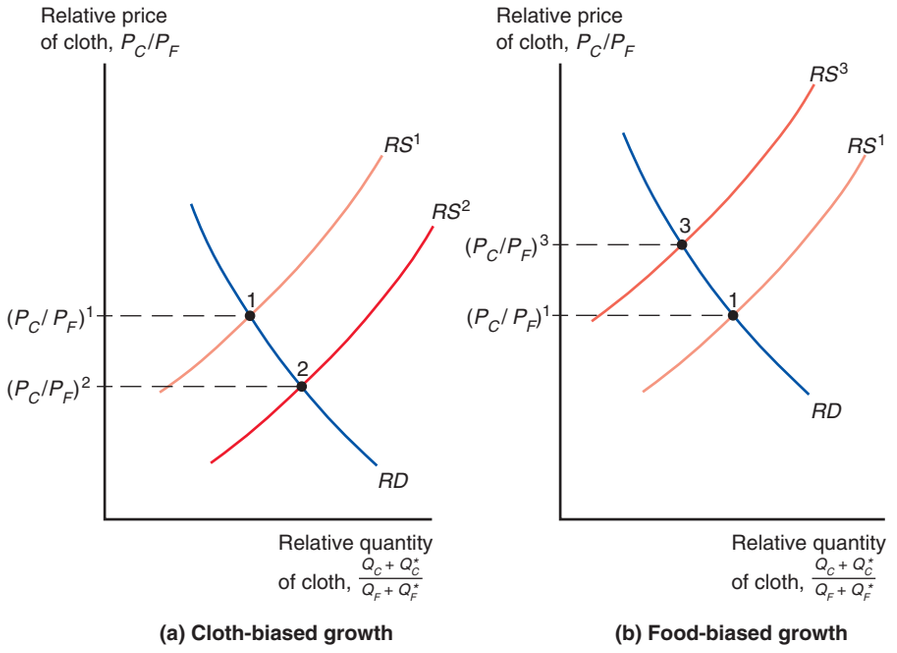


Figure 6-7

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 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 panel (b)). 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

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

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

[7] Paul Samuelson, "Where Ricardo and Mill Rebut and Confirm Arguments of Mainstream Economists Supporting Globalization," *Journal of Economic Perspectives* 18 (Summer 2004), pp. 135–146.

[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

	Change by Decade			Overall Change
	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 M. Ayhan Kose, "Explaining Business Cycles in Small Open Economies: 'How Much Do World Prices Matter?'" *Journal of International Economics* 56 (March 2002), pp. 299–327.

[10] See Christian Broda and Cédric Tille, "Coping with Terms-of-Trade Shocks in Developing Countries," *Current Issues in Economics and Finance* 9 (November 2003), pp 1–7.

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.*

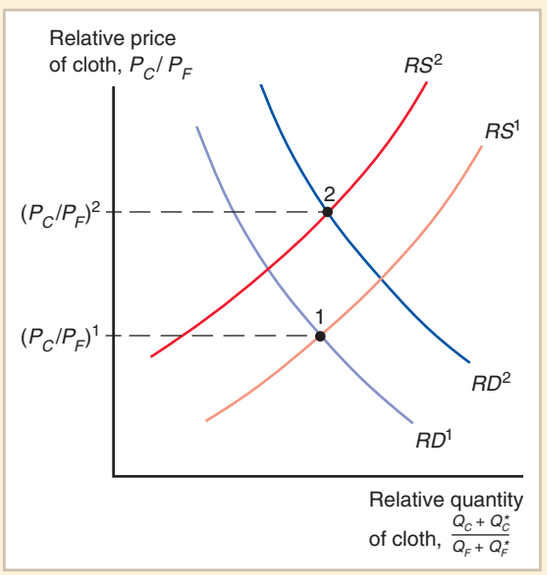
If Home imposes a 20 percent tariff on the value of food imports, for example, the internal price of food relative to cloth faced by Home producers and consumers will be 20 percent higher than the external relative price of food on the world market. Equivalently, the internal relative price of cloth 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) for the world as a whole. 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.

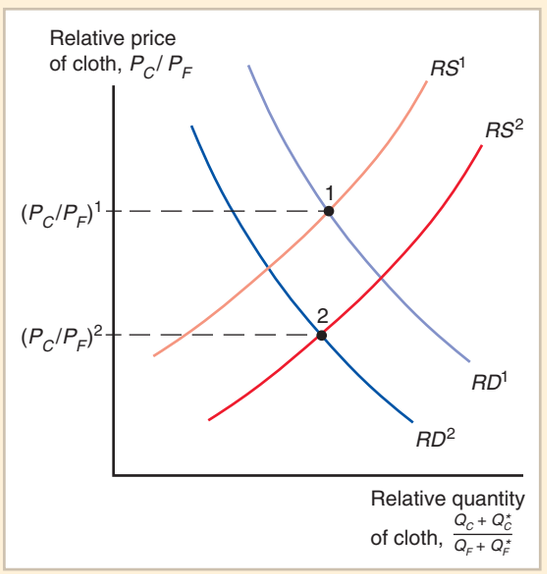
Implications of Terms of Trade Effects: Who Gains and Who Loses?

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 for the world rises, while relative demand for the world 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] See the appendix for additional details and derivations.

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 panel (a) of Figure 6-5). The intertemporal relative supply curves for Home and Foreign reflect how Home's production possibilities are biased

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.