CHAPTER 1

# Introduction

You could say that the study of international trade and finance is where the discipline of economics as we know it began. Historians of economic thought often describe the essay "Of the Balance of Trade" by the Scottish philosopher David Hume as the first real exposition of an economic model. Hume published his essay in 1758, almost 20 years before his friend Adam Smith published *The Wealth of Nations*. And the debates over British trade policy in the early 19th century did much to convert economics from a discursive, informal field to the model-oriented subject it has been ever since.

Yet the study of international economics has never been as important as it is now. In the early 21st century, nations are more closely linked through trade in goods and services, flows of money, and investment in each other's economies than ever before. And the global economy created by these linkages is a turbulent place: Both policy makers and business leaders in every country, including the United States, must now pay attention to what are sometimes rapidly changing economic fortunes halfway around the world.

A look at some basic trade statistics gives us a sense of the unprecedented importance of international economic relations. Figure 1-1 shows the levels of U.S. exports and imports as shares of gross domestic product from 1960 to 2009. The most obvious feature of the figure is the long-term upward trend in both shares: International trade has roughly tripled in importance compared with the economy as a whole.

Almost as obvious is that, while both imports and exports have increased, imports have grown more, leading to a large excess of imports over exports. How is the United States able to pay for all those imported goods? The answer is that the money is supplied by large inflows of capital, money invested by foreigners willing to take a stake in the U.S. economy. Inflows of capital on that scale would once have been inconceivable; now they are taken for granted. And so the gap between imports and exports is an indicator of another aspect of growing international linkages, in this case the growing linkages between national capital markets.

Finally, notice that both imports and exports took a plunge in 2009. This decline reflected the global economic crisis that began in 2008, and is a reminder of the close links between world trade and the overall state of the world economy.

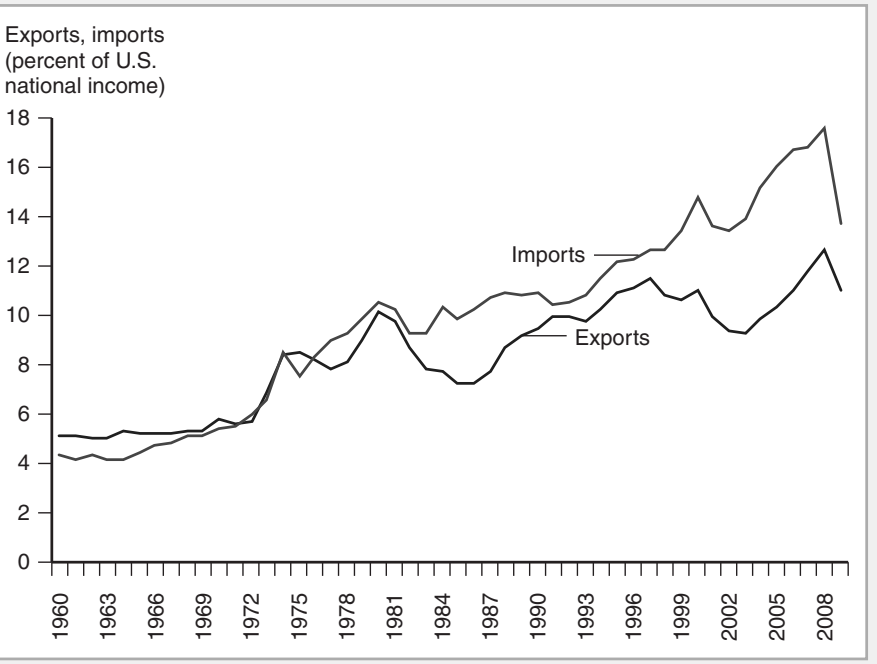



**Figure 1-1**

**Exports and Imports as a Percentage of U.S. National Income**

Both imports and exports have risen as a share of the U.S. economy, but imports have risen more.

**Source:** U.S. Bureau of Economic Analysis.

If international economic relations have become crucial to the United States, they are even more crucial to other nations. Figure 1-2 shows the average of imports and exports as a share of GDP for a sample of countries. The United States, by virtue of its size and the diversity of its resources, relies less on international trade than almost any other country.

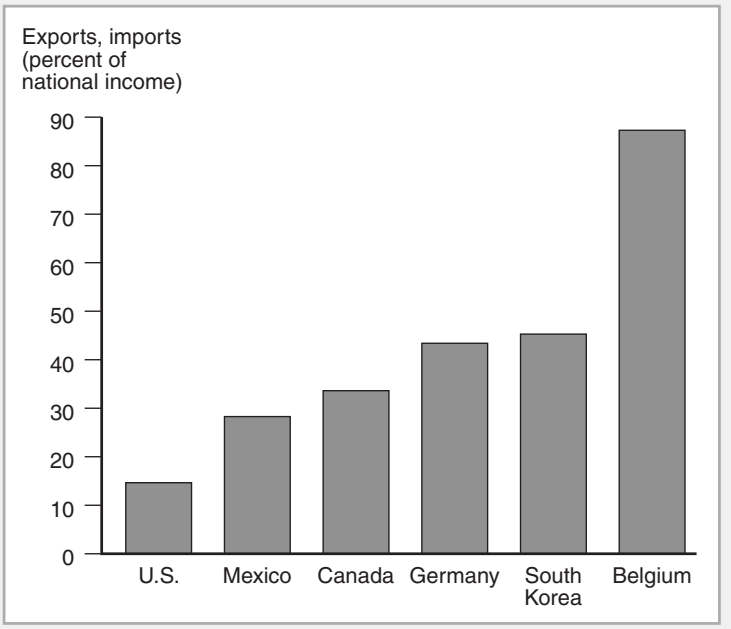
This book introduces the main concepts and methods of international economics and illustrates them with applications drawn from the real world. Much of the book is devoted to old ideas that are still as valid as ever: The 19th-century trade theory of David Ricardo and even the 18th-century monetary analysis of David Hume remain highly relevant to the 21st-century world economy. At the same time, we have made a special effort to bring the analysis up to date. Over the past decade the global economy threw up many new challenges, from the backlash against globalization to an unprecedented series of financial crises. Economists were able to apply existing analyses to some of these challenges, but they were also forced to rethink some important concepts. Furthermore, new approaches have emerged to old questions, such as the impacts of changes in monetary and fiscal policy. We have attempted to convey the key ideas that have emerged in recent research while stressing the continuing usefulness of old ideas.

**Figure 1-2**

**Average of Exports and Imports as Percentages of National Income in 2007**

International trade is even more important to most other countries than it is to the United States.

**Source:** Organization for Economic Cooperation and Development.




## LEARNING GOALS

After reading this chapter, you will be able to:

- Distinguish between international and domestic economic issues.
- Explain why seven themes recur in international economics, and discuss their significance.
- Distinguish between the trade and monetary aspects of international economics.

# What Is International Economics About?

International economics uses the same fundamental methods of analysis as other branches of economics, because the motives and behavior of individuals are the same in international trade as they are in domestic transactions. Gourmet food shops in Florida sell coffee beans from both Mexico and Hawaii; the sequence of events that brought those beans to the shop is not very different, and the imported beans traveled a much shorter distance than the beans shipped within the United States! Yet international economics involves new and different concerns, because international trade and investment occur between independent nations. The United States and Mexico are sovereign states; Florida and Hawaii are not. Mexico's coffee shipments to Florida could be disrupted if the U.S. government imposed a quota that limits imports; Mexican coffee could suddenly become cheaper to U.S. buyers if the peso were to fall in value against the dollar. By contrast, neither of those events can happen in commerce within the United States because the Constitution forbids restraints on interstate trade and all U.S. states use the same currency.

The subject matter of international economics, then, consists of issues raised by the special problems of economic interaction between sovereign states. Seven themes recur throughout the study of international economics: (1) the gains from trade, (2) the pattern of trade, (3) protectionism, (4) the balance of payments, (5) exchange rate determination, (6) international policy coordination, and (7) the international capital market.

## The Gains from Trade

Everybody knows that some international trade is beneficial—for example, nobody thinks that Norway should grow its own oranges. Many people are skeptical, however, about the benefits of trading for goods that a country could produce for itself. Shouldn't Americans buy American goods whenever possible, to help create jobs in the United States?

Probably the most important single insight in all of international economics is that there are *gains from trade*—that is, when countries sell goods and services to each other, this exchange is almost always to their mutual benefit. The range of circumstances under which international trade is beneficial is much wider than most people imagine. It is a common misconception that trade is harmful if there are large disparities between countries in productivity or wages. On one side, businesspeople in less technologically advanced countries, such as India, often worry that opening their economies to international trade will lead to disaster because their industries won't be able to compete. On the other side, people in technologically advanced nations where workers earn high wages often fear that trading with less advanced, lower-wage countries will drag their standard of living down—one presidential candidate memorably warned of a "giant sucking sound" if the United States were to conclude a free trade agreement with Mexico.

Yet the first model this book presents of the causes of trade (Chapter 3) demonstrates that two countries can trade to their mutual benefit even when one of them is more efficient than the other at producing everything, and when producers in the less efficient country can compete only by paying lower wages. We'll also see that trade provides benefits by allowing countries to export goods whose production makes relatively heavy use of resources that are locally abundant while importing goods whose production makes heavy use of resources that are locally scarce (Chapter 5). International trade also allows countries to specialize in producing narrower ranges of goods, giving them greater efficiencies of large-scale production.

Nor are the benefits of international trade limited to trade in tangible goods. International migration and international borrowing and lending are also forms of mutually beneficial trade—the first a trade of labor for goods and services (Chapter 4), the second a trade of current goods for the promise of future goods (Chapter 6). Finally, international exchanges of risky assets such as stocks and bonds can benefit all countries by allowing each country to diversify its wealth and reduce the variability of its income (Chapter 21). These invisible forms of trade yield gains as real as the trade that puts fresh fruit from Latin America in Toronto markets in February.

Although nations generally gain from international trade, it is quite possible that international trade may hurt particular groups *within* nations—in other words, that international trade will have strong effects on the distribution of income. The effects of trade on income distribution have long been a concern of international trade theorists, who have pointed out that:

> International trade can adversely affect the owners of resources that are "specific" to industries that compete with imports, that is, cannot find alternative employment in other industries. Examples would include specialized machinery, such as power looms made less valuable by textile imports, and workers with specialized skills, like fishermen who find the value of their catch reduced by imported seafood.
>
> Trade can also alter the distribution of income between broad groups, such as workers and the owners of capital.

These concerns have moved from the classroom into the center of real-world policy debate, as it has become increasingly clear that the real wages of less-skilled workers in

the United States have been declining even though the country as a whole is continuing to grow richer. Many commentators attribute this development to growing international trade, especially the rapidly growing exports of manufactured goods from low-wage countries. Assessing this claim has become an important task for international economists and is a major theme of Chapters 4 through 6.

## The Pattern of Trade

Economists cannot discuss the effects of international trade or recommend changes in government policies toward trade with any confidence unless they know their theory is good enough to explain the international trade that is actually observed. As a result, attempts to explain the pattern of international trade—who sells what to whom—have been a major preoccupation of international economists.

Some aspects of the pattern of trade are easy to understand. Climate and resources clearly explain why Brazil exports coffee and Saudi Arabia exports oil. Much of the pattern of trade is more subtle, however. Why does Japan export automobiles, while the United States exports aircraft? In the early 19th century, English economist David Ricardo offered an explanation of trade in terms of international differences in labor productivity, an explanation that remains a powerful insight (Chapter 3). In the 20th century, however, alternative explanations also were proposed. One of the most influential, but still controversial, explanations links trade patterns to an interaction between the relative supplies of national resources such as capital, labor, and land on one side and the relative use of these factors in the production of different goods on the other. We present this theory in Chapter 5. Recent efforts to test the implications of this theory, however, appear to show that it is less valid than many had previously thought. More recently still, some international economists have proposed theories that suggest a substantial random component in the pattern of international trade, theories that are developed in Chapters 7 and 8.

## How Much Trade?

If the idea of gains from trade is the most important theoretical concept in international economics, the seemingly eternal debate over how much trade to allow is its most important policy theme. Since the emergence of modern nation-states in the 16th century, governments have worried about the effect of international competition on the prosperity of domestic industries and have tried either to shield industries from foreign competition by placing limits on imports or to help them in world competition by subsidizing exports. The single most consistent mission of international economics has been to analyze the effects of these so-called protectionist policies—and usually, though not always, to criticize protectionism and show the advantages of freer international trade.

The debate over how much trade to allow took a new direction in the 1990s. After World War II the advanced democracies, led by the United States, pursued a broad policy of removing barriers to international trade; this policy reflected the view that free trade was a force not only for prosperity but also for promoting world peace. In the first half of the 1990s, several major free trade agreements were negotiated. The most notable were the North American Free Trade Agreement (NAFTA) between the United States, Canada, and Mexico, approved in 1993, and the so-called Uruguay Round agreement, which established the World Trade Organization in 1994.

Since that time, however, an international political movement opposing "globalization" has gained many adherents. The movement achieved notoriety in 1999, when demonstrators representing a mix of traditional protectionists and new ideologies disrupted a major international trade meeting in Seattle. If nothing else, the anti-globalization movement has forced advocates of free trade to seek new ways to explain their views.

As befits both the historical importance and the current relevance of the protectionist issue, roughly a quarter of this book is devoted to this subject. Over the years, international economists have developed a simple yet powerful analytical framework for determining the effects of government policies that affect international trade. This framework helps predict the effects of trade policies, while also allowing for cost-benefit analysis and defining criteria for determining when government intervention is good for the economy. We present this framework in Chapters 9 and 10 and use it to discuss a number of policy issues in those chapters and in the two that follow.

In the real world, however, governments do not necessarily do what the cost-benefit analysis of economists tells them they should. This does not mean that analysis is useless. Economic analysis can help make sense of the politics of international trade policy, by showing who benefits and who loses from such government actions as quotas on imports and subsidies to exports. The key insight of this analysis is that conflicts of interest *within* nations are usually more important in determining trade policy than conflicts of interest *between* nations. Chapters 4 and 5 show that trade usually has very strong effects on income distribution within countries, while Chapters 10 through 12 reveal that the relative power of different interest groups within countries, rather than some measure of overall national interest, is often the main determining factor in government policies toward international trade.

## Balance of Payments

In 1998 both China and South Korea ran large trade surpluses of about $40 billion each. In China's case the trade surplus was not out of the ordinary—the country had been running large surpluses for several years, prompting complaints from other countries, including the United States, that China was not playing by the rules. So is it good to run a trade surplus and bad to run a trade deficit? Not according to the South Koreans: Their trade surplus was forced on them by an economic and financial crisis, and they bitterly resented the necessity of running that surplus.

This comparison highlights the fact that a country's *balance of payments* must be placed in the context of an economic analysis to understand what it means. It emerges in a variety of specific contexts: in discussing foreign direct investment by multinational corporations (Chapter 8), in relating international transactions to national income accounting (Chapter 13), and in discussing virtually every aspect of international monetary policy (Chapters 17 through 22). Like the problem of protectionism, the balance of payments has become a central issue for the United States because the nation has run huge trade deficits in every year since 1982.

## Exchange Rate Determination

The euro, a common currency for most of the nations of Western Europe, was introduced on January 1, 1999. On that day the euro was worth about $1.17. By early 2002, the euro was worth only about $0.85, denting Europe's pride (although helping its exporters). By late 2007, the euro was worth more than $1.40; by the middle of 2010, it had slid back to $1.29.

A key difference between international economics and other areas of economics is that countries usually have their own currencies—the euro being the exception that proves the rule. And as the example of the euro/dollar exchange rate illustrates, the relative values of currencies can change over time, sometimes drastically.

For historical reasons, the study of exchange rate determination is a relatively new part of international economics. For much of modern economic history, exchange rates were fixed by government action rather than determined in the marketplace. Before World War I the values of the world's major currencies were fixed in terms of gold; for a generation

after World War II, the values of most currencies were fixed in terms of the U.S. dollar. The analysis of international monetary systems that fix exchange rates remains an important subject. Chapter 18 is devoted to the working of fixed-rate systems, Chapter 19 to the historical performance of alternative exchange-rate systems, and Chapter 20 to the economics of currency areas such as the European monetary union. For the time being, however, some of the world's most important exchange rates fluctuate minute by minute and the role of changing exchange rates remains at the center of the international economics story. Chapters 14 through 17 focus on the modern theory of floating exchange rates.

## International Policy Coordination

The international economy comprises sovereign nations, each free to choose its own economic policies. Unfortunately, in an integrated world economy, one country's economic policies usually affect other countries as well. For example, when Germany's Bundesbank raised interest rates in 1990—a step it took to control the possible inflationary impact of the reunification of West and East Germany—it helped precipitate a recession in the rest of Western Europe. Differences in goals among countries often lead to conflicts of interest. Even when countries have similar goals, they may suffer losses if they fail to coordinate their policies. A fundamental problem in international economics is determining how to produce an acceptable degree of harmony among the international trade and monetary policies of different countries in the absence of a world government that tells countries what to do.

For almost 70 years, international trade policies have been governed by an international treaty known as the General Agreement on Tariffs and Trade (GATT). Since 1994, trade rules have been enforced by an international organization, the World Trade Organization, that can tell countries, including the United States, that their policies violate prior agreements. We discuss the rationale for this system in Chapter 9 and look at whether the current rules of the game for international trade in the world economy can or should survive.

While cooperation on international trade policies is a well-established tradition, coordination of international macroeconomic policies is a newer and more uncertain topic. Only in the past few years have economists formulated at all precisely the case for macroeconomic policy coordination. Nonetheless, attempts at international macroeconomic coordination are occurring with growing frequency in the real world. Both the theory of international macroeconomic coordination and the developing experience are reviewed in Chapter 19.

## The International Capital Market

During the 1970s, banks in advanced countries lent large sums to firms and governments in poorer nations, especially in Latin America. In 1982, however, first Mexico, then a number of other countries, found themselves unable to pay back the money they owed. The resulting "debt crisis" persisted until 1990. In the 1990s, investors once again became willing to put hundreds of billions of dollars into "emerging markets," both in Latin America and in the rapidly growing economies of Asia. All too soon, however, this investment boom came to grief as well; Mexico experienced another financial crisis at the end of 1994, much of Asia was caught up in a massive crisis beginning in the summer of 1997, and Argentina had a severe crisis in 2002. This roller coaster history contains many lessons, the most undisputed of which is the growing importance of the international capital market.

In any sophisticated economy there is an extensive capital market: a set of arrangements by which individuals and firms exchange money now for promises to pay in the future. The growing importance of international trade since the 1960s has been accompanied by a

growth in the *international* capital market, which links the capital markets of individual countries. Thus in the 1970s, oil-rich Middle Eastern nations placed their oil revenues in banks in London or New York, and these banks in turn lent money to governments and corporations in Asia and Latin America. During the 1980s, Japan converted much of the money it earned from its booming exports into investments in the United States, including the establishment of a growing number of U.S. subsidiaries of Japanese corporations. Nowadays China is funneling its own export earnings into a range of foreign assets, including dollars that its government holds as international reserves.

International capital markets differ in important ways from domestic capital markets. They must cope with special regulations that many countries impose on foreign investment; they also sometimes offer opportunities to evade regulations placed on domestic markets. Since the 1960s, huge international capital markets have arisen, most notably the remarkable London Eurodollar market, in which billions of dollars are exchanged each day without ever touching the United States.

Some special risks are associated with international capital markets. One risk is that of currency fluctuations: If the euro falls against the dollar, U.S. investors who bought euro bonds suffer a capital loss—as the many investors who had assumed that Europe's new currency would be strong discovered to their horror. Another risk is that of national default: A nation may simply refuse to pay its debts (perhaps because it cannot), and there may be no effective way for its creditors to bring it to court. International financial linkages helped turn the downturn in the U.S. housing market that had begun in 2006 into a global economic crisis.

The growing importance of international capital markets and their new problems demand greater attention than ever before. This book devotes two chapters to issues arising from international capital markets: one on the functioning of global asset markets (Chapter 21) and one on foreign borrowing by developing countries (Chapter 22).

## International Economics: Trade and Money

The economics of the international economy can be divided into two broad subfields: the study of *international trade* and the study of *international money.* International trade analysis focuses primarily on the *real* transactions in the international economy, that is, on those transactions that involve a physical movement of goods or a tangible commitment of economic resources. International monetary analysis focuses on the *monetary* side of the international economy, that is, on financial transactions such as foreign purchases of U.S. dollars. An example of an international trade issue is the conflict between the United States and Europe over Europe's subsidized exports of agricultural products; an example of an international monetary issue is the dispute over whether the foreign exchange value of the dollar should be allowed to float freely or be stabilized by government action.

In the real world there is no simple dividing line between trade and monetary issues. Most international trade involves monetary transactions, while, as the examples in this chapter already suggest, many monetary events have important consequences for trade. Nonetheless, the distinction between international trade and international money is useful. The first half of this book covers international trade issues. Part One (Chapters 2 through 8) develops the analytical theory of international trade, and Part Two (Chapters 9 through 12) applies trade theory to the analysis of government policies toward trade. The second half of the book is devoted to international monetary issues. Part Three (Chapters 13 through 18) develops international monetary theory, and Part Four (Chapters 19 through 22) applies this analysis to international monetary policy.

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CHAPTER 2

# World Trade: An Overview

In 2008, the world as a whole produced goods and services worth about $50 trillion at current prices. Of this total, more than 30 percent was sold across national borders: World trade in goods and services exceeded $16 trillion. That's a whole lot of exporting and importing.

In later chapters we'll analyze why countries sell much of what they produce to other countries and why they purchase much of what they consume from other countries. We'll also examine the benefits and costs of international trade and the motivations for and effects of government policies that restrict or encourage trade.

Before we get to all that, however, let's begin by describing who trades with whom. An empirical relationship known as the *gravity model* helps to make sense of the value of trade between any pair of countries and also sheds light on the impediments that continue to limit international trade even in today's global economy.

We'll then turn to the changing structure of world trade. As we'll see, recent decades have been marked by a large increase in the share of world output that is sold internationally, by a shift in the world's economic center of gravity toward Asia, and by major changes in the types of goods that make up that trade.

## LEARNING GOALS

After reading this chapter, you will be able to:

- Describe how the value of trade between any two countries depends on the size of these countries' economies and explain the reasons for that relationship.
- Discuss how distance and borders reduce trade.
- Describe how the share of international production that is traded has fluctuated over time and why there have been two ages of globalization.
- Explain how the mix of goods and services that are traded internationally has changed over time.

## Who Trades with Whom?

Figure 2-1 shows the total value of trade in goods—exports plus imports—between the United States and its top 15 trading partners in 2008. (Data on trade in services are less well broken down by trading partner; we'll talk about the rising importance of trade in

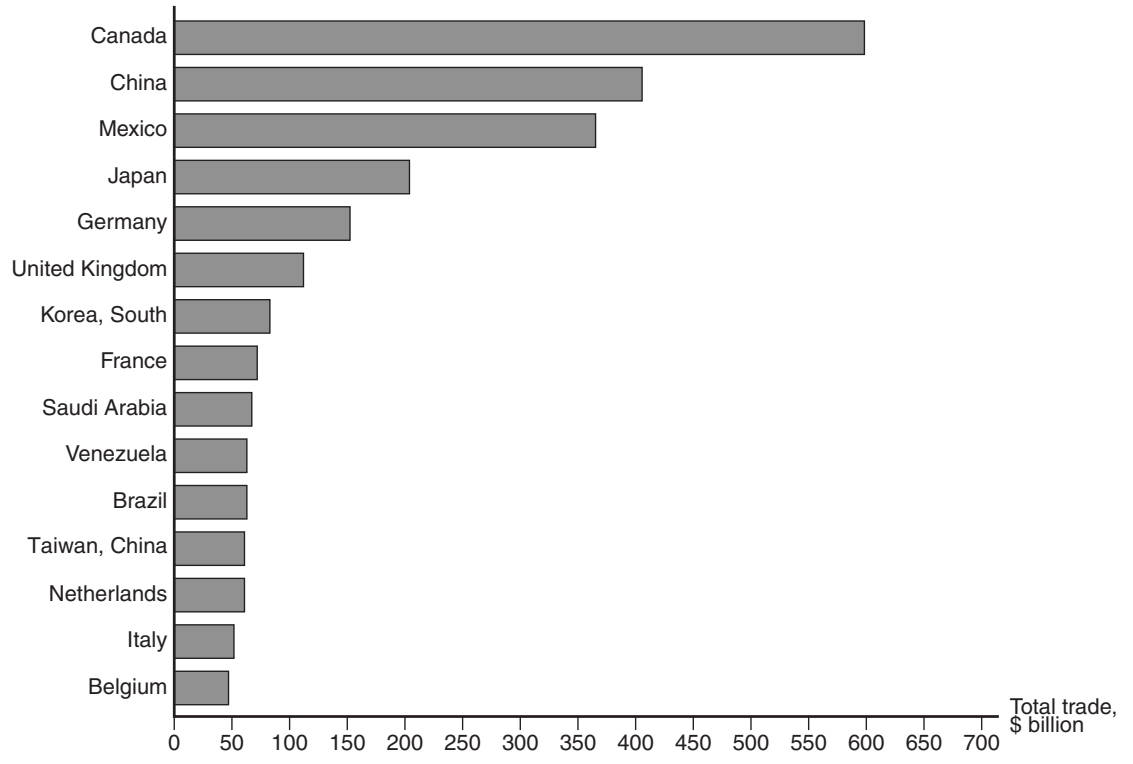



**Figure 2-1**

**Total U.S. Trade with Major Partners, 2008**

U.S. trade—measured as the sum of imports and exports—is mostly with 15 major partners.

**Source:** U.S. Department of Commerce.

services, and the issues raised by that trade, later in this chapter.) Taken together, these 15 economies accounted for 69 percent of the value of U.S. trade in that year.

Why did the United States trade so much with these economies? Let's look at the factors that, in practice, determine who trades with whom.

## Size Matters: The Gravity Model

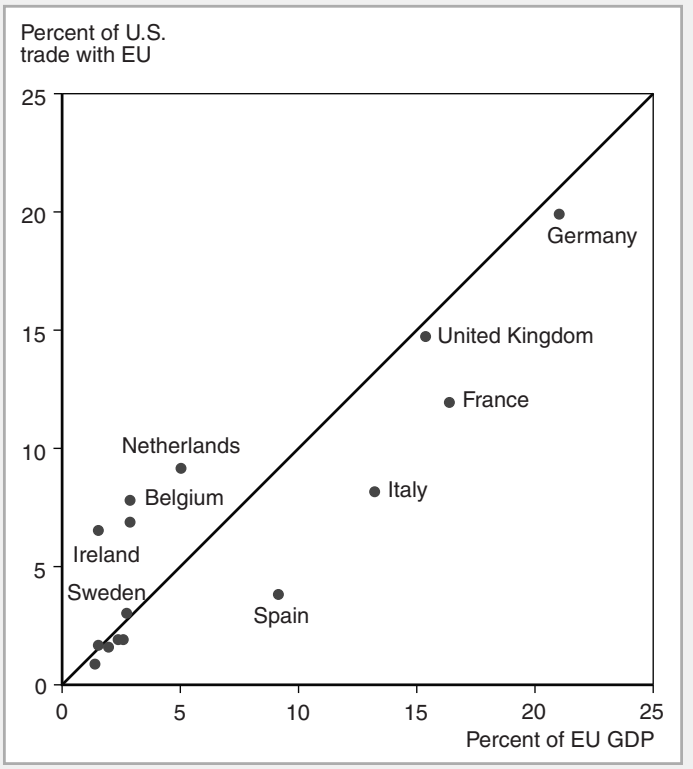
Three of the top 15 U.S. trading partners are European nations: Germany, the United Kingdom, and France. Why does the United States trade more heavily with these three European countries than with others? The answer is that these are the three largest European economies. That is, they have the highest values of **gross domestic product (GDP),** which measures the total value of all goods and services produced in an economy. There is a strong empirical relationship between the size of a country's economy and the volume of both its imports and its exports.

Figure 2-2 illustrates that relationship by showing the correspondence between the size of different European economies—specifically, America's 15 most important Western

**Figure 2-2**

**The Size of European Economies, and the Value of Their Trade with the United States**

**Source:** U.S. Department of Commerce, European Commission.




European trading partners in 2008—and those countries' trade with the United States in that year. On the horizontal axis is each country's GDP, expressed as a percentage of the total GDP of the European Union; on the vertical axis is each country's share of the total trade of the United States with the EU. As you can see, the scatter of points clustered around the dotted 45-degree line—that is, each country's share of U.S. trade with Europe—was roughly equal to that country's share of Western European GDP. Germany has a large economy, accounting for 21 percent of Western European GDP; it also accounts for 19.9 percent of U.S. trade with the region. Sweden has a much smaller economy, accounting for only 2.7 percent of European GDP; correspondingly, it accounts for only 3 percent of U.S.–Europe trade.

Looking at world trade as a whole, economists have found that an equation of the following form predicts the volume of trade between any two countries fairly accurately,

$$T_{ij} = A \times Y_i \times Y_j / D_{ij}, \tag{2-1}$$

where $A$ is a constant term, $T_{ij}$ is the value of trade between country $i$ and country $j$, $Y_i$ is country $i$'s GDP, $Y_i$ is country $j$'s GDP, and $D_{ij}$ is the distance between the two countries. That is, the value of trade between any two countries is proportional, other things equal, to the *product* of the two countries' GDPs, and diminishes with the distance between the two countries.

An equation such as (2-1) is known as a **gravity model** of world trade. The reason for the name is the analogy to Newton's law of gravity: Just as the gravitational attraction between any two objects is proportional to the product of their masses and diminishes with

distance, the trade between any two countries is, other things equal, proportional to the product of their GDPs and diminishes with distance.

Economists often estimate a somewhat more general gravity model of the following form:

$$T_{ij} = A \times Y_i^a \times Y_j^b / D_{ij}^c. \quad \text{(2-2)}$$

This equation says that the three things that determine the volume of trade between two countries are the size of the two countries' GDPs and the distance between the countries, without specifically assuming that trade is proportional to the product of the two GDPs and inversely proportional to distance. Instead, *a, b,* and *c* are chosen to fit the actual data as closely as possible. If *a, b,* and *c* were all equal to 1, Equation (2-2) would be the same as Equation (2-1). In fact, estimates often find that (2-1) is a pretty good approximation.

Why does the gravity model work? Broadly speaking, large economies tend to spend large amounts on imports because they have large incomes. They also tend to attract large shares of other countries' spending because they produce a wide range of products. So, other things equal, the trade between any two economies is larger, the larger is *either* economy.

What other things *aren't* equal? As we have already noted, in practice countries spend much or most of their income at home. The United States and the European Union each account for about 25 percent of the world's GDP, but each attracts only about 2 percent of the other's spending. To make sense of actual trade flows, we need to consider the factors limiting international trade. Before we get there, however, let's look at an important reason why the gravity model is useful.

## Using the Gravity Model: Looking for Anomalies

It's clear from Figure 2-2 that a gravity model fits the data on U.S. trade with European countries pretty well but not perfectly. In fact, one of the principal uses of gravity models is that they help us to identify anomalies in trade. Indeed, when trade between two countries is either much more or much less than a gravity model predicts, economists search for the explanation.

Looking again at Figure 2-2, we see that the Netherlands, Belgium, and Ireland trade considerably more with the United States than a gravity model would have predicted. Why might this be the case?

For Ireland, the answer lies partly in cultural affinity: Not only does Ireland share a language with the United States, but tens of millions of Americans are descended from Irish immigrants. Beyond this consideration, Ireland plays a special role as host to many U.S.-based corporations; we'll discuss the role of such *multinational corporations* in Chapter 8.

In the case of both the Netherlands and Belgium, geography and transport costs probably explain their large trade with the United States. Both countries are located near the mouth of the Rhine, Western Europe's longest river, which runs past the Ruhr, Germany's industrial heartland. So the Netherlands and Belgium have traditionally been the point of entry to much of northwestern Europe; Rotterdam in the Netherlands is the most important port in Europe, as measured by the tonnage handled, and Antwerp in Belgium ranks second. The large trade of Belgium and the Netherlands suggests, in other words, an important role of transport costs and geography in determining the volume of trade. The importance of these factors is clear when we turn to a broader example of trade data.

## Impediments to Trade: Distance, Barriers, and Borders

Figure 2-3 shows the same data as Figure 2-2—U.S. trade as a percentage of total trade with Western Europe in 2008, versus GDP as a percentage of the region's total GDP—but adds two more countries: Canada and Mexico. As you can see, the two neighbors of the United States do a lot more trade with the United States than European economies of equal size. In fact, Canada, whose economy is roughly the same size as Spain's, trades as much with the United States as all of Europe does.

Why does the United States do so much more trade with its North American neighbors than with its European partners? One main reason is the simple fact that Canada and Mexico are much closer.

All estimated gravity models show a strong negative effect of distance on international trade; typical estimates say that a 1 percent increase in the distance between two countries is associated with a fall of 0.7 to 1 percent in the trade between those countries. This drop partly reflects increased costs of transporting goods and services. Economists also believe that less tangible factors play a crucial role: Trade tends to be intense when countries have close personal contact, and this contact tends to diminish when distances are large. For example, it's easy for a U.S. sales representative to pay a quick visit to Toronto, but it's a much bigger project for that representative to go to Paris. Unless the company is based on the West Coast, it's an even bigger project to visit Tokyo.

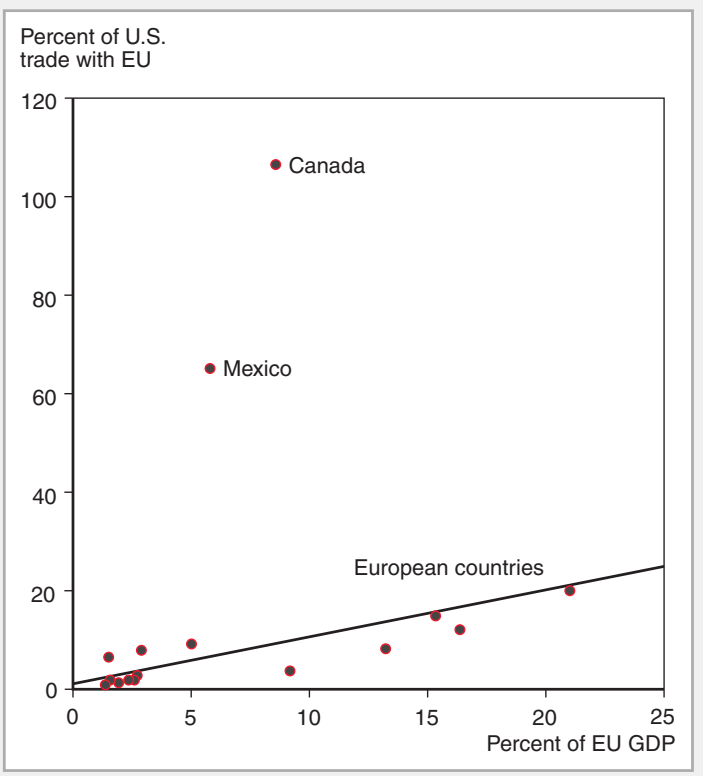
In addition to being U.S. neighbors, Canada and Mexico are part of a **trade agreement** with the United States, the North American Free Trade Agreement, or NAFTA, which ensures that most goods shipped among the three countries are not subject to tariffs or other barriers to international trade. We'll analyze the effects of barriers to international

**Figure 2-3**

**Economic Size and Trade with the United States**

The United States does markedly more trade with its neighbors than it does with European economies of the same size.

**Source:** U.S. Department of Commerce, European Commission.



trade in Chapters 8–9, and the role of trade agreements such as NAFTA in Chapter 10. For now, let's notice that economists use gravity models as a way of assessing the impact of trade agreements on actual international trade: If a trade agreement is effective, it should lead to significantly more trade among its partners than one would otherwise predict given their GDPs and distances from one another.

It's important to note, however, that although trade agreements often end all formal barriers to trade between countries, they rarely make national borders irrelevant. Even when most goods and services shipped across a national border pay no tariffs and face few legal restrictions, there is much more trade between regions of the same country than between equivalently situated regions in different countries. The Canadian–U.S. border is a case in point. The two countries are part of a free trade agreement (indeed, there was a Canadian–U.S. free trade agreement even before NAFTA); most Canadians speak English; and the citizens of either country are free to cross the border with a minimum of formalities. Yet data on the trade of individual Canadian provinces both with each other and with U.S. states show that, other things equal, there is much more trade between provinces than between provinces and U.S. states.

Table 2-1 illustrates the extent of the difference. It shows the total trade (exports plus imports) of the Canadian province of British Columbia, just north of the state of Washington, with other Canadian provinces and with U.S. states, measured as a percentage of each province or state's GDP. Figure 2-4 shows the location of these provinces and states. Each Canadian province is paired with a U.S. state that is roughly the same distance from British Columbia: Washington State and Alberta both border British Columbia; Ontario and Ohio are both in the Midwest; and so on. With the exception of trade with the far eastern Canadian province of New Brunswick, intra-Canadian trade drops off steadily with distance. But in each case, the trade between British Columbia and a Canadian province is much larger than trade with an equally distant U.S. state.

Economists have used data like those shown in Table 2-1, together with estimates of the effect of distance in gravity models, to calculate that the Canadian–U.S. border, although it is one of the most open borders in the world, has as much effect in deterring trade as if the countries were between 1,500 and 2,500 miles apart.

Why do borders have such a large negative effect on trade? That is a topic of ongoing research. Chapter 20 describes one recent focus of that research: an effort to determine how much effect the existence of separate national currencies has on international trade in goods and services.

**TABLE 2-1 Trade with British Columbia, as Percent of GDP, 1996**

| Canadian Province | Trade as Percent of GDP | Trade as Percent of GDP | U.S. State at Similar Distance from British Columbia |
|---|---|---|---|
| Alberta | 6.9 | 2.6 | Washington |
| Saskatchewan | 2.4 | 1.0 | Montana |
| Manitoba | 2.0 | 0.3 | California |
| Ontario | 1.9 | 0.2 | Ohio |
| Quebec | 1.4 | 0.1 | New York |
| New Brunswick | 2.3 | 0.2 | Maine |

**Source:** Howard J. Wall, "Gravity Model Specification and the Effects of the U.S.-Canadian Border," Federal Reserve Bank of St. Louis Working Paper 2000–024A, 2000.

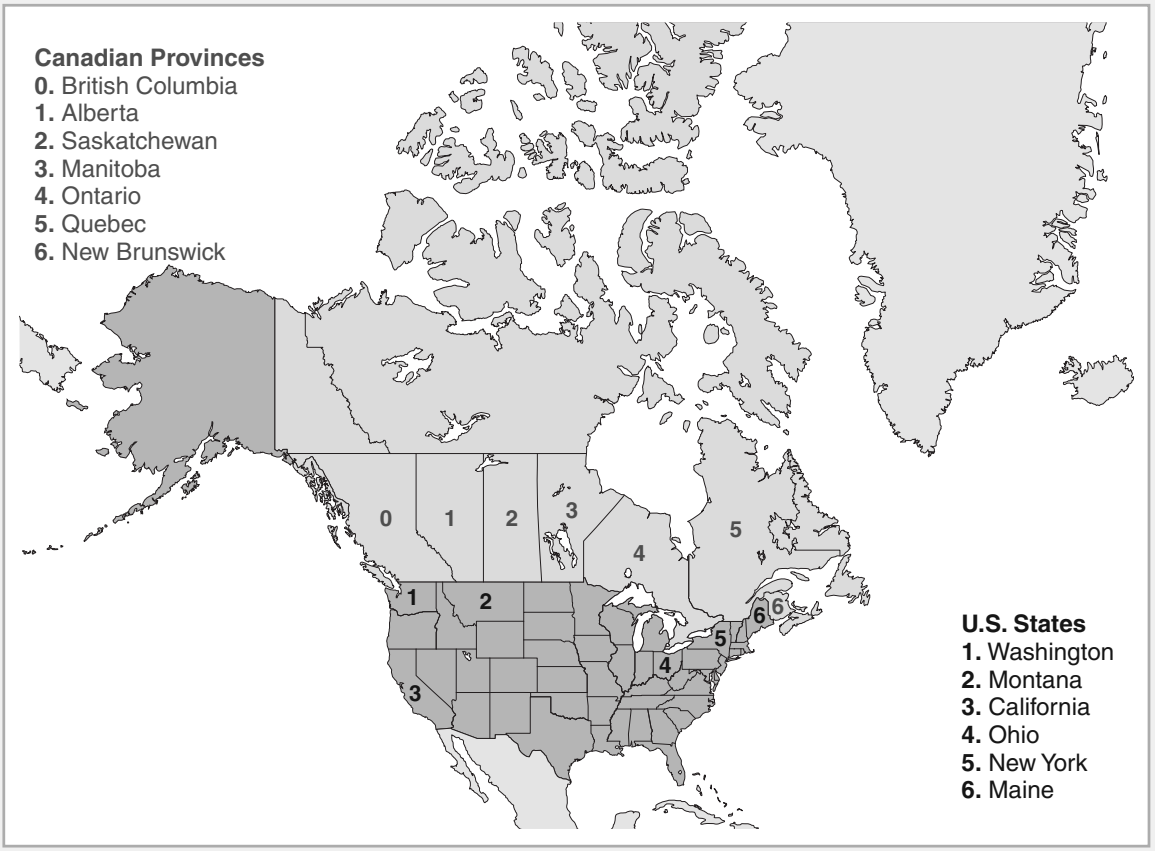



**Figure 2-4**
**Canadian Provinces and U.S. States That Trade with British Columbia**

# The Changing Pattern of World Trade

World trade is a moving target. The direction and composition of world trade is quite different today from what it was a generation ago, and even more different from what it was a century ago. Let's look at some of the main trends.

## Has the World Gotten Smaller?

In popular discussions of the world economy, one often encounters statements that modern transportation and communications have abolished distance, so that the world has become a small place. There's clearly some truth to these statements: The Internet makes instant and almost free communication possible between people thousands of miles apart, while jet transport allows quick physical access to all parts of the globe. On the other hand, gravity models continue to show a strong negative relationship between distance and international trade. But have such effects grown weaker over time? Has the progress of transportation and communication made the world smaller?

The answer is yes—but history also shows that political forces can outweigh the effects of technology. The world got smaller between 1840 and 1914, but it got bigger again for much of the 20th century.

| TABLE 2-2 | World Exports as a Percentage of World GDP |
|---|---|
| 1870 | 4.6 |
| 1913 | 7.9 |
| 1950 | 5.5 |
| 1973 | 10.5 |
| 1998 | 17.2 |

**Source:** Angus Maddison, *The World Economy: A Millennial Perspective,* World Bank, 2001.

Economic historians tell us that a global economy, with strong economic linkages between even distant nations, is not new. In fact, there have been two great waves of globalization, with the first wave relying not on jets and the Internet but on railroads, steamships, and the telegraph. In 1919, the great economist John Maynard Keynes described the results of that surge of globalization:

> What an extraordinary episode in the economic progress of man that age was which came to an end in August 1914! . . . The inhabitant of London could order by telephone, sipping his morning tea in bed, the various products of the whole earth, in such quantity as he might see fit, and reasonably expect their early delivery upon his doorstep.

Notice, however, Keynes's statement that the age "came to an end" in 1914. In fact, two subsequent world wars, the Great Depression of the 1930s, and widespread protectionism did a great deal to depress world trade. Table 2-2 shows estimates of world exports as a percentage of world GDP for selected years since the 19th century. World trade grew rapidly between 1870 and 1913, but suffered a sharp setback in the decades that followed, and did not recover to pre–World War I levels until around 1970.

Since 1970, world trade as a share of world GDP has risen to unprecedented heights. Much of this rise in the value of world trade reflects the so-called "vertical disintegration" of production: Before a product reaches the hands of consumers, it often goes through many production stages in different countries. For example, consumer electronic products—cell phones, iPods, and so on—are often assembled in low-wage nations such as China from components produced in higher-wage nations like Japan. Because of the extensive cross-shipping of components, a $100 product can give rise to $200 or $300 worth of international trade flows.

## What Do We Trade?

When countries trade, what do they trade? For the world as a whole, the main answer is that they ship manufactured goods such as automobiles, computers, and clothing to each other. However, trade in mineral products—a category that includes everything from copper ore to coal, but whose main component in the modern world is oil—remains an important part of world trade. Agricultural products such as wheat, soybeans, and cotton are another key piece of the picture, and services of various kinds play an important role and are widely expected to become more important in the future.

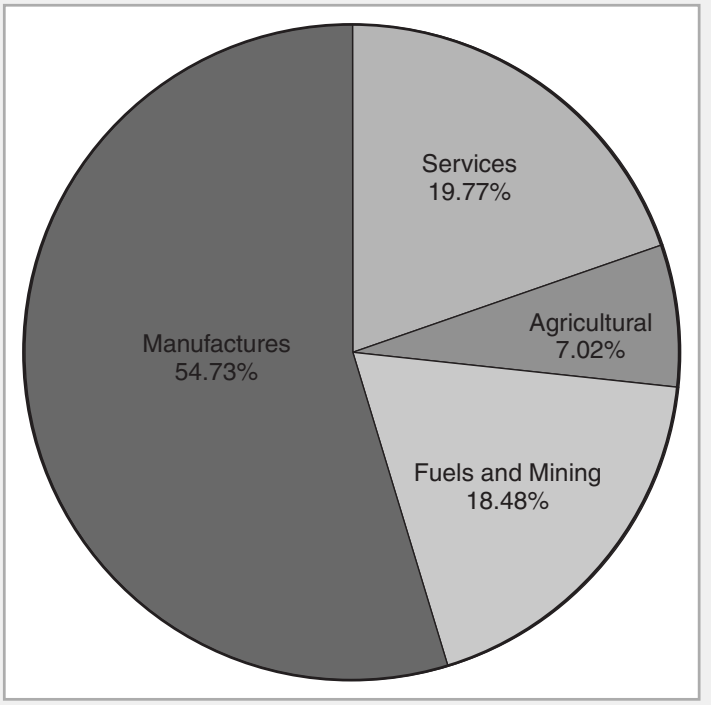
Figure 2-5 shows the percentage breakdown of world exports in 2008. Manufactured goods of all kinds make up the lion's share of world trade. Most of the value of mining goods consists of oil and other fuels. Trade in agricultural products, although crucial in feeding many countries, accounts for only a small fraction of the value of modern world trade.

**Figure 2-5**

**The Composition of World Trade, 2008**

Most world trade is in manufactured goods, but minerals—mainly oil—remain important.

**Source:** World Trade Organization.




Meanwhile, service exports include traditional transportation fees charged by airlines and shipping companies, insurance fees received from foreigners, and spending by foreign tourists. In recent years new types of service trade, made possible by modern telecommunications, have drawn a great deal of media attention. The most famous example is the rise of overseas call and help centers: If you call an 800 number for information or technical help, the person on the other end of the line may well be in a remote country (the Indian city of Bangalore is a particularly popular location). So far, these exotic new forms of trade are still a relatively small part of the overall trade picture, but as explained below, that may change in the years ahead.

The current picture, in which manufactured goods dominate world trade, is relatively new. In the past, primary products—agricultural and mining goods—played a much more important role in world trade. Table 2-3 shows the share of manufactured goods in the exports and imports of the United Kingdom and the United States in 1910 and 2008. In the early 20th century Britain, while it overwhelmingly exported manufactured goods (manufactures), mainly imported primary products. Today manufactured goods dominate both sides of its trade. Meanwhile, the United States has gone from a trade pattern in which

**TABLE 2-3 Manufactured Goods as Percent of Merchandise Trade**

| | United Kingdom | | United States | |
|---|---|---|---|---|
| | **Exports** | **Imports** | **Exports** | **Imports** |
| 1910 | 75.4 | 24.5 | 47.5 | 40.7 |
| 2008 | 71.0 | 67.8 | 74.8 | 65.3 |

**Source:** 1910 data from Simon Kuznets, *Modern Economic Growth: Rate, Structure and Speed.* New Haven: Yale Univ. Press, 1966. 2008 data from World Trade Organization.

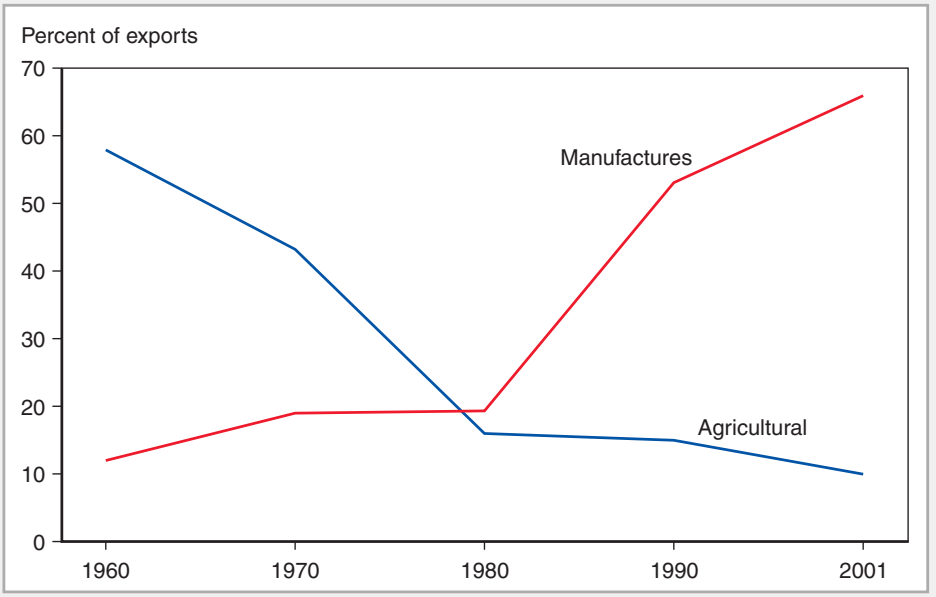



**Figure 2-6**

**The Changing Composition of Developing-Country Exports**

Over the past 50 years, the exports of developing countries have shifted toward manufactures.

**Source:** United Nations Council on Trade and Development.

primary products were more important than manufactured goods on both sides to one in which manufactured goods dominate on both sides.

A more recent transformation has been the rise of third world exports of manufactured goods. The terms **third world** and **developing countries** are applied to the world's poorer nations, many of which were European colonies before World War II. As recently as the 1970s, these countries mainly exported primary products. Since then, however, they have moved rapidly into exports of manufactured goods. Figure 2-6 shows the shares of agricultural products and manufactured goods in developing-country exports since 1960. There has been an almost complete reversal of relative importance. For example, more than 90 percent of the exports of China, the largest developing economy and a rapidly growing force in world trade, consists of manufactured goods.

## Service Offshoring

One of the hottest disputes in international economics right now is whether modern information technology, which makes it possible to perform some economic functions at long range, will lead to a dramatic increase in new forms of international trade. We've already mentioned the example of call centers, where the person answering your request for information may be 8,000 miles away. Many other services can also be done in a remote location. When a service previously done within a country is shifted to a foreign location, the change is known as **service offshoring** (sometimes known as **service outsourcing**). In addition, producers must decide whether they should set up a foreign subsidiary to provide those services (and operate as a multinational firm) or outsource those services to another firm. In Chapter 8, we describe in more detail how firms make these important decisions.

In a famous *Foreign Affairs* article published in 2006, Alan Blinder, an economist at Princeton University, argued that "in the future, and to a great extent already in the present, the key distinction for international trade will no longer be between things that can be put in a box and things that cannot. It will, instead, be between services that can be delivered electronically over long distances with little or no degradation of quality, and those that cannot." For example, the worker who restocks the shelves at your local grocery has to be on site, but the accountant who keeps the grocery's books could be in another country, keeping in touch over the Internet. The nurse who takes your pulse has to be nearby, but the radiologist who reads your X-ray could receive the images electronically anywhere that has a high-speed connection.

At this point, service outsourcing gets a great deal of attention precisely because it's still fairly rare. The question is how big it might become, and how many workers who currently face no international competition might see that change in the future. One way economists have tried to answer this question is by looking at which services are traded at long distances *within* the United States. For example, many financial services are provided to the nation from New York, the country's financial capital; much of the country's software publishing takes place in Seattle, home of Microsoft; much of America's (and the world's) Internet search services are provided from the Googleplex in Mountain View, California, and so on.

Figure 2-7 shows the results of one study that systematically used data on the location of industries within the United States to determine which services are and are not

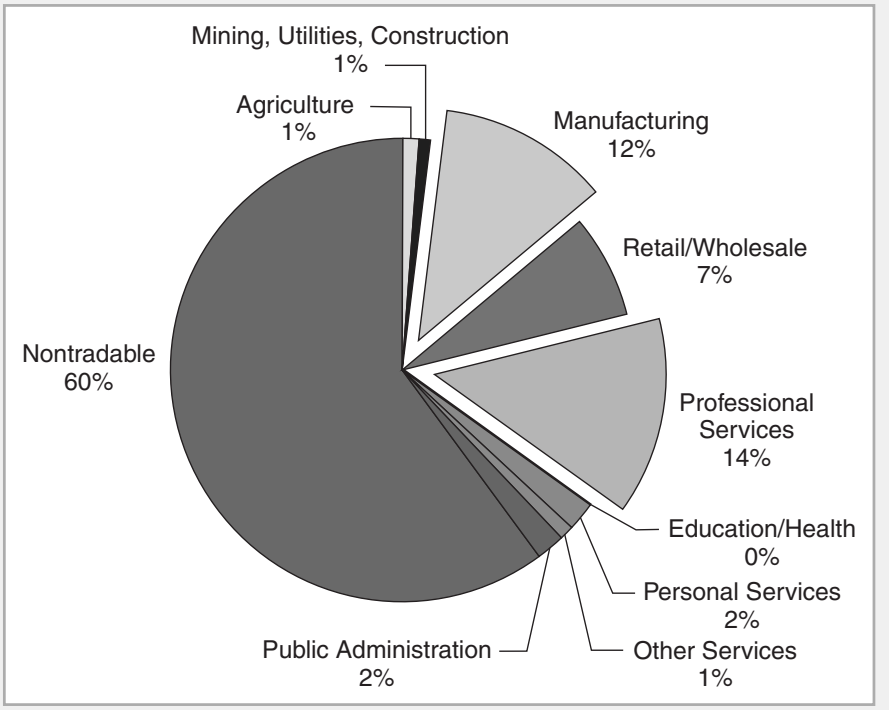



**Figure 2-7**

**Tradable Industries' Share of Employment**

Estimates based on trade within the United States suggest that trade in services may eventually become bigger than trade in manufactures.

**Source:** J. Bradford Jensen and Lori. G. Kletzer, "Tradable Services: Understanding the Scope and Impact of Services Outsourcing," Peterson Institute of Economics Working Paper 5–09, May 2005.

tradable at long distances. As the figure shows, the study concluded that about 60 percent of total U.S. employment consists of jobs that must be done close to the customer, making them nontradable. But the 40 percent of employment that is in tradable activities includes more service than manufacturing jobs. This suggests that the current dominance of world trade by manufactures, shown in Figure 2-5, may be only temporary. In the long run, trade in services, delivered electronically, may become the most important component of world trade.

## Do Old Rules Still Apply?

We begin our discussion of the causes of world trade in Chapter 3, with an analysis of a model originally put forth by the British economist David Ricardo in 1819. Given all the changes in world trade since Ricardo's time, can old ideas still be relevant? The answer is a resounding yes. Even though much about international trade has changed, the fundamental principles discovered by economists at the dawn of a global economy still apply.

It's true that world trade has become harder to characterize in simple terms. A century ago, each country's exports were obviously shaped in large part by its climate and natural resources. Tropical countries exported tropical products such as coffee and cotton; land-rich countries such as the United States and Australia exported food to densely populated European nations. Disputes over trade were also easy to explain: The classic political battles over free trade versus protectionism were waged between English landowners who wanted protection from cheap food imports and English manufacturers who exported much of their output.

The sources of modern trade are more subtle. Human resources and human-created resources (in the form of machinery and other types of capital) are more important than natural resources. Political battles over trade typically involve workers whose skills are made less valuable by imports—clothing workers who face competition from imported apparel, and tech workers who now face competition from Bangalore.

As we'll see in later chapters, however, the underlying logic of international trade remains the same. Economic models developed long before the invention of jet planes or the Internet remain key to understanding the essentials of 21st-century international trade.

## SUMMARY

1. The *gravity model* relates the trade between any two countries to the sizes of their economies. Using the gravity model also reveals the strong effects of distance and international borders—even friendly borders like that between the United States and Canada—in discouraging trade.
2. International trade is at record levels relative to the size of the world economy, thanks to falling costs of transportation and communications. However, trade has not grown in a straight line: The world was highly integrated in 1914, but trade was greatly reduced by economic depression, protectionism, and war, and took decades to recover.
3. Manufactured goods dominate modern trade today. In the past, however, primary products were much more important than they are now; recently, trade in services has become increasingly important.
4. *Developing countries*, in particular, have shifted from being mainly exporters of primary products to being mainly exporters of manufactured goods.

## KEY TERMS

developing countries, p. 49
gravity model, p. 42
gross domestic product (GDP), p. 41
service offshoring (service outsourcing), p. 49
third world, p. 49
trade agreement, p. 44

## PROBLEMS


1. Canada and Australia are (mainly) English-speaking countries with populations that are not too different in size (Canada's is 60 percent larger). But Canadian trade is twice as large, relative to GDP, as Australia's. Why should this be the case?
2. Mexico and Brazil have very different trading patterns. While Mexico trades mainly with the United States, Brazil trades about equally with the United States and with the European Union. In addition, Mexico does much more trade relative to its GDP. Explain these differences using the gravity model.
3. Equation (2.1) says that trade between any two countries is proportional to the product of their GDPs. Does this mean that if the GDP of every country in the world doubled, world trade would quadruple?
4. Over the past few decades, East Asian economies have increased their share of world GDP. Similarly, intra–East Asian trade—that is, trade among East Asian nations—has grown as a share of world trade. More than that, East Asian countries do an increasing share of their trade with each other. Explain why, using the gravity model.
5. A century ago, most British imports came from relatively distant locations: North America, Latin America, and Asia. Today, most British imports come from other European countries. How does this fit in with the changing types of goods that make up world trade?

## FURTHER READINGS

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Harold James. *The End of Globalization: Lessons from the Great Depression*. Cambridge: Harvard University Press, 2001. A survey of how the first great wave of globalization ended.

J. Bradford Jensen and Lori G. Kletzer. "Tradable Services: Understanding the Scope and Impact of Services Outsourcing." Peterson Institute Working Paper 5–09, May 2005. A systematic look at which services are traded within the United States, with implications about the future of international trade in services.

World Bank. *World Development Report 1995*. Each year the World Bank spotlights an important global issue; the 1995 report focused on the effects of growing world trade.

World Trade Organization. *World Trade Report*. An annual report on the state of world trade. Each year's report has a theme; for example, the 2004 report focused on the effects on world trade of domestic policies such as spending on infrastructure.


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CHAPTER 3

# Labor Productivity and Comparative Advantage: The Ricardian Model

Countries engage in international trade for two basic reasons, each of which contributes to their gains from trade. First, countries trade because they are different from each other. Nations, like individuals, can benefit from their differences by reaching an arrangement in which each does the things it does relatively well. Second, countries trade to achieve economies of scale in production. That is, if each country produces only a limited range of goods, it can produce each of these goods at a larger scale and hence more efficiently than if it tried to produce everything. In the real world, patterns of international trade reflect the interaction of both these motives. As a first step toward understanding the causes and effects of trade, however, it is useful to look at simplified models in which only one of these motives is present.

The next four chapters develop tools to help us to understand how differences between countries give rise to trade between them and why this trade is mutually beneficial. The essential concept in this analysis is that of comparative advantage.

Although comparative advantage is a simple concept, experience shows that it is a surprisingly hard concept for many people to understand (or accept). Indeed, the late Paul Samuelson—the Nobel laureate economist who did much to develop the models of international trade discussed in Chapters 4 and 5—once described comparative advantage as the best example he knows of an economic principle that is undeniably true yet not obvious to intelligent people.

In this chapter we begin with a general introduction to the concept of comparative advantage, then proceed to develop a specific model of how comparative advantage determines the pattern of international trade.

## LEARNING GOALS

After reading this chapter, you will be able to:

- Explain how the *Ricardian model*, the most basic model of international trade, works and how it illustrates the principle of *comparative advantage*.

- Demonstrate *gains from trade* and refute common fallacies about international trade.
- Describe the empirical evidence that wages reflect productivity and that trade patterns reflect relative productivity.

# The Concept of Comparative Advantage

On Valentine's Day, 1996, which happened to fall less than a week before the crucial February 20 primary in New Hampshire, Republican presidential candidate Patrick Buchanan stopped at a nursery to buy a dozen roses for his wife. He took the occasion to make a speech denouncing the growing imports of flowers into the United States, which he claimed were putting American flower growers out of business. And it is indeed true that a growing share of the market for winter roses in the United States is being supplied by imports flown in from South American countries, Colombia in particular. But is that a bad thing?

The case of winter roses offers an excellent example of the reasons why international trade can be beneficial. Consider first how hard it is to supply American sweethearts with fresh roses in February. The flowers must be grown in heated greenhouses, at great expense in terms of energy, capital investment, and other scarce resources. Those resources could be used to produce other goods. Inevitably, there is a trade-off. In order to produce winter roses, the U.S. economy must produce fewer of other things, such as computers. Economists use the term **opportunity cost** to describe such trade-offs: The opportunity cost of roses in terms of computers is the number of computers that could have been produced with the resources used to produce a given number of roses.

Suppose, for example, that the United States currently grows 10 million roses for sale on Valentine's Day and that the resources used to grow those roses could have produced 100,000 computers instead. Then the opportunity cost of those 10 million roses is 100,000 computers. (Conversely, if the computers were produced instead, the opportunity cost of those 100,000 computers would be 10 million roses.)

Those 10 million Valentine's Day roses could instead have been grown in Colombia. It seems extremely likely that the opportunity cost of those roses in terms of computers would be less than it would be in the United States. For one thing, it is a lot easier to grow February roses in the Southern Hemisphere, where it is summer in February rather than winter. Furthermore, Colombian workers are less efficient than their U.S. counterparts at making sophisticated goods such as computers, which means that a given amount of resources used in computer production yields fewer computers in Colombia than in the United States. So the trade-off in Colombia might be something like 10 million winter roses for only 30,000 computers.

This difference in opportunity costs offers the possibility of a mutually beneficial rearrangement of world production. Let the United States stop growing winter roses and devote the resources this frees up to producing computers; meanwhile, let Colombia grow those roses instead, shifting the necessary resources out of its computer industry. The resulting changes in production would look like Table 3-1.

Look what has happened: The world is producing just as many roses as before, but it is now producing more computers. So this rearrangement of production, with the United States concentrating on computers and Colombia concentrating on roses, increases the size of the world's economic pie. Because the world as a whole is producing more, it is possible in principle to raise everyone's standard of living.

**TABLE 3-1 Hypothetical Changes in Production**

| | Million Roses | Thousand Computers |
|---|---|---|
| United States | − 10 | + 100 |
| Colombia | + 10 | − 30 |
| Total | 0 | + 70 |

The reason that international trade produces this increase in world output is that it allows each country to specialize in producing the good in which it has a comparative advantage. A country has a **comparative advantage** in producing a good if the opportunity cost of producing that good in terms of other goods is lower in that country than it is in other countries.

In this example, Colombia has a comparative advantage in winter roses and the United States has a comparative advantage in computers. The standard of living can be increased in both places if Colombia produces roses for the U.S. market, while the United States produces computers for the Colombian market. We therefore have an essential insight about comparative advantage and international trade: *Trade between two countries can benefit both countries if each country exports the goods in which it has a comparative advantage.*

This is a statement about possibilities, not about what will actually happen. In the real world, there is no central authority deciding which country should produce roses and which should produce computers. Nor is there anyone handing out roses and computers to consumers in both places. Instead, international production and trade are determined in the marketplace, where supply and demand rule. Is there any reason to suppose that the potential for mutual gains from trade will be realized? Will the United States and Colombia actually end up producing the goods in which each has a comparative advantage? Will the trade between them actually make both countries better off?

To answer these questions, we must be much more explicit in our analysis. In this chapter we will develop a model of international trade originally proposed by the British economist David Ricardo, who introduced the concept of comparative advantage in the early 19th century.[1] This approach, in which international trade is solely due to international differences in the productivity of labor, is known as the **Ricardian model**.

# A One-Factor Economy

To introduce the role of comparative advantage in determining the pattern of international trade, we begin by imagining that we are dealing with an economy—which we call Home—that has only one factor of production. (In Chapter 4 we extend the analysis to models in which there are several factors.) We imagine that only two goods, wine and cheese, are produced. The technology of Home's economy can be summarized by labor productivity in each industry, expressed in terms of the **unit labor requirement,** the number of hours of labor required to produce a pound of cheese or a gallon of wine. For example, it might require one hour of labor to produce a pound of cheese, two hours to produce a gallon of wine. Notice, by the way, that we're defining unit labor requirements as the

[1] The classic reference is David Ricardo, *The Principles of Political Economy and Taxation*, first published in 1817.

*inverse* of productivity—the more cheese or wine a worker can produce in an hour, the *lower* the unit labor requirement. For future reference, we define $a_{LW}$ and $a_{LC}$ as the unit labor requirements in wine and cheese production, respectively. The economy's total resources are defined as $L$, the total labor supply.

## Production Possibilities

Because any economy has limited resources, there are limits on what it can produce, and there are always trade-offs; to produce more of one good, the economy must sacrifice some production of another good. These trade-offs are illustrated graphically by a **production possibility frontier** (line $PF$ in Figure 3-1), which shows the maximum amount of wine that can be produced once the decision has been made to produce any given amount of cheese, and vice versa.

When there is only one factor of production, the production possibility frontier of an economy is simply a straight line. We can derive this line as follows: If $Q_W$ is the economy's production of wine and $Q_C$ its production of cheese, then the labor used in producing wine will be $a_{LW}Q_W$, and the labor used in producing cheese will be $a_{LC}Q_C$. The production possibility frontier is determined by the limits on the economy's resources—in this case, labor. Because the economy's total labor supply is $L$, the limits on production are defined by the inequality

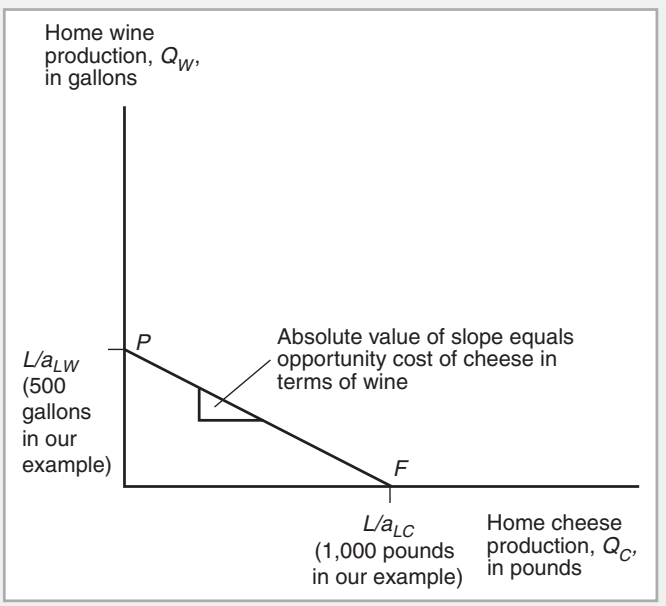
$$a_{LC}Q_C + a_{LW}Q_W \leq L. \tag{3-1}$$

Suppose, for example, that the economy's total labor supply is 1,000 hours, and that it takes 1 hour of labor to produce a pound of cheese and 2 hours of labor to produce a gallon of wine. Then the total labor used in production is (1 × pounds of cheese produced) + (2 × gallons of wine produced), and this total must be no more than the 1,000 hours of labor available. If the economy devoted all its labor to cheese production, it could, as shown in Figure 3-1, produce $L/a_{LC}$ pounds of cheese (1,000 pounds). If it devoted all its labor to wine production instead, it could produce $L/a_{LW}$ gallons—1000/2 = 500 gallons—of wine.

**Figure 3-1**

**Home's Production Possibility Frontier**

The line *PF* shows the maximum amount of cheese Home can produce given any production of wine, and vice versa.



And it can produce any mix of wine and cheese that lies on the straight line connecting those two extremes.

When the production possibility frontier is a straight line, the *opportunity cost* of a pound of cheese in terms of wine is constant. As we saw in the previous section, this opportunity cost is defined as the number of gallons of wine the economy would have to give up in order to produce an extra pound of cheese. In this case, to produce another pound would require $a_{LC}$ person-hours. Each of these person-hours could in turn have been used to produce $1/a_{LW}$ gallons of wine. Thus the opportunity cost of cheese in terms of wine is $a_{LC}/a_{LW}$. For example, if it takes one person-hour to make a pound of cheese and two hours to produce a gallon of wine, the opportunity cost of each pound of cheese is half a gallon of wine. As Figure 3-1 shows, this opportunity cost is equal to the absolute value of the slope of the production possibility frontier.

## Relative Prices and Supply

The production possibility frontier illustrates the different mixes of goods the economy *can* produce. To determine what the economy will actually produce, however, we need to look at prices. Specifically, we need to know the relative price of the economy's two goods, that is, the price of one good in terms of the other.

In a competitive economy, supply decisions are determined by the attempts of individuals to maximize their earnings. In our simplified economy, since labor is the only factor of production, the supply of cheese and wine will be determined by the movement of labor to whichever sector pays the higher wage.

Suppose, once again, that it takes one hour of labor to produce a pound of cheese and two hours to produce a gallon of wine. Now suppose further that cheese sells for $4 a pound, while wine sells for $7 a gallon. What will workers produce? Well, if they produce cheese they can earn $4 an hour. (Bear in mind that since labor is the only input into production here, there are no profits, so workers receive the full value of their output.) On the other hand, if workers produce wine, they will earn only $3.50 an hour, because a $7 gallon of wine takes two hours to produce. So if cheese sells for $4 a pound while wine sells for $7 a gallon, workers will do better by producing cheese—and the economy as a whole will specialize in cheese production.

But what if cheese prices drop to $3 a pound? In that case workers can earn more by producing wine, and the economy will specialize in wine production instead.

More generally, let $P_C$ and $P_W$ be the prices of cheese and wine, respectively. It takes $a_{LC}$ person-hours to produce a pound of cheese; since there are no profits in our one-factor model, the hourly wage in the cheese sector will equal the value of what a worker can produce in an hour, $P_C/a_{LC}$. Since it takes $a_{LW}$ person-hours to produce a gallon of wine, the hourly wage rate in the wine sector will be $P_W/a_{LW}$. Wages in the cheese sector will be higher if $P_C/P_W > a_{LC}/a_{LW}$; wages in the wine sector will be higher if $P_C/P_W < a_{LC}/a_{LW}$. Because everyone will want to work in whichever industry offers the higher wage, the economy will specialize in the production of cheese if $P_C/P_W > a_{LC}/a_{LW}$. On the other hand, it will specialize in the production of wine if $P_C/P_W < a_{LC}/a_{LW}$. Only when $P_C/P_W$ is equal to $a_{LC}/a_{LW}$ will both goods be produced.

What is the significance of the number $a_{LC}/a_{LW}$? We saw in the previous section that it is the opportunity cost of cheese in terms of wine. We have therefore just derived a crucial proposition about the relationship between prices and production: *The economy will specialize in the production of cheese if the relative price of cheese exceeds its opportunity cost in terms of wine; it will specialize in the production of wine if the relative price of cheese is less than its opportunity cost in terms of wine.*

In the absence of international trade, Home would have to produce both goods for itself. But it will produce both goods only if the relative price of cheese is just equal to its opportunity cost. Since opportunity cost equals the ratio of unit labor requirements in cheese and wine, we can summarize the determination of prices in the absence of international trade with a simple labor theory of value: *In the absence of international trade, the relative prices of goods are equal to their relative unit labor requirements.*

# Trade in a One-Factor World

To describe the pattern and effects of trade between two countries when each country has only one factor of production is simple. Yet the implications of this analysis can be surprising. Indeed, to those who have not thought about international trade, many of these implications seem to conflict with common sense. Even this simplest of trade models can offer some important guidance on real-world issues, such as what constitutes fair international competition and fair international exchange.

Before we get to these issues, however, let us get the model stated. Suppose that there are two countries. One of them we again call Home and the other we call Foreign. Each of these countries has one factor of production (labor) and can produce two goods, wine and cheese. As before, we denote Home's labor force by $L$ and Home's unit labor requirements in wine and cheese production by $a_{LW}$ and $a_{LC}$, respectively. For Foreign we will use a convenient notation throughout this book: When we refer to some aspect of Foreign, we will use the same symbol that we use for Home, but with an asterisk. Thus Foreign's labor force will be denoted by $L^*$, Foreign's unit labor requirements in wine and cheese will be denoted by $a^*_{LW}$ and $a^*_{LC}$, respectively, and so on.

In general, the unit labor requirements can follow any pattern. For example, Home could be less productive than Foreign in wine but more productive in cheese, or vice versa. For the moment, we make only one arbitrary assumption: that

$$a_{LC}/a_{LW} < a^*_{LC}/a^*_{LW} \tag{3-2}$$

or, equivalently, that

$$a_{LC}/a^*_{LC} < a_{LW}/a^*_{LW}. \tag{3-3}$$

In words, we are assuming that the ratio of the labor required to produce a pound of cheese to that required to produce a gallon of wine is lower in Home than it is in Foreign. More briefly still, we are saying that Home's relative productivity in cheese is higher than it is in wine.

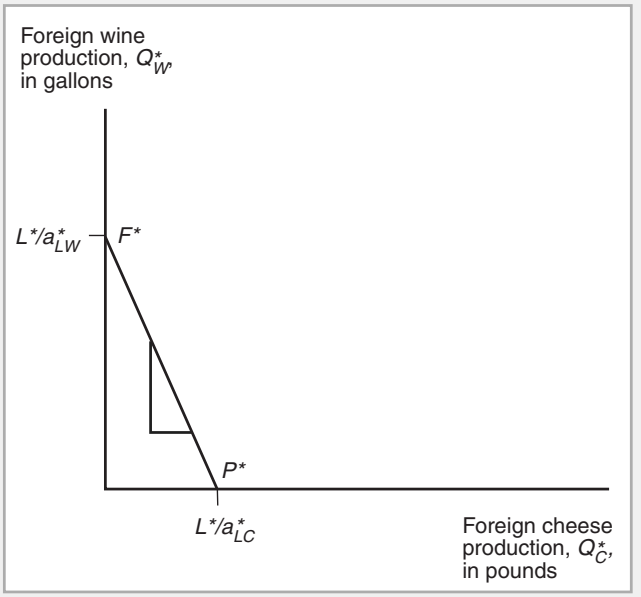
But remember that the ratio of unit labor requirements is equal to the opportunity cost of cheese in terms of wine; and remember also that we defined comparative advantage precisely in terms of such opportunity costs. So the assumption about relative productivities embodied in equations (3-2) and (3-3) amounts to saying that *Home has a comparative advantage in cheese.*

One point should be noted immediately: The condition under which Home has this comparative advantage involves all four unit labor requirements, not just two. You might think that to determine who will produce cheese, all you need to do is compare the two countries' unit labor requirements in cheese production, $a_{LC}$ and $a^*_{LC}$. If $a_{LC} < a^*_{LC}$, Home labor is more efficient than Foreign in producing cheese. When one country can produce a unit of a good with less labor than another country, we say that the first country has an **absolute advantage** in producing that good. In our example, Home has an absolute advantage in producing cheese.

**Figure 3-2**

**Foreign's Production Possibility Frontier**

Because Foreign's relative unit labor requirement in cheese is higher than Home's (it needs to give up many more units of wine to produce one more unit of cheese), its production possibility frontier is steeper.




What we will see in a moment, however, is that we cannot determine the pattern of trade from absolute advantage alone. One of the most important sources of error in discussing international trade is to confuse comparative advantage with absolute advantage.

Given the labor forces and the unit labor requirements in the two countries, we can draw the production possibility frontier for each country. We have already done this for Home, by drawing $PF$ in Figure 3-1. The production possibility frontier for Foreign is shown as $PF^*$ in Figure 3-2. Since the slope of the production possibility frontier equals the opportunity cost of cheese in terms of wine, Foreign's frontier is steeper than Home's.

In the absence of trade, the relative prices of cheese and wine in each country would be determined by the relative unit labor requirements. Thus in Home the relative price of cheese would be $a_{LC}/a_{LW}$; in Foreign it would be $a^*_{LC}/a^*_{LW}$.

Once we allow for the possibility of international trade, however, prices will no longer be determined purely by domestic considerations. If the relative price of cheese is higher in Foreign than in Home, it will be profitable to ship cheese from Home to Foreign and to ship wine from Foreign to Home. This cannot go on indefinitely, however. Eventually Home will export enough cheese and Foreign enough wine to equalize the relative price. But what determines the level at which that price settles?

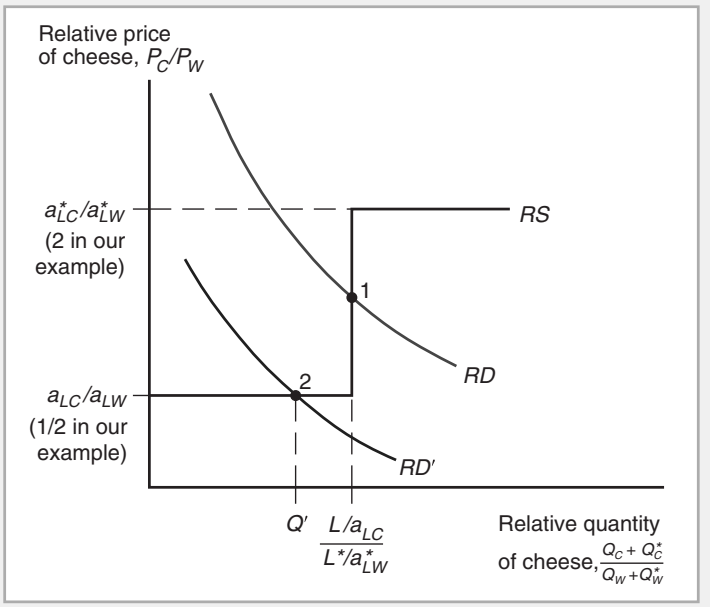
## Determining the Relative Price After Trade

Prices of internationally traded goods, like other prices, are determined by supply and demand. In discussing comparative advantage, however, we must apply supply-and-demand analysis carefully. In some contexts, such as some of the trade policy analysis in Chapters 9 through 12, it is acceptable to focus only on supply and demand in a single market. In assessing the effects of U.S. import quotas on sugar, for example, it is reasonable to use **partial equilibrium analysis,** that is, to study a single market, the sugar market. When we study comparative advantage, however, it is crucial to keep track of the relationships between

**Figure 3-3**

**World Relative Supply and Demand**

The *RD* and *RD′* curves show that the demand for cheese relative to wine is a decreasing function of the price of cheese relative to that of wine, while the *RS* curve shows that the supply of cheese relative to wine is an increasing function of the same relative price.




markets (in our example, the markets for wine and cheese). Since Home exports cheese only in return for imports of wine, and Foreign exports wine in return for cheese, it can be misleading to look at the cheese and wine markets in isolation. What is needed is **general equilibrium analysis,** which takes account of the linkages between the two markets.

One useful way to keep track of two markets at once is to focus not just on the quantities of cheese and wine supplied and demanded but also on the *relative* supply and demand, that is, on the number of pounds of cheese supplied or demanded divided by the number of gallons of wine supplied or demanded.

Figure 3-3 shows world supply and demand for cheese relative to wine as functions of the price of cheese relative to that of wine. The **relative demand curve** is indicated by *RD*; the **relative supply curve** is indicated by *RS.* World general equilibrium requires that relative supply equal relative demand, and thus the world relative price is determined by the intersection of *RD* and *RS.*

The striking feature of Figure 3-3 is the funny shape of the relative supply curve *RS*: It's a "step" with flat sections linked by a vertical section. Once we understand the derivation of the *RS* curve, we will be almost home-free in understanding the whole model.

First, as drawn, the *RS* curve shows that there would be *no* supply of cheese if the world price dropped below $a_{LC}/a_{LW}$. To see why, recall that we showed that Home will specialize in the production of wine whenever $P_C/P_W < a_{LC}/a_{LW}$. Similarly, Foreign will specialize in wine production whenever $P_C/P_W < a^*_{LC}/a^*_{LW}$. At the start of our discussion of equation (3-2), we made the assumption that $a_{LC}/a_{LW} < a^*_{LC}/a^*_{LW}$. So at relative prices of cheese below $a_{LC}/a_{LW}$, there would be no world cheese production.

Next, when the relative price of cheese $P_C/P_W$ is exactly $a_{LC}/a_{LW}$, we know that workers in Home can earn exactly the same amount making either cheese or wine. So Home will be willing to supply any relative amount of the two goods, producing a flat section to the supply curve.

We have already seen that if $P_C/P_W$ is above $a_{LC}/a_{LW}$, Home will specialize in the production of cheese. As long as $P_C/P_W < a^*_{LC}/a^*_{LW}$, however, Foreign will continue to specialize in

producing wine. When Home specializes in cheese production, it produces $L/a_{LC}$ pounds. Similarly, when Foreign specializes in wine, it produces $L^*/a^*_{LW}$ gallons. So for any relative price of cheese between $a_{LC}/a_{LW}$ and $a^*_{LC}/a^*_{LW}$, the relative supply of cheese is

$$(L/a_{LC})/(L^*/a^*_{LW}). \tag{3-4}$$

At $P_C/P_W = a^*_{LC}/a^*_{LW}$, we know that Foreign workers are indifferent between producing cheese and wine. Thus here we again have a flat section of the supply curve.

Finally, for $P_C/P_W > a^*_{LC}/a^*_{LW}$, both Home and Foreign will specialize in cheese production. There will be no wine production, so that the relative supply of cheese will become infinite.

A numerical example may help at this point. Let's assume, as we did before, that in Home it takes one hour of labor to produce a pound of cheese and two hours to produce a gallon of wine. Meanwhile, let's assume that in Foreign it takes six hours to produce a pound of cheese—Foreign workers are much less productive than Home workers when it comes to cheesemaking—but only three hours to produce a gallon of wine.

In this case, the opportunity cost of cheese production in terms of wine is 1/2 in Home—that is, the labor used to produce a pound of cheese could have produced half a gallon of wine. So the lower flat section of *RS* corresponds to a relative price of 1/2.

Meanwhile, in Foreign the opportunity cost of cheese in terms of wine is 2: The six hours of labor required to produce a pound of cheese could have produced two gallons of wine. So the upper flat section of *RS* corresponds to a relative price of 2.

The relative demand curve *RD* does not require such exhaustive analysis. The downward slope of *RD* reflects substitution effects. As the relative price of cheese rises, consumers will tend to purchase less cheese and more wine, so the relative demand for cheese falls.

The equilibrium relative price of cheese is determined by the intersection of the relative supply and relative demand curves. Figure 3-3 shows a relative demand curve *RD* that intersects the *RS* curve at point 1, where the relative price of cheese is between the two countries' pretrade prices—say, at a relative price of 1, in between the pretrade prices of 1/2 and 2. In this case, each country specializes in the production of the good in which it has a comparative advantage: Home produces only cheese, while Foreign produces only wine.

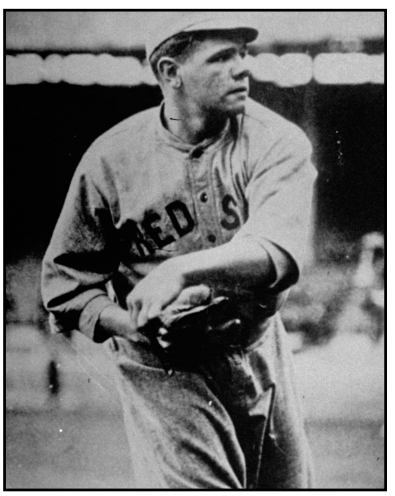
This is not, however, the only possible outcome. If the relevant *RD* curve were *RD′*, for example, relative supply and relative demand would intersect on one of the horizontal sections of *RS.* At point 2 the world relative price of cheese after trade is $a_{LC}/a_{LW}$, the same as the opportunity cost of cheese in terms of wine in Home.

What is the significance of this outcome? If the relative price of cheese is equal to its opportunity cost in Home, the Home economy need not specialize in producing either cheese or wine. In fact, at point 2 Home must be producing both some wine and some cheese; we can infer this from the fact that the relative supply of cheese (point $Q'$ on the horizontal axis) is less than it would be if Home were in fact completely specialized. Since $P_C/P_W$ is below the opportunity cost of cheese in terms of wine in Foreign, however, Foreign does specialize completely in producing wine. It therefore remains true that if a country does specialize, it will do so in the good in which it has a comparative advantage.

For the moment, let's leave aside the possibility that one of the two countries does not completely specialize. Except in this case, the normal result of trade is that the price of a

## *Comparative Advantage in Practice: The Case of Babe Ruth*

Everyone knows that Babe Ruth was the greatest slugger in the history of baseball. Only true fans of the sport know, however, that Ruth also was one of the greatest *pitchers* of all time. Because Ruth stopped pitching after 1918 and played outfield during all the time he set his famous batting records, most people don't realize that he even could pitch. What explains Ruth's lopsided reputation as a batter? The answer is provided by the principle of comparative advantage.



As a player with the Boston Red Sox early in his career, Ruth certainly had an *absolute* advantage in pitching. According to historian Geoffrey C. Ward and filmmaker Ken Burns:

> In the Red Sox's greatest years, he was their greatest player, the best left-handed pitcher in the American League, winning 89 games in six seasons. In 1916 he got his first chance to pitch in the World Series and made the most of it. After giving up a run in the first, he drove in the tying run himself, after which he held the Brooklyn Dodgers scoreless for eleven innings until his teammates could score the winning run.... In the 1918 series, he would show that he could still handle them, stretching his series record to $29\,^2/_3$ scoreless innings, a mark that stood for forty-three years.*

The Babe's World Series pitching record was broken by New York Yankee Whitey Ford in the same year, 1961, that his teammate Roger Maris shattered Ruth's 1927 record of 60 home runs in a single season.

Although Ruth had an absolute advantage in pitching, his skill as a batter relative to his teammates' abilities was even greater: His *comparative* advantage was at the plate. As a pitcher, however, Ruth had to rest his arm between appearances and therefore could not bat in every game. To exploit Ruth's *comparative* advantage, the Red Sox moved him to center field in 1919 so that he could bat more frequently.

The payoff to having Ruth specialize in batting was huge. In 1919, he hit 29 home runs, "more than any player had ever hit in a single season," according to Ward and Burns. The Yankees kept Ruth in the outfield (and at the plate) after they acquired him in 1920. They knew a good thing when they saw it. That year, Ruth hit 54 home runs, set a slugging record (bases divided by at bats) that remains untouched to this day, and turned the Yankees into baseball's most renowned franchise.

*See Geoffrey C. Ward and Ken Burns, *Baseball: An Illustrated History* (New York: Knopf, 1994), p. 155. Ruth's career preceded the designated hitter rule, so American League pitchers, like National League pitchers today, took their turns at bat. For a more extensive discussion of Babe Ruth's relation to the comparative advantage principle, see Edward Scahill, "Did Babe Ruth Have a Comparative Advantage as a Pitcher?" *Journal of Economic Education* 21(4), Fall 1990, pp. 402–410.

traded good (e.g., cheese) relative to that of another good (wine) ends up somewhere in between its pretrade levels in the two countries.

The effect of this convergence in relative prices is that each country specializes in the production of that good in which it has the relatively lower unit labor requirement. The rise in the relative price of cheese in Home will lead Home to specialize in the production of cheese, producing at point $F$ in Figure 3-4a. The fall in the relative price of cheese in Foreign will lead Foreign to specialize in the production of wine, producing at point $F^*$ in Figure 3-4b.

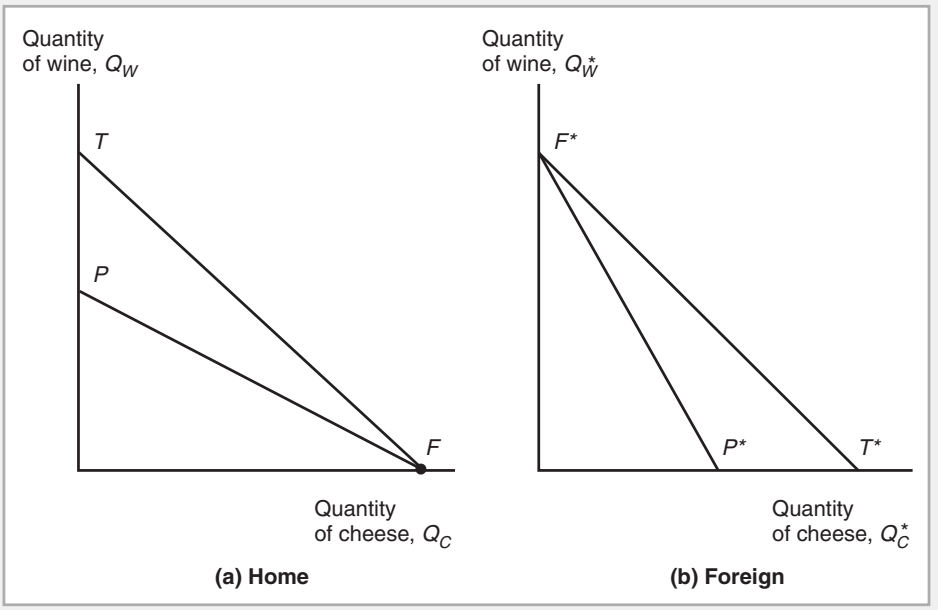



**Figure 3-4**

**Trade Expands Consumption Possibilities**
International trade allows Home and Foreign to consume anywhere within the colored lines, which lie outside the countries' production frontiers.

## The Gains from Trade

We have now seen that countries whose relative labor productivities differ across industries will specialize in the production of different goods. We next show that both countries derive **gains from trade** from this specialization. This mutual gain can be demonstrated in two alternative ways.

The first way to show that specialization and trade are beneficial is to think of trade as an indirect method of production. Home could produce wine directly, but trade with Foreign allows it to "produce" wine by producing cheese and then trading the cheese for wine. This indirect method of "producing" a gallon of wine is a more efficient method than direct production.

Consider our numerical example yet again: In Home, we assume that it takes one hour to produce a pound of cheese and two hours to produce a gallon of wine. This means that the opportunity cost of cheese in terms of wine is 1/2. But we know that the relative price of cheese after trade will be higher than this, say 1. So here's one way to see the gains from trade for Home: Instead of using two hours of labor to produce a gallon of wine, it can use that labor to produce two pounds of cheese, and trade that cheese for *two* gallons of wine.

More generally, consider two alternative ways of using an hour of labor. On one side, Home could use the hour directly to produce $1/a_{LW}$ gallons of wine. Alternatively, Home could use the hour to produce $1/a_{LC}$ pounds of cheese. This cheese could then be traded for wine, with each pound trading for $P_C/P_W$ gallons, so our original hour of labor yields $(1/a_{LC})(P_C/P_W)$ gallons of wine. This will be more wine than the hour could have produced directly as long as

$$(1/a_{LC})(P_C/P_W) > 1/a_{LW}, \tag{3-5}$$

or

$$P_C/P_W > a_{LC}/a_{LW}.$$

But we just saw that in international equilibrium, if neither country produces both goods, we must have $P_C/P_W > a_{LC}/a_{LW}$. This shows that Home can "produce" wine more efficiently by making cheese and trading it than by producing wine directly for itself. Similarly, Foreign can "produce" cheese more efficiently by making wine and trading it. This is one way of seeing that both countries gain.

Another way to see the mutual gains from trade is to examine how trade affects each country's possibilities for consumption. In the absence of trade, consumption possibilities are the same as production possibilities (the solid lines $PF$ and $P^*F^*$ in Figure 3-4). Once trade is allowed, however, each economy can consume a different mix of cheese and wine from the mix it produces. Home's consumption possibilities are indicated by the colored line $TF$ in Figure 3-4a, while Foreign's consumption possibilities are indicated by $T^*F^*$ in Figure 3-4b. In each case, trade has enlarged the range of choice, and therefore it must make residents of each country better off.

## A Note on Relative Wages

Political discussions of international trade often focus on comparisons of wage rates in different countries. For example, opponents of trade between the United States and Mexico often emphasize the point that workers in Mexico are paid only about $2 per hour, compared with more than $15 per hour for the typical worker in the United States. Our discussion of international trade up to this point has not explicitly compared wages in the two countries, but it is possible in the context of our numerical example to determine how the wage rates in the two countries compare.

In our example, once the countries have specialized, all Home workers are employed producing cheese. Since it takes one hour of labor to produce one pound of cheese, workers in Home earn the value of one pound of cheese per hour of their labor. Similarly, Foreign workers produce only wine; since it takes three hours for them to produce each gallon, they earn the value of 1/3 of a gallon of wine per hour.

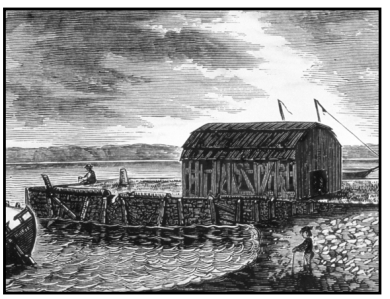
To convert these numbers into dollar figures, we need to know the prices of cheese and wine. Suppose that a pound of cheese and a gallon of wine both sell for $12; then Home workers will earn $12 per hour, while Foreign workers will earn $4 per hour. The **relative wage** of a country's workers is the amount they are paid per hour, compared with the amount workers in another country are paid per hour. The relative wage of Home workers will therefore be 3.

Clearly, this relative wage does not depend on whether the price of a pound of cheese is $12 or $20, as long as a gallon of wine sells for the same price. As long as the relative price of cheese—the price of a pound of cheese divided by the price of a gallon of wine—is 1, the wage of Home workers will be three times that of Foreign workers.

Notice that this wage rate lies between the ratios of the two countries' productivities in the two industries. Home is six times as productive as Foreign in cheese, but only one-and-a-half times as productive in wine, and it ends up with a wage rate three times as high as Foreign's. It is precisely because the relative wage is between the relative productivities that each country ends up with a *cost* advantage in one good. Because of its lower wage rate, Foreign has a cost advantage in wine even though it has lower productivity. Home has a cost advantage in cheese, despite its higher wage rate, because the higher wage is more than offset by its higher productivity.

## The Losses from Nontrade

Our discussion of the gains from trade took the form of a "thought experiment" in which we compared two situations: one in which countries do not trade at all and another in which they have free trade. It's a hypothetical case that helps us to understand the principles of international economics, but it does not have much to do with actual events. After all, countries don't suddenly go from no trade to free trade or vice versa. Or do they?



As economic historian Douglas Irwin* has pointed out, in the early history of the United States the country actually did carry out something very close to the thought experiment of moving from free trade to no trade. The historical context was as follows: In the early 19th century Britain and France were engaged in a massive military struggle, the Napoleonic Wars. Both countries endeavored to bring economic pressures to bear: France tried to keep European countries from trading with Britain, while Britain imposed a blockade on France. The young United States was neutral in the conflict but suffered considerably. In particular, the British navy often seized U.S. merchant ships and, on occasion, forcibly recruited their crews into its service.

In an effort to pressure Britain into ceasing these practices, President Thomas Jefferson declared a complete ban on overseas shipping. This embargo would deprive both the United States and Britain of the gains from trade, but Jefferson hoped that Britain would be hurt more and would agree to stop its depredations.

Irwin presents evidence suggesting that the embargo was quite effective: Although some smuggling took place, trade between the United States and the rest of the world was drastically reduced. In effect, the United States gave up international trade for a while.

The costs were substantial. Although quite a lot of guesswork is involved, Irwin suggests that real income in the United States may have fallen by about 8 percent as a result of the embargo. When you bear in mind that in the early 19th century only a fraction of output could be traded—transport costs were still too high, for example, to allow large-scale shipments of commodities like wheat across the Atlantic—that's a pretty substantial sum.

Unfortunately for Jefferson's plan, Britain did not seem to feel equal pain and showed no inclination to give in to U.S. demands. Fourteen months after the embargo was imposed, it was repealed. Britain continued its practices of seizing American cargoes and sailors; three years later the two countries went to war.

*Douglas Irwin, "The Welfare Cost of Autarky: Evidence from the Jeffersonian Trade Embargo, 1807–1809," *Review of International Economics* 13 (September 2005), pp. 631–645.

We have now developed the simplest of all models of international trade. Even though the Ricardian one-factor model is far too simple to be a complete analysis of either the causes or the effects of international trade, a focus on relative labor productivities can be a very useful tool for thinking about trade issues. In particular, the simple one-factor model is a good way to deal with several common misconceptions about the meaning of comparative advantage and the nature of the gains from free trade. These misconceptions appear so frequently in public debate about international economic policy, and even in statements by those who regard themselves as experts, that in the next section we take time out to discuss some of the most common misunderstandings about comparative advantage in light of our model.

# Misconceptions About Comparative Advantage

There is no shortage of muddled ideas in economics. Politicians, business leaders, and even economists frequently make statements that do not stand up to careful economic analysis. For some reason this seems to be especially true in international economics. Open the business section of any Sunday newspaper or weekly news magazine and you will probably find at least one article that makes foolish statements about international trade. Three misconceptions in particular have proved highly persistent. In this section we will use our simple model of comparative advantage to see why they are incorrect.

## Productivity and Competitiveness

*Myth 1: Free trade is beneficial only if your country is strong enough to stand up to foreign competition.* This argument seems extremely plausible to many people. For example, a well-known historian once criticized the case for free trade by asserting that it may fail to hold in reality: "What if there is nothing you can produce more cheaply or efficiently than anywhere else, except by constantly cutting labor costs?" he worried.[2]

The problem with this commentator's view is that he failed to understand the essential point of Ricardo's model—that gains from trade depend on *comparative* rather than *absolute* advantage. He is concerned that your country may turn out not to have anything it produces more efficiently than anyone else—that is, that you may not have an absolute advantage in anything. Yet why is that such a terrible thing? In our simple numerical example of trade, Home has lower unit labor requirements and hence higher productivity in both the cheese and wine sectors. Yet, as we saw, both countries gain from trade.

It is always tempting to suppose that the ability to export a good depends on your country having an absolute advantage in productivity. But an absolute productivity advantage over other countries in producing a good is neither a necessary nor a sufficient condition for having a *comparative* advantage in that good. In our one-factor model, the reason that an absolute productivity advantage in an industry is neither necessary nor sufficient to yield competitive advantage is clear: *The competitive advantage of an industry depends not only on its productivity relative to the foreign industry, but also on the domestic wage rate relative to the foreign wage rate.* A country's wage rate, in turn, depends on relative productivity in its other industries. In our numerical example, Foreign is less efficient than Home in the manufacture of wine, but it is at an even greater relative productivity disadvantage in cheese. Because of its overall lower productivity, Foreign must pay lower wages than Home, sufficiently lower that it ends up with lower costs in wine production. Similarly, in the real world, Portugal has low productivity in producing, say, clothing as compared with the United States, but because Portugal's productivity disadvantage is even greater in other industries, it pays low enough wages to have a comparative advantage in clothing over the United States all the same.

But isn't a competitive advantage based on low wages somehow unfair? Many people think so; their beliefs are summarized by our second misconception.

## The Pauper Labor Argument

*Myth 2: Foreign competition is unfair and hurts other countries when it is based on low wages.* This argument, sometimes referred to as the **pauper labor argument,** is a particular favorite of labor unions seeking protection from foreign competition. People who adhere to this belief argue that industries should not have to cope with foreign industries that are less efficient but pay lower wages. This view is widespread and has

[2]Paul Kennedy, "The Threat of Modernization," *New Perspectives Quarterly* (Winter 1995), pp. 31–33.

## Do Wages Reflect Productivity?

In the numerical example that we use to puncture common misconceptions about comparative advantage, we assume that the relative wage of the two countries reflects their relative productivity—specifically, that the ratio of Home to Foreign wages is in a range that gives each country a cost advantage in one of the two goods. This is a necessary implication of our theoretical model. But many people are unconvinced by that model. In particular, rapid increases in productivity in "emerging" economies like China have worried some Western observers, who argue that these countries will continue to pay low wages even as their productivity increases—putting high-wage countries at a cost disadvantage—and dismiss the contrary predictions of orthodox economists as unrealistic theoretical speculation. Leaving aside the logic of this position, what is the evidence?

The answer is that in the real world, national wage rates do, in fact, reflect differences in productivity. The accompanying figure compares estimates of productivity with estimates of wage rates for a selection of countries in 2007. Both measures are expressed as percentages of U.S. levels. Our estimate of productivity is GDP per worker measured in U.S. dollars. As we'll see in the second half of this book, that basis should indicate productivity in the production of traded goods. Wage rates are measured by wages in manufacturing.

If wages were exactly proportional to productivity, all the points in this chart would lie along the indicated 45-degree line. In reality, the fit isn't bad. In particular, low wage rates in China and India reflect low productivity.

The low estimate of overall Chinese productivity may seem surprising, given all the stories one hears about Americans who find themselves competing with Chinese exports. The Chinese workers producing those exports don't seem to have extremely low productivity. But remember what the theory of comparative advantage says: Countries export the goods in which they have relatively high productivity. So it's only to be expected that China's overall relative productivity is far below the level of its export industries.

The figure that follows tells us that the orthodox economists' view that national wage rates reflect national productivity is, in fact, verified by the data at a point in time. It's also true that in the past, rising relative productivity led to rising wages. Consider, for example, the case of South Korea. In 2007, South Korea's labor productivity was about half of the U.S. level, and its wage rate was actually slightly higher than that. But it wasn't always that way: In the not too distant past, South Korea was a low-productivity, low-wage economy. As recently as 1975, South

acquired considerable political influence. In 1993, Ross Perot, a self-made billionaire and former presidential candidate, warned that free trade between the United States and Mexico, with the latter's much lower wages, would lead to a "giant sucking sound" as U.S. industry moved south. In the same year, another self-made billionaire, Sir James Goldsmith, who was an influential member of the European Parliament, offered similar if less picturesquely expressed views in his book *The Trap*, which became a best seller in France.

Again, our simple example reveals the fallacy of this argument. In the example, Home is more productive than Foreign in both industries, and Foreign's lower cost of wine production is entirely due to its much lower wage rate. Foreign's lower wage rate, however, is irrelevant to the question of whether Home gains from trade. Whether the lower cost of wine produced in Foreign is due to high productivity or low wages does not matter. All that matters to Home is that it is cheaper *in terms of its own labor* for Home to produce cheese and trade it for wine than to produce wine for itself.

This is fine for Home, but what about Foreign? Isn't there something wrong with basing one's exports on low wages? Certainly it is not an attractive position to be in, but the idea that trade is good only if you receive high wages is our final fallacy.

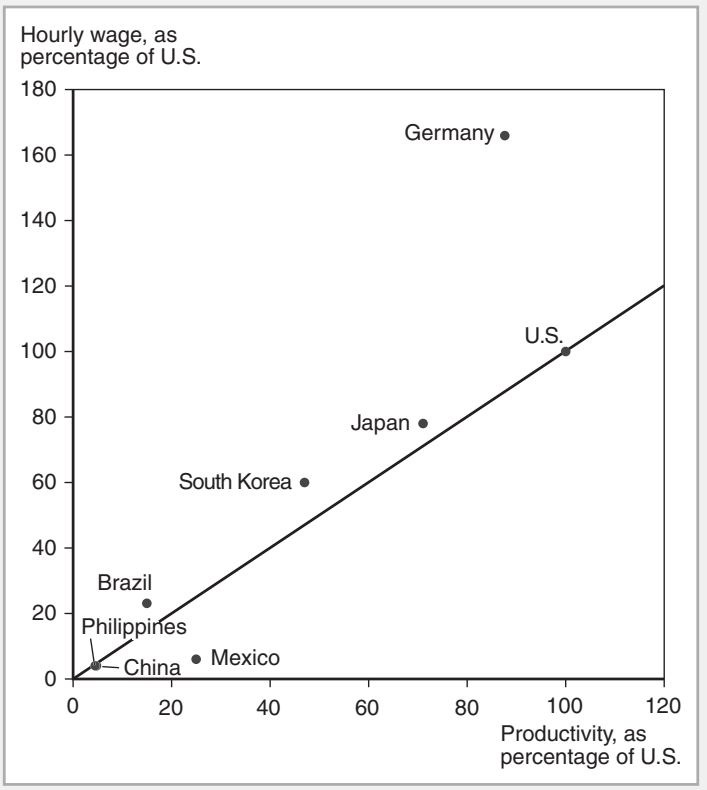
Korean wages were only 5 percent those of the United States. But when South Korea's productivity rose, so did its wage rate.

In short, the evidence strongly supports the view, based on economic models, that productivity increases are reflected in wage increases.

**Productivity and Wages**

A country's wage rate is roughly proportional to the country's productivity.

**Source:** International Monetary Fund, Bureau of Labor Statistics, and The Conference Board.




## Exploitation

*Myth 3: Trade exploits a country and makes it worse off if its workers receive much lower wages than workers in other nations.* This argument is often expressed in emotional terms. For example, one columnist contrasted the multimillion-dollar income of the chief executive officer of the clothing chain The Gap with the low wages—often less than $1 an hour—paid to the Central American workers who produce some of its merchandise.[3] It can seem hard-hearted to try to justify the terrifyingly low wages paid to many of the world's workers.

If one is asking about the desirability of free trade, however, the point is not to ask whether low-wage workers deserve to be paid more but to ask whether they and their country are worse off exporting goods based on low wages than they would be if they refused to enter into such demeaning trade. And in asking this question, one must also ask, *What is the alternative?*

Abstract though it is, our numerical example makes the point that one cannot declare that a low wage represents exploitation unless one knows what the alternative is. In that example, Foreign workers are paid much less than Home workers, and one could easily imagine a

[3]Bob Herbert, "Sweatshop Beneficiaries: How to Get Rich on 56 Cents an Hour," *New York Times* (July 24, 1995), p. A13.

columnist writing angrily about their exploitation. Yet if Foreign refused to let itself be "exploited" by refusing to trade with Home (or by insisting on much higher wages in its export sector, which would have the same effect), real wages would be even lower: The purchasing power of a worker's hourly wage would fall from 1/3 to 1/6 pound of cheese.

The columnist who pointed out the contrast in incomes between the executive at The Gap and the workers who make its clothes was angry at the poverty of Central American workers. But to deny them the opportunity to export and trade might well be to condemn them to even deeper poverty.

# Comparative Advantage with Many Goods

In our discussion so far, we have relied on a model in which only two goods are produced and consumed. This simplified analysis allows us to capture many essential points about comparative advantage and trade and, as we saw in the last section, gives us a surprising amount of mileage as a tool for discussing policy issues. To move closer to reality, however, it is necessary to understand how comparative advantage functions in a model with a larger number of goods.

## Setting Up the Model

Again, imagine a world of two countries, Home and Foreign. As before, each country has only one factor of production, labor. However, let's assume that each of these countries consumes and is able to produce a large number of goods—say, $N$ different goods altogether. We assign each of the goods a number from 1 to $N$.

The technology of each country can be described by its unit labor requirement for each good, that is, the number of hours of labor it takes to produce one unit of each good. We label Home's unit labor requirement for a particular good as $a_{Li}$, where $i$ is the number we have assigned to that good. If cheese is assigned the number 7, $a_{L7}$ will mean the unit labor requirement in cheese production. Following our usual rule, we label the corresponding Foreign unit labor requirement $a^*_{Li}$.

To analyze trade, we next pull one more trick. For any good, we can calculate $a_{Li}/a^*_{Li}$, the ratio of Home's unit labor requirement to Foreign's. The trick is to relabel the goods so that the lower the number, the lower this ratio. That is, we reshuffle the order in which we number goods in such a way that

$$a_{L1}/a^*_{L1} < a_{L2}/a^*_{L2} < a_{L3}/a^*_{L13} < \ldots < a_{LN}/a^*_{LN}. \tag{3-6}$$

## Relative Wages and Specialization

We are now prepared to look at the pattern of trade. This pattern depends on only one thing: the ratio of Home to Foreign wages. Once we know this ratio, we can determine who produces what.

Let $w$ be the wage rate per hour in Home and $w^*$ be the wage rate in Foreign. The ratio of wage rates is then $w/w^*$. The rule for allocating world production, then, is simply this: Goods will always be produced where it is cheapest to make them. The cost of making some good, say good $i$, is the unit labor requirement times the wage rate. To produce good $i$ in Home will cost $wa_{Li}$. To produce the same good in Foreign will cost $w^*a^*_{Li}$. It will be cheaper to produce the good in Home if

$$wa_{Li} < w^*a^*_{Li},$$

which can be rearranged to yield

$$a^*_{Li}/a_{Li} > w/w^*.$$

On the other hand, it will be cheaper to produce the good in Foreign if

$$wa_{Li} > w^* a^*_{Li},$$

which can be rearranged to yield

$$a^*_{Li}/a_{Li} < w/w^*.$$

Thus we can restate the allocation rule: Any good for which $a^*_{Li}/a_{Li} > w/w^*$ will be produced in Home, while any good for which $a^*_{Li}/a_{Li} < w/w^*$ will be produced in Foreign.

We have already lined up the goods in increasing order of $a_{Li}/a^*_{Li}$ (equation (3-6)). This criterion for specialization tells us that there is a "cut" in the lineup determined by the ratio of the two countries' wage rates, $w/w^*$. All the goods to the left of that point end up being produced in Home; all the goods to the right end up being produced in Foreign. (It is possible, as we will see in a moment, that the ratio of wage rates is exactly equal to the ratio of unit labor requirements for one good. In that case this borderline good may be produced in both countries.)

Table 3-2 offers a numerical example in which Home and Foreign both consume and are able to produce *five* goods: apples, bananas, caviar, dates, and enchiladas.

The first two columns of this table are self-explanatory. The third column is the ratio of the Foreign unit labor requirement to the Home unit labor requirement for each good—or, stated differently, the relative Home productivity advantage in each good. We have labeled the goods in order of Home productivity advantage, with the Home advantage greatest for apples and least for enchiladas.

Which country produces which goods depends on the ratio of Home and Foreign wage rates. Home will have a cost advantage in any good for which its relative productivity is higher than its relative wage, and Foreign will have the advantage in the others. If, for example, the Home wage rate is five times that of Foreign (a ratio of Home wage to Foreign wage of five to one), apples and bananas will be produced in Home and caviar, dates, and enchiladas in Foreign. If the Home wage rate is only three times that of Foreign, Home will produce apples, bananas, and caviar, while Foreign will produce only dates and enchiladas.

Is such a pattern of specialization beneficial to both countries? We can see that it is by using the same method we used earlier: comparing the labor cost of producing a good directly in a country with that of indirectly "producing" it by producing another good and trading for the desired good. If the Home wage rate is three times the Foreign wage (put another way, Foreign's wage rate is one-third that of Home), Home will import dates and enchiladas. A unit of dates requires 12 units of Foreign labor to produce, but its cost in terms of Home labor, given the three-to-one wage ratio, is only 4 person-hours (12/4 = 3).

**TABLE 3-2 Home and Foreign Unit Labor Requirements**

| Good | Home Unit Labor Requirement $a_{Li}$ | Foreign Unit Labor Requirement ($a^*_{Li}$) | Relative Home Productivity Advantage ($a^*_{Li}/a_{Li}$) |
|---|---|---|---|
| Apples | 1 | 10 | 10 |
| Bananas | 5 | 40 | 8 |
| Caviar | 3 | 12 | 4 |
| Dates | 6 | 12 | 2 |
| Enchiladas | 12 | 9 | 0.75 |

This cost of 4 person-hours is less than the 6 person-hours it would take to produce the unit of dates in Home. For enchiladas, Foreign actually has higher productivity along with lower wages; it will cost Home only 3 person-hours to acquire a unit of enchiladas through trade, compared with the 12 person-hours it would take to produce it domestically. A similar calculation will show that Foreign also gains; for each of the goods Foreign imports, it turns out to be cheaper in terms of domestic labor to trade for the good rather than produce the good domestically. For example, it would take 10 hours of Foreign labor to produce a unit of apples; even with a wage rate only one-third that of Home workers, it will require only 3 hours of labor to earn enough to buy that unit of apples from Home.

In making these calculations, however, we have simply assumed that the relative wage rate is 3. How does this relative wage rate actually get determined?

## Determining the Relative Wage in the Multigood Model

In the two-good model, we determined relative wages by first calculating Home wages in terms of cheese and Foreign wages in terms of wine. We then used the price of cheese relative to that of wine to deduce the ratio of the two countries' wage rates. We could do this because we knew that Home would produce cheese and Foreign wine. In the many-good case, who produces what can be determined only after we know the relative wage rate, so we need a new procedure. To determine relative wages in a multigood economy, we must look behind the relative demand for goods to the implied relative demand for labor. This is not a direct demand on the part of consumers; rather, it is a **derived demand** that results from the demand for goods produced with each country's labor.

The relative derived demand for Home labor will fall when the ratio of Home to Foreign wages rises, for two reasons. First, as Home labor becomes more expensive relative to Foreign labor, goods produced in Home also become relatively more expensive, and world demand for these goods falls. Second, as Home wages rise, fewer goods will be produced in Home and more in Foreign, further reducing the demand for Home labor.

We can illustrate these two effects using our numerical example as illustrated in Table 3-2. Suppose we start with the following situation: The Home wage is initially 3.5 times the Foreign wage. At that level, Home would produce apples, bananas, and caviar while Foreign would produce dates and enchiladas. If the relative Home wage were to increase from 3.5 to 3.99, the pattern of specialization would not change. However, as the goods produced in Home became relatively more expensive, the relative demand for these goods would decline and the relative demand for Home labor would decline with it.

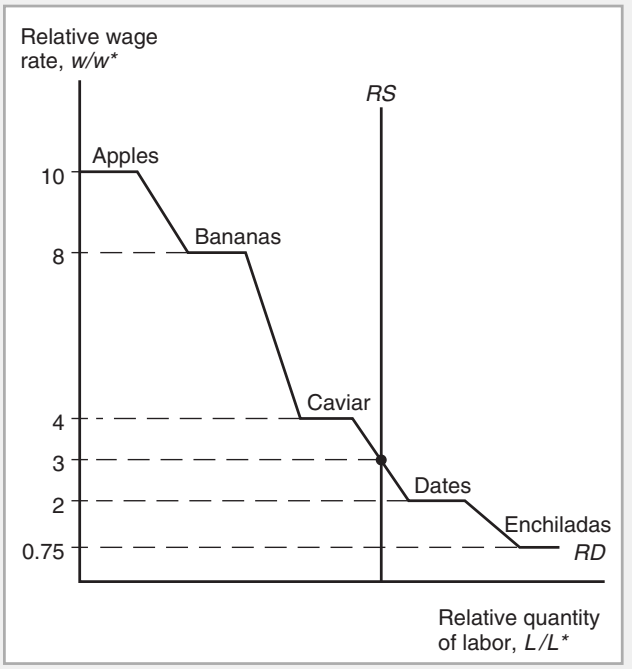
Suppose now that the relative wage were to increase slightly from 3.99 to 4.01. This small further increase in the relative Home wage would bring about a shift in the pattern of specialization. Because it is now cheaper to produce caviar in Foreign than in Home, the production of caviar shifts from Home to Foreign. What does this imply for the relative demand for Home labor? Clearly it implies that as the relative wage rises from a little less than 4 to a little more than 4, there is an abrupt drop-off in the relative demand, as Home production of caviar falls to zero and Foreign acquires a new industry. If the relative wage continues to rise, relative demand for Home labor will gradually decline, then drop off abruptly at a relative wage of 8, at which point production of bananas shifts to Foreign.

We can illustrate the determination of relative wages with a diagram like Figure 3-5. Unlike Figure 3-3, this diagram does not have relative quantities of goods or relative prices of goods on its axes. Instead it shows the relative quantity of labor and the relative wage rate. The world demand for Home labor relative to its demand for Foreign labor is shown by the curve *RD*. The world supply of Home labor relative to Foreign labor is shown by the line *RS*.

**Figure 3-5**

**Determination of Relative Wages**

In a many-good Ricardian model, relative wages are determined by the intersection of the derived relative demand curve for labor, *RD*, with the relative supply, *RS*.




The relative supply of labor is determined by the relative sizes of Home's and Foreign's labor forces. Assuming that the number of person-hours available does not vary with the wage, the relative wage has no effect on relative labor supply and *RS* is a vertical line.

Our discussion of the relative demand for labor explains the "stepped" shape of *RD*. Whenever we increase the wage rate of Home workers relative to that of Foreign workers, the relative demand for goods produced in Home will decline and the demand for Home labor will decline with it. In addition, the relative demand for Home labor will drop off abruptly whenever an increase in the relative Home wage makes a good cheaper to produce in Foreign. So the curve alternates between smoothly downward-sloping sections where the pattern of specialization does not change and "flats" where the relative demand shifts abruptly because of shifts in the pattern of specialization. As shown in the figure, these "flats" correspond to relative wages that equal the ratio of Home to Foreign productivity for each of the five goods.

The equilibrium relative wage is determined by the intersection of *RD* and *RS*. As drawn, the equilibrium relative wage is 3. At this wage, Home produces apples, bananas, and caviar while Foreign produces dates and enchiladas. The outcome depends on the relative size of the countries (which determines the position of *RS*) and the relative demand for the goods (which determines the shape and position of *RD*).

If the intersection of *RD* and *RS* happens to lie on one of the flats, both countries produce the good to which the flat applies.

# Adding Transport Costs and Nontraded Goods

We now extend our model another step closer to reality by considering the effects of transport costs. Transportation costs do not change the fundamental principles of comparative advantage or the gains from trade. Because transport costs pose obstacles to the movement of goods and services, however, they have important implications for the way a trading world economy

is affected by a variety of factors such as foreign aid, international investment, and balance of payments problems. While we will not deal with the effects of these factors yet, the multigood one-factor model is a good place to introduce the effects of transport costs.

First, notice that the world economy described by the model of the last section is marked by very extreme international specialization. At most there is one good that both countries produce; all other goods are produced either in Home or in Foreign, but not in both.

There are three main reasons why specialization in the real international economy is not this extreme:

1. The existence of more than one factor of production reduces the tendency toward specialization (as we will see in the next two chapters).
2. Countries sometimes protect industries from foreign competition (discussed at length in Chapters 9 through 12).
3. It is costly to transport goods and services; in some cases the cost of transportation is enough to lead countries into self-sufficiency in certain sectors.

In the multigood example of the last section, we found that at a relative Home wage of 3, Home could produce apples, bananas, and caviar more cheaply than Foreign, while Foreign could produce dates and enchiladas more cheaply than Home. *In the absence of transport costs*, then, Home will export the first three goods and import the last two.

Now suppose there is a cost to transport goods, and that this transport cost is a uniform fraction of production cost, say 100 percent. This transportation cost will discourage trade. Consider dates, for example. One unit of this good requires 6 hours of Home labor or 12 hours of Foreign labor to produce. At a relative wage of 3, 12 hours of Foreign labor costs only as much as 4 hours of Home labor; so in the absence of transport costs, Home imports dates. With a 100 percent transport cost, however, importing dates would cost the equivalent of 8 hours of Home labor (4 hours of labor plus the equivalent of 4 hours for the transportation costs), so Home will produce the good for itself instead.

A similar cost comparison shows that Foreign will find it cheaper to produce its own caviar than to import it. A unit of caviar requires 3 hours of Home labor to produce. Even at a relative Home wage of 3, which makes this the equivalent of 9 hours of Foreign labor, this is cheaper than the 12 hours Foreign would need to produce caviar for itself. In the absence of transport costs, then, Foreign would find it cheaper to import caviar than to make it domestically. With a 100 percent cost of transportation, however, imported caviar would cost the equivalent of 18 hours of Foreign labor and would therefore be produced locally instead.

The result of introducing transport costs in this example, then, is that Home will still export apples and bananas and import enchiladas, but caviar and dates will become **nontraded goods,** which each country will produce for itself.

In this example we have assumed that transport costs are the same fraction of production cost in all sectors. In practice there is a wide range of transportation costs. In some cases transportation is virtually impossible: Services such as haircuts and auto repair cannot be traded internationally (except where there is a metropolitan area that straddles a border, like Detroit, Michigan–Windsor, Ontario). There is also little international trade in goods with high weight-to-value ratios, like cement. (It is simply not worth the transport cost of importing cement, even if it can be produced much more cheaply abroad.) Many goods end up being nontraded either because of the absence of strong national cost advantages or because of high transportation costs.

The important point is that nations spend a large share of their income on nontraded goods. This observation is of surprising importance in our later discussion of international monetary economics.

# Empirical Evidence on the Ricardian Model

The Ricardian model of international trade is an extremely useful tool for thinking about the reasons why trade may happen and about the effects of international trade on national welfare. But is the model a good fit to the real world? Does the Ricardian model make accurate predictions about actual international trade flows?

The answer is a heavily qualified yes. Clearly there are a number of ways in which the Ricardian model makes misleading predictions. First, as mentioned in our discussion of nontraded goods, the simple Ricardian model predicts an extreme degree of specialization that we do not observe in the real world. Second, the Ricardian model assumes away effects of international trade on the distribution of income *within* countries, and thus predicts that countries as a whole will always gain from trade; in practice, international trade has strong effects on income distribution. Third, the Ricardian model allows no role for differences in resources among countries as a cause of trade, thus missing an important aspect of the trading system (the focus of Chapters 4 and 5). Finally, the Ricardian model neglects the possible role of economies of scale as a cause of trade, which leaves it unable to explain the large trade flows between apparently similar nations—an issue discussed in Chapters 7 and 8.

In spite of these failings, however, the basic prediction of the Ricardian model—that countries should tend to export those goods in which their productivity is relatively high—has been strongly confirmed by a number of studies over the years.

Several classic tests of the Ricardian model, performed using data from the early post-World War II period, compared British with American productivity and trade.[4] This was an unusually illuminating comparison, because it revealed that British labor productivity was lower than American productivity in almost every sector. As a result, the United States had an absolute advantage in everything. Nonetheless, the amount of overall British exports was about as large as the amount of American exports at the time. Despite its lower absolute productivity, there must have been some sectors in which Britain had a comparative advantage. The Ricardian model would predict that these would be the sectors in which the United States' productivity advantage was smaller.

Figure 3-6 illustrates the evidence in favor of the Ricardian model, using data presented in a paper by the Hungarian economist Bela Balassa in 1963. The figure compares the ratio of U.S. to British exports in 1951 with the ratio of U.S. to British labor productivity for 26 manufacturing industries. The productivity ratio is measured on the horizontal axis, the export ratio on the vertical axis. Both axes are given a logarithmic scale, which turns out to produce a clearer picture.

Ricardian theory would lead us broadly to expect that the higher the relative productivity in the U.S. industry, the more likely U.S. rather than U.K. firms would export in that industry. And that is what Figure 3-6 shows. In fact, the scatterplot lies quite close to an upward-sloping line, also shown in the figure. Bearing in mind that the data used for this comparison are, like all economic data, subject to substantial measurement errors, the fit is remarkably close.

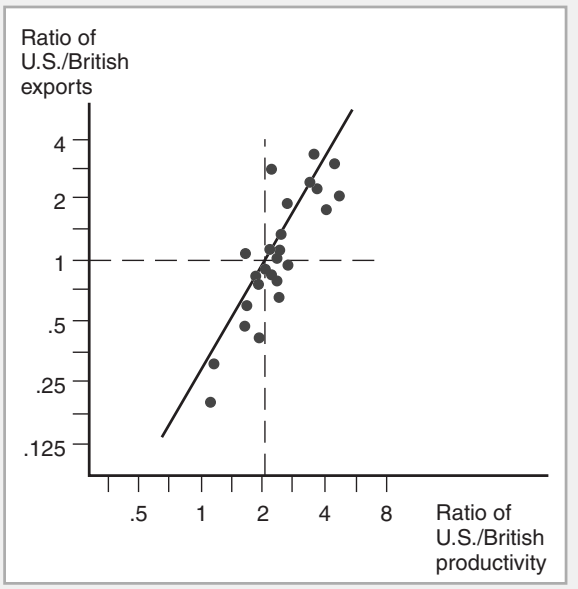
As expected, the evidence in Figure 3-6 confirms the basic insight that trade depends on *comparative*, not *absolute* advantage. At the time to which the data refer, U.S. industry had much higher labor productivity than British industry—on average about twice as high.

[4] The pioneering study by G. D. A. MacDougall is listed in Further Readings at the end of the chapter. A well-known follow-up study, on which we draw here, was Bela Balassa, "An Empirical Demonstration of Classical Comparative Cost Theory," *Review of Economics and Statistics* 45 (August 1963), pp. 231–238; we use Balassa's numbers as an illustration.

**Figure 3-6**

**Productivity and Exports**

A comparative study showed that U.S. exports were high relative to British exports in industries in which the United States had high relative labor productivity. Each dot represents a different industry.




The commonly held misconception that a country can be competitive only if it can match other countries' productivity, which we discussed earlier in this chapter, would have led one to predict a U.S. export advantage across the board. The Ricardian model tells us, however, that having high productivity in an industry compared with that of foreigners is not enough to ensure that a country will export that industry's products; the relative productivity must be high compared with relative productivity in other sectors. As it happened, U.S. productivity exceeded British productivity in all 26 sectors (indicated by dots) shown in Figure 3-6, by margins ranging from 11 to 366 percent. In 12 of the sectors, however, Britain actually had larger exports than the United States. A glance at the figure shows that, in general, U.S. exports were larger than U.K. exports only in industries where the U.S. productivity advantage was somewhat more than two to one.

More recent evidence on the Ricardian model has been less clear-cut. In part, this is because the growth of world trade and the resulting specialization of national economies means that we do not get a chance to see what countries do badly! In the world economy of the 21st century, countries often do not produce goods for which they are at a comparative disadvantage, so there is no way to measure their productivity in those sectors. For example, most countries do not produce airplanes, so there are no data on what their unit labor requirements would be if they did. Nonetheless, several pieces of evidence suggest that differences in labor productivity continue to play an important role in determining world trade patterns.

Perhaps the most striking demonstration of the continuing usefulness of the Ricardian theory of comparative advantage is the way it explains the emergence of China as an export powerhouse in some industries. Overall, Chinese labor productivity in manufacturing, although rising, remains very low by American or European standards. In some industries, however, the Chinese productivity disadvantage is not as large as it is on average—and in these industries, China has become one of the world's largest producers and exporters.

Table 3-3 illustrates this point with some estimates based on 1995 data. The researchers compared Chinese output and productivity with that of Germany in a number of industries. On average, they found that Chinese productivity was only 5 percent that of Germany, and

**TABLE 3-3 China versus Germany, 1995**

| | Chinese Output per Worker as % of Germany | Total Chinese Output as % of Germany |
|---|---|---|
| All manufacturing | 5.2 | 71.6 |
| Apparel | 19.7 | 802.2 |

**Source:** Ren Ruoen and Bai Manying, "China's Manufacturing Industry in an International Perspective: A China-Germany Comparison," *Economie internationale*, no. 92–2002/4, pp. 103–130.

that in 1995, total Chinese manufacturing output was still almost 30 percent less than Germany's total manufacturing production.

In apparel (that is, clothing), however, Chinese productivity was closer to German levels. China still had an *absolute* disadvantage in clothing production, with only about a fifth of German productivity. But because China's relative productivity in apparel was so much higher than in other industries, China had a strong comparative advantage in apparel—and China's apparel industry was eight times the size of Germany's apparel industry.

In sum, while few economists believe that the Ricardian model is a fully adequate description of the causes and consequences of world trade, its two principal implications—that productivity differences play an important role in international trade and that it is comparative rather than absolute advantage that matters—do seem to be supported by the evidence.

## SUMMARY

1. We examined the Ricardian model, the simplest model that shows how differences between countries give rise to trade and gains from trade. In this model, labor is the only factor of production, and countries differ only in the productivity of labor in different industries.
2. In the Ricardian model, countries will export goods that their labor produces relatively efficiently and will import goods that their labor produces relatively inefficiently. In other words, a country's production pattern is determined by comparative advantage.
3. We can show that trade benefits a country in either of two ways. First, we can think of trade as an indirect method of production. Instead of producing a good for itself, a country can produce another good and trade it for the desired good. The simple model shows that whenever a good is imported, it must be true that this indirect "production" requires less labor than direct production. Second, we can show that trade enlarges a country's consumption possibilities, which implies gains from trade.
4. The distribution of the gains from trade depends on the relative prices of the goods countries produce. To determine these relative prices, it is necessary to look at the relative world supply and demand for goods. The relative price implies a relative wage rate as well.
5. The proposition that trade is beneficial is unqualified. That is, there is no requirement that a country be "competitive" or that the trade be "fair." In particular, we can show that three commonly held beliefs about trade are wrong. First, a country gains from trade even if it has lower productivity than its trading partner in all industries. Second, trade is beneficial even if foreign industries are competitive only because of low wages. Third, trade is beneficial even if a country's exports embody more labor than its imports.
6. Extending the one-factor, two-good model to a world of many commodities does not alter these conclusions. The only difference is that it becomes necessary to focus

directly on the relative demand for labor to determine relative wages rather than to work via relative demand for goods. Also, a many-commodity model can be used to illustrate the important point that transportation costs can give rise to a situation in which some goods are nontraded.

**7.** While some of the predictions of the Ricardian model are clearly unrealistic, its basic prediction—that countries will tend to export goods in which they have relatively high productivity—has been confirmed by a number of studies.

## KEY TERMS

absolute advantage, p. 59
comparative advantage, p. 56
derived demand, p. 72
gains from trade, p. 64
general equilibrium analysis, p. 61
nontraded goods, p. 74
opportunity cost, p. 55
partial equilibrium analysis, p. 60
pauper labor argument, p. 67
production possibility frontier, p. 57
relative demand curve, p. 61
relative supply curve, p. 61
relative wage, p. 65
Ricardian model, p. 56
unit labor requirement, p. 56

## PROBLEMS

myeconlab

**1.** Home has 1,200 units of labor available. It can produce two goods, apples and bananas. The unit labor requirement in apple production is 3, while in banana production it is 2.
   **a.** Graph Home's production possibility frontier.
   **b.** What is the opportunity cost of apples in terms of bananas?
   **c.** In the absence of trade, what would the price of apples in terms of bananas be? Why?

**2.** Home is as described in problem 1. There is now also another country, Foreign, with a labor force of 800. Foreign's unit labor requirement in apple production is 5, while in banana production it is 1.
   **a.** Graph Foreign's production possibility frontier.
   **b.** Construct the world relative supply curve.

**3.** Now suppose world relative demand takes the following form: Demand for apples/demand for bananas = price of bananas/price of apples.
   **a.** Graph the relative demand curve along with the relative supply curve.
   **b.** What is the equilibrium relative price of apples?
   **c.** Describe the pattern of trade.
   **d.** Show that both Home and Foreign gain from trade.

**4.** Suppose that instead of 1,200 workers, Home has 2,400. Find the equilibrium relative price. What can you say about the efficiency of world production and the division of the gains from trade between Home and Foreign in this case?

**5.** Suppose that Home has 2,400 workers, but they are only half as productive in both industries as we have been assuming. Construct the world relative supply curve and determine the equilibrium relative price. How do the gains from trade compare with those in the case described in problem 4?

**6.** "Chinese workers earn only $.75 an hour; if we allow China to export as much as it likes, our workers will be forced down to the same level. You can't import a $10 shirt without importing the $.75 wage that goes with it." Discuss.

**7.** Japanese labor productivity is roughly the same as that of the United States in the manufacturing sector (higher in some industries, lower in others), while the United States is still considerably more productive in the service sector. But most services are

nontraded. Some analysts have argued that this poses a problem for the United States, because our comparative advantage lies in things we cannot sell on world markets. What is wrong with this argument?

**8.** Anyone who has visited Japan knows it is an incredibly expensive place; although Japanese workers earn about the same as their U.S. counterparts, the purchasing power of their incomes is about one-third less. Extend your discussion from question 7 to explain this observation. (Hint: Think about wages and the implied prices of nontraded goods.)

**9.** How does the fact that many goods are nontraded affect the extent of possible gains from trade?

**10.** We have focused on the case of trade involving only two countries. Suppose that there are many countries capable of producing two goods, and that each country has only one factor of production, labor. What could we say about the pattern of production and trade in this case? (Hint: Try constructing the world relative supply curve.)

## FURTHER READINGS

Donald Davis. "Intraindustry Trade: A Heckscher-Ohlin-Ricardo Approach." *Journal of International Economics* 39 (November 1995), pp. 201–226. A recent revival of the Ricardian approach to explain trade between countries with similar resources.

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 (December 1977), pp. 823–839. More recent theoretical modeling in the Ricardian mode, developing the idea of simplifying the many-good Ricardian model by assuming that the number of goods is so large as to form a smooth continuum.

Giovanni Dosi, Keith Pavitt, and Luc Soete. *The Economics of Technical Change and International Trade.* Brighton: Wheatsheaf, 1988. An empirical examination that suggests that international trade in manufactured goods is largely driven by differences in national technological competencies.

Stephen Golub and Chang-Tai Hsieh. "Classical Ricardian Theory of Comparative Advantage Revisited." *Review of International Economics* 8(2), 2000, pp. 221–234. A modern statistical analysis of the relationship between relative productivity and trade patterns, which finds reasonably strong correlations.

G. D. A. MacDougall. "British and American Exports: A Study Suggested by the Theory of Comparative Costs." *Economic Journal* 61 (December 1951), pp. 697–724; 62 (September 1952), pp. 487–521. In this famous study, MacDougall used comparative data on U.S. and U.K. productivity to test the predictions of the Ricardian model.

John Stuart Mill. *Principles of Political Economy.* London: Longmans, Green, 1917. Mill's 1848 treatise extended Ricardo's work into a full-fledged model of international trade.

David Ricardo. *The Principles of Political Economy and Taxation.* Homewood, IL: Irwin, 1963. The basic source for the Ricardian model is Ricardo himself in this book, first published in 1817.

CHAPTER 4

# Specific Factors and Income Distribution

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

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

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

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

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

### LEARNING GOALS

After reading this chapter, you will be able to:

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

## The Specific Factors Model

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

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

### What Is a Specific Factor?

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

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

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

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

## Assumptions of the Model

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

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

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

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

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

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

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

## Production Possibilities

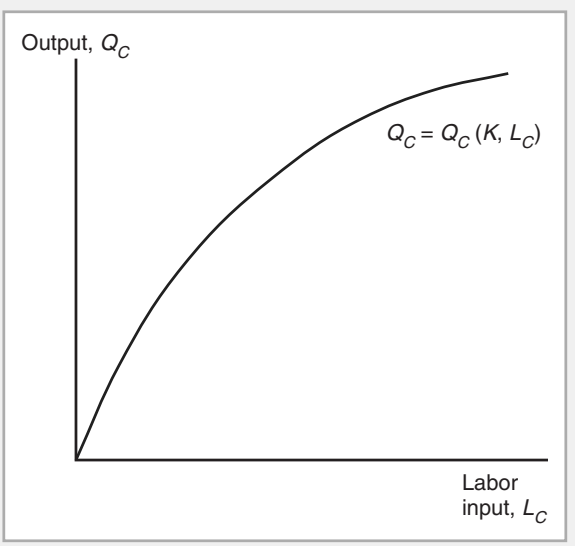
The specific factors model assumes that each of the specific factors, capital and land, can be used in only one sector, cloth and food, respectively. Only labor can be used in either sector. Thus to analyze the economy's production possibilities, we need only to ask how the economy's mix of output changes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

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

**Figure 4-1**

**The Production Function for Cloth**

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




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

**Figure 4-2**

**The Marginal Product of Labor**

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

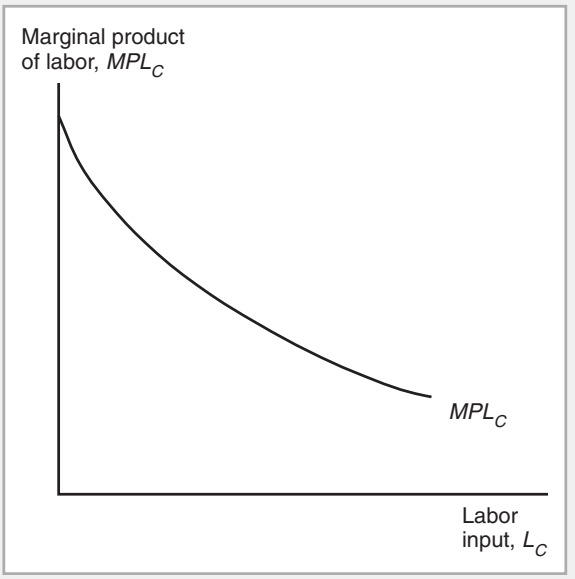



Figure 4-2 shows the same information a different way. In this figure we directly plot the marginal product of labor as a function of the labor employed. (In the appendix to this chapter, we show that the area under the marginal product curve represents the total output of cloth.)

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

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

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

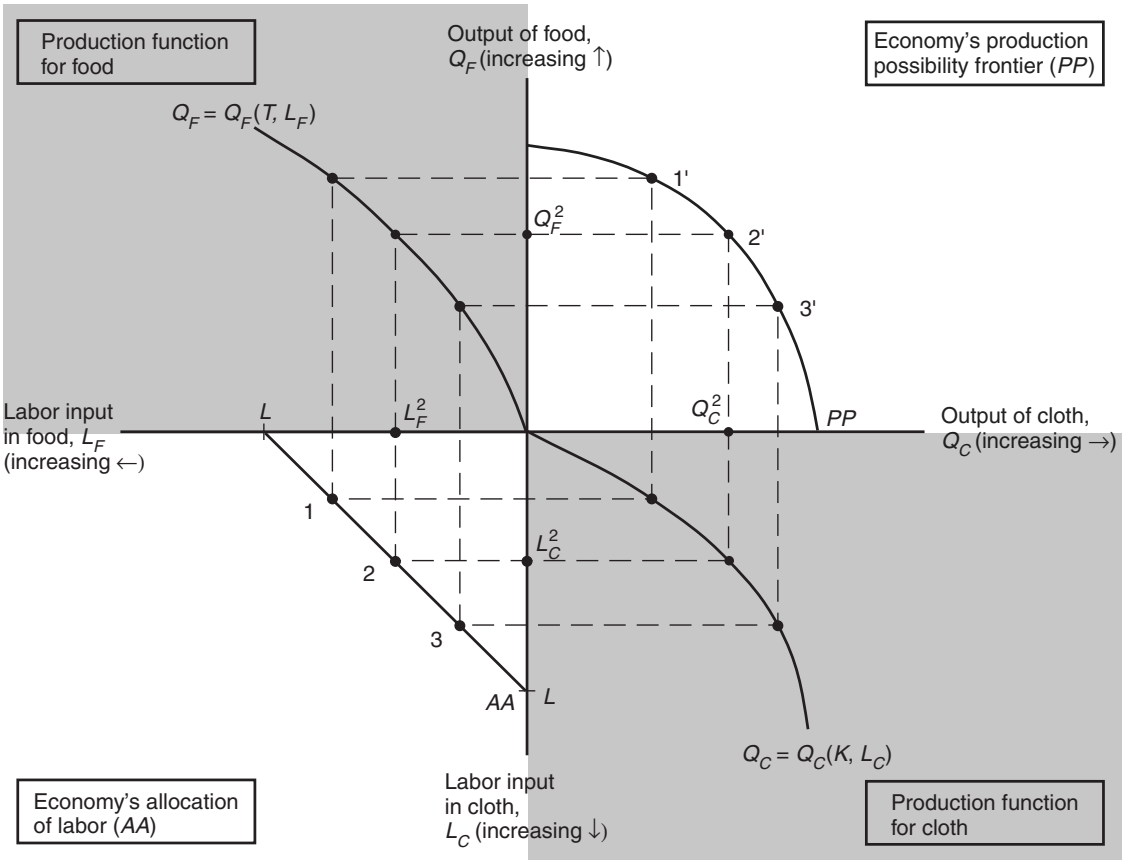



**Figure 4-3**

**The Production Possibility Frontier in the Specific Factors Model**

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

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

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

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

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

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

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

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

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

## Prices, Wages, and Labor Allocation

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

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

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

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

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

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

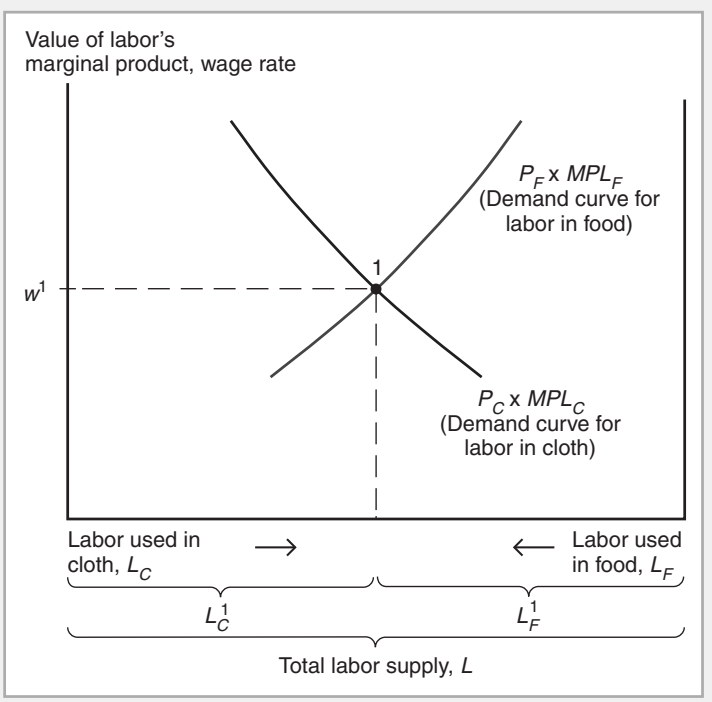
The wage rate $w$ must be the same in both sectors, because of the assumption that labor is freely mobile between sectors. That is, because labor is a mobile factor, it will move from the low-wage sector to the high-wage sector until wages are equalized. The wage rate, in turn, is determined by the requirement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

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

**Figure 4-4**

**The Allocation of Labor**

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



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

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

or, rearranging, that

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

The left side of equation (4-6) is the slope of the production possibility frontier at the actual production point; the right side is minus the relative price of cloth. This result tells us that *at the production point, the production possibility frontier must be tangent to a line whose slope is minus the price of cloth divided by that of food.* As we will see in the following chapters, this is a very general result that characterizes production responses to changes in relative prices along a production possibility frontier. It is illustrated in Figure 4-5: If the relative price of cloth is $(P_C/P_F)^1$, the economy produces at point 1.

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

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

**Figure 4-5**

**Production in the Specific Factors Model**

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

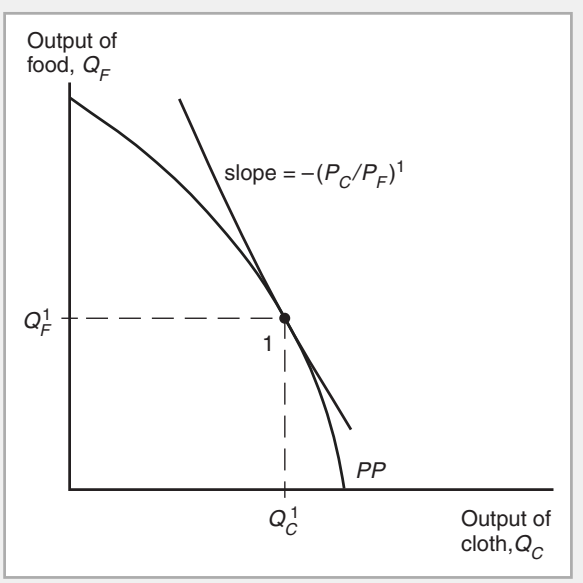
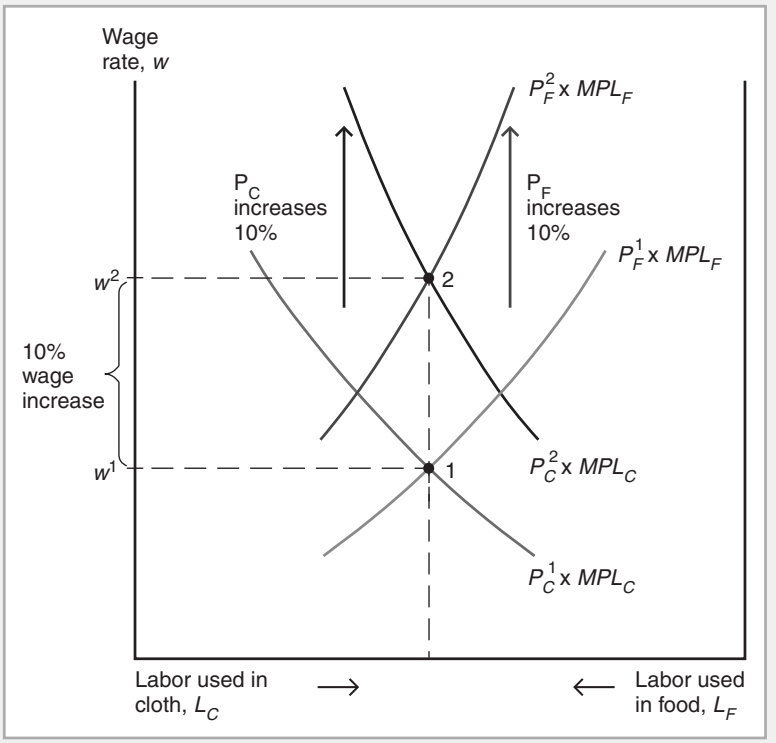


**Figure 4-6**

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

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




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

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

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

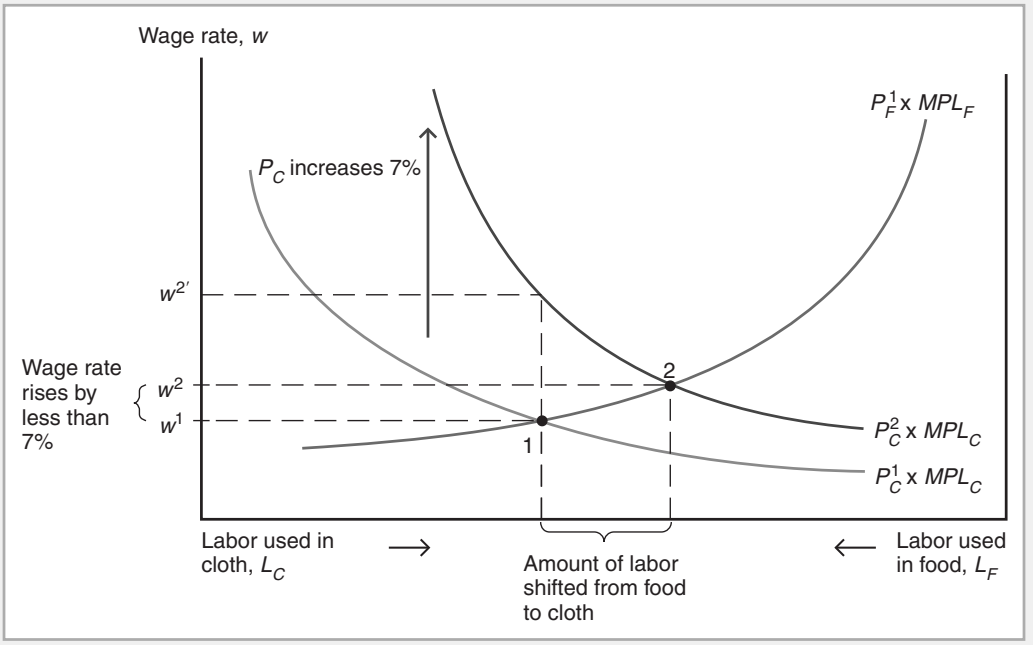



**Figure 4-7**

**A Rise in the Price of Cloth**

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

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

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

## Relative Prices and the Distribution of Income

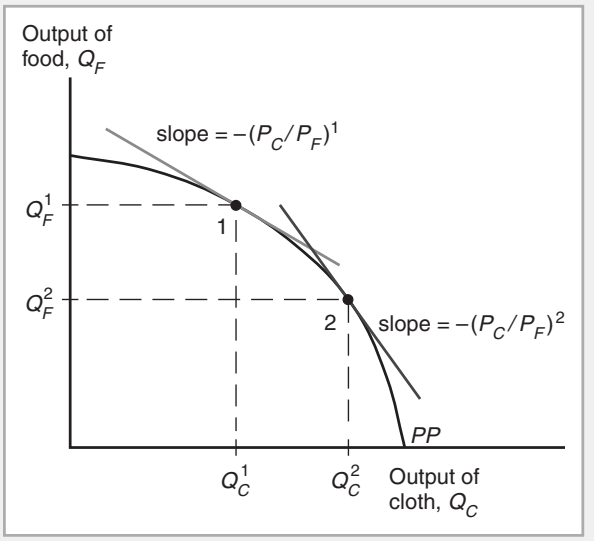
So far we have examined the following aspects of the specific factors model: (1) the determination of production possibilities given an economy's resources and technology and (2) the determination of resource allocation, production, and relative prices in a market economy. Before turning to the effects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

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

**Figure 4-8**

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

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




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

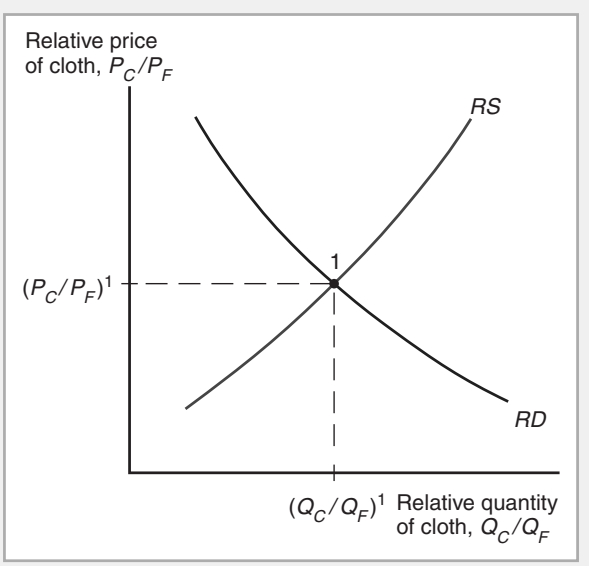
Let's look at what this outcome implies for the incomes of three groups: workers, owners of capital, and owners of land. Workers find that their wage rate has risen, but less than in proportion to the rise in $P_C$. Thus their real wage in terms of cloth (the amount of cloth they can buy with their wage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

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

**Figure 4-9**

**Determination of Relative Prices**

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



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

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

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

# International Trade in the Specific Factors Model

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

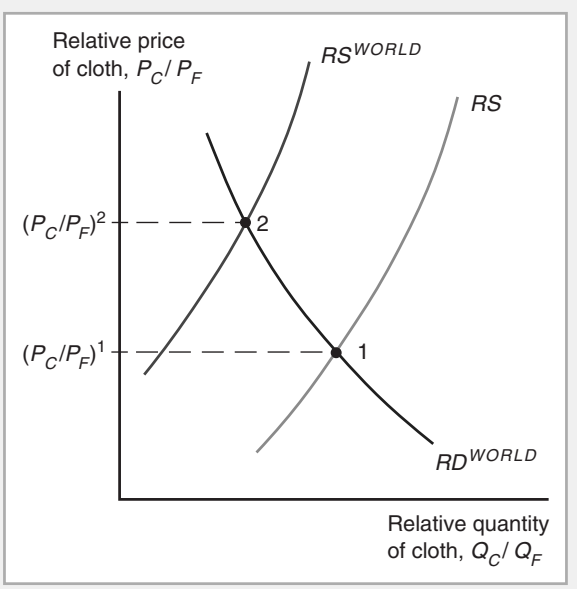
For trade to take place, a country must face a world relative price that is different from the relative price that would prevail in the absence of trade. Figure 4-9 shows how this relative price was determined for our specific factors economy. In Figure 4-10, we also add a relative supply curve for the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

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

**Figure 4-10**

**Trade and Relative Prices**

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



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

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

# Income Distribution and the Gains from Trade

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

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

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

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

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

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

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

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

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

Equation (4-7) can be rearranged to yield the following:

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

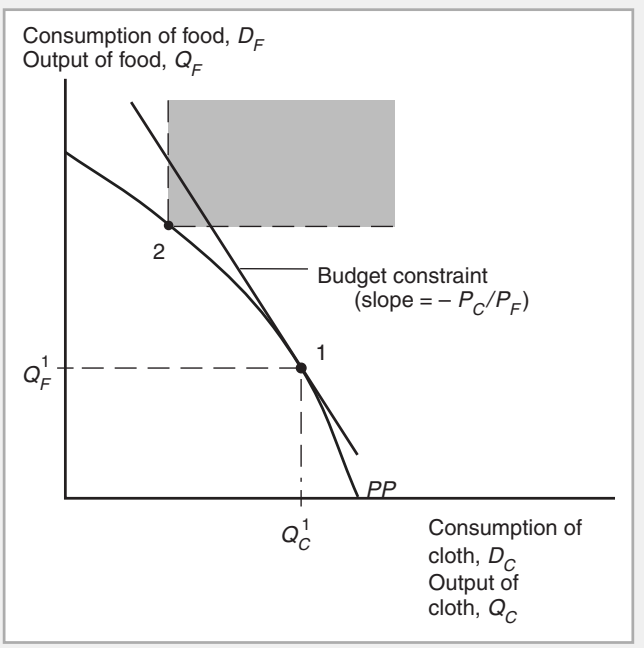
$D_F - Q_F$ is the economy's food *imports*, the amount by which its consumption of food exceeds its production. The right-hand side of the equation is the product of the relative price of cloth and the amount by which production of cloth exceeds consumption, that is, the economy's *exports* of cloth. The equation, then, states that imports of food equal exports of cloth times the relative price of cloth. While it does not tell us how much the economy will import or export, the equation does show that the amount the economy can afford to import is limited, or constrained, by the amount it exports. Equation (4-8) is therefore known as a **budget constraint**.[5]

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

**Figure 4-11**

**Budget Constraint for a Trading Economy and Gains from Trade**

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




[5]The constraint that the value of consumption equals that of production (or, equivalently, that imports equal exports in value) may not hold when countries can borrow from other countries or lend to them. For now we assume that these possibilities are not available and that the budget constraint (equation (4-8)) therefore holds. International borrowing and lending are examined in Chapter 6, which shows that an economy's consumption *over time* is still constrained by the necessity of paying its debts to foreign lenders.

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

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

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

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

## The Political Economy of Trade: A Preliminary View

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

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

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

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

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

## Case Study

### Trade and Unemployment

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

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

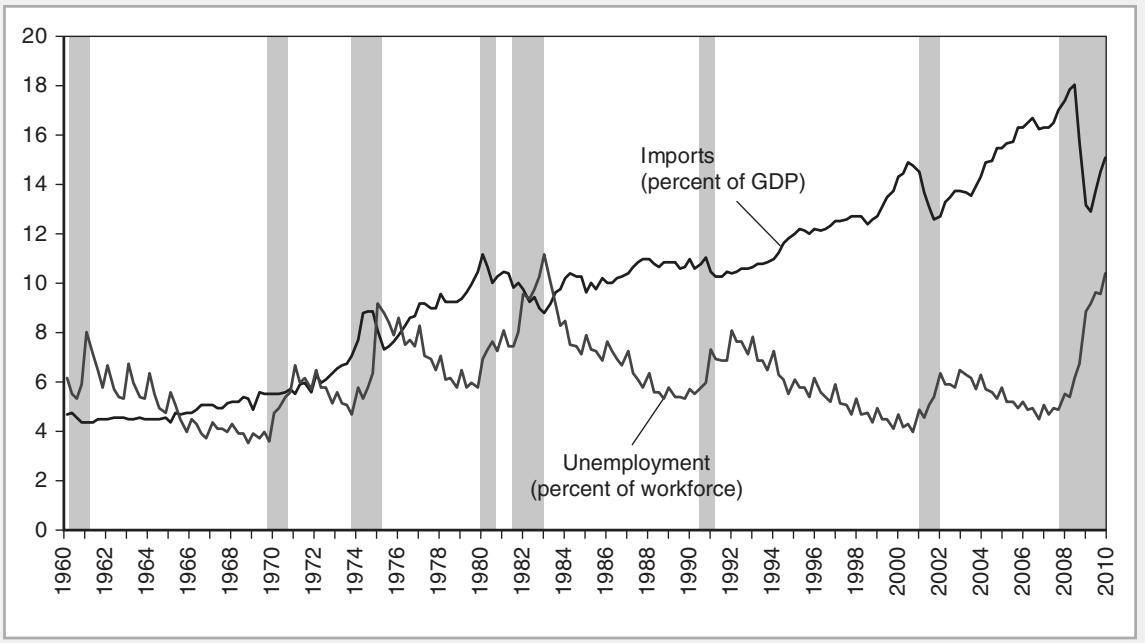



**Figure 4-12**

**Unemployment and Import Penetration in the U.S.**

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

**Source:** US Bureau of Economic Analysis for imports and US Bureau of Labor Studies for unemployment.

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

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

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

## Income Distribution and Trade Politics

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

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

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

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

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

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

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

# International Labor Mobility

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

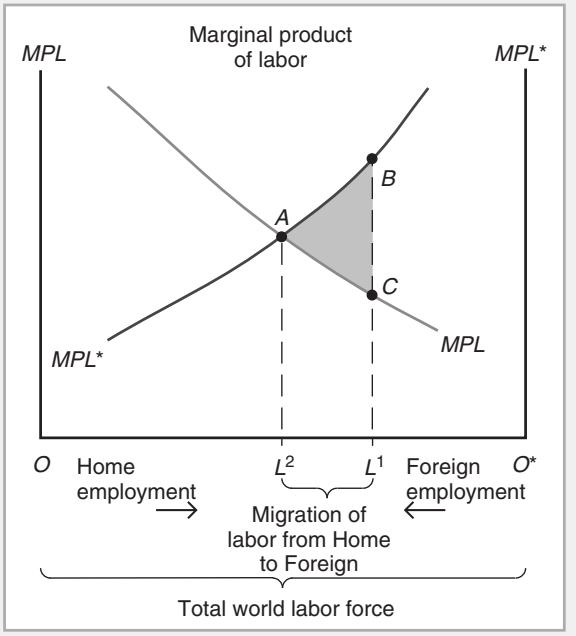
In the previous sections, we saw how workers move between the cloth and food sectors within one country until the wages in the two sectors are equalized. Whenever international migration is possible, workers will also want to move from the low-wage to the high-wage country.[9] To keep things simple and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

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

**Figure 4-13**

**Causes and Effects of International Labor Mobility**

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




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

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

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

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

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

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

## Case Study

### Wage Convergence in the Age of Mass Migration

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

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

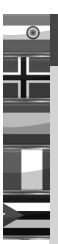
Did this process cause the kind of real wage convergence that our model predicts? Indeed it did. Table 4-1 shows real wages in 1870, and the change in these wages up to the eve of World War I, for four major "destination" countries and for four important "origin" countries. As the table shows, at the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

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

**TABLE 4-1**

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

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



## Case Study

### Foreign Workers: The Story of the GCC

Following the discovery of large oil and natural gas reserves in the mid-1900s, the economies of the Gulf Cooperation Council (GCC) countries have relied heavily on foreign workers.[10] As Figure 4-14 shows, the mean share of foreign workers in the GCC countries has steadily increased, and made up 50 percent of the population in 2005. While the influx of workers to the Gulf has been mainly from Arab and Indian subcontinent countries, recently there has been a significant inflow of people from Europe and

[10] GCC countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates.

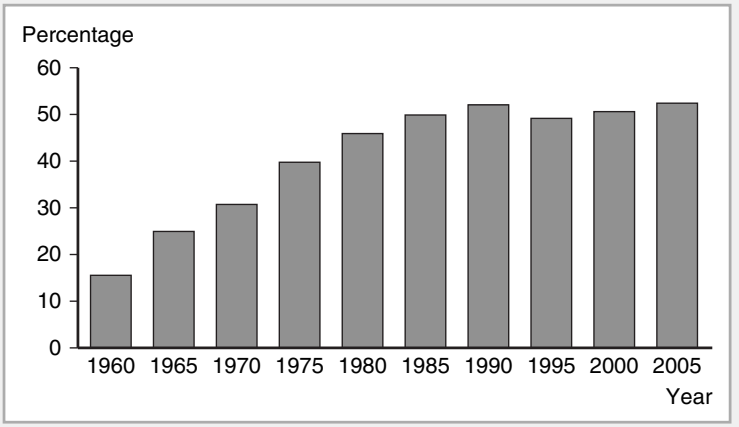



**Figure 4-14**

**Mean Migrant Stock as a Percentage of the GCC Population**

**Source:** *World Development Indicators Online databases.*

North America.[11] The Gulf has become home to the regional headquarters of many multinational corporations (for instance, Oracle, Microsoft, and IBM) generating demand for highly skilled foreign workers mainly from the West with professional and technical skills needed to run these companies in sync with their home country operations. With such a large presence, one has to wonder about the implications for the GCC economies of large numbers of expatriates. First of all, the standards of living reflected in Gross Domestic Product (GDP) per capita have increased tremendously in the last three decades. Kuwait, Qatar, and the United Arab Emirates (UAE) consistently rank in the top 15 countries in terms of standard of living.

However, the large number of foreigners puts serious pressures on the GCC economies. The proportion of foreign workers to the total population is even higher when one looks only at the labor force.[12] This has resulted in severe competition for local workers and has prompted all GCC governments to issue labor protective policies that have their own share of consequences for migrant workers.[13] Foreigners are separated into two types of accommodations based on their skill level and while no foreign worker can become a citizen or own property, low-skilled workers cannot even sponsor their families to join them.[14] These restrictions have turned migration to the Gulf into a temporary guest worker program. The nature of the foreign labor market in the Gulf has installed a sense of unease among foreign workers, which is explicitly expressed in the size of remittances. The official remittances from the GCC

[11] See G. Naufal and C. Vargas-Silva. "Migrant Transfers in the MENA Region: A Two Way Street in Which Traffic Is Changing." *Migration Letters* 7(2), 2010, pp. 168–178.

[12] See N. Ann Colton. "The International Political Economy of Gulf Migration." *Viewpoints* Special Edition Migration and the Gulf. *Middle East Institute Viewpoints* (February 2010), pp. 34–36.

[13] For example, in the United Arab Emirates, the government has introduced Emiratization as a policy aimed at securing jobs for the local labor force.

[14] Low-skilled workers are housed in labor camps (similar to army barracks), and high-skilled workers are housed in regular accommodations.

economies in 2007 surpassed US$37 billion, making the Gulf one of the most active remitting regions in the world.

Thus, the GCC countries present a unique and interesting case of migration. While the large share of foreigners in the population has subjected the local economies to certain complications, foreign workers have also helped the local population achieve one of the highest standards of living in the world. This is the story of the GCC; a story of trade-offs.

## SUMMARY

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

## KEY TERMS

budget constraint, p. 94
diminishing returns, p. 83
marginal product of labor, p. 83
mobile factor, p. 81
production function, p. 82
production possibility frontier, p. 83
specific factor, p. 81
specific factors model, p. 81
U.S. Trade Adjustment Assistance program, p. 97

## PROBLEMS

myeconlab

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

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

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

| Workers Employed | MPL in Sector 1 | MPL in Sector 2 |
|---|---|---|
| 10 | 15.1 | 15.9 |
| 20 | 11.4 | 10.5 |
| 30 | 10.0 | 8.2 |
| 40 | 8.7 | 6.9 |
| 50 | 7.8 | 6.0 |
| 60 | 7.4 | 5.4 |
| 70 | 6.9 | 5.0 |
| 80 | 6.6 | 4.6 |
| 90 | 6.3 | 4.3 |
| 100 | 6.0 | 4.0 |

   **a.** Suppose that the price of good 2 relative to that of good 1 is 2. Determine graphically the wage rate and the allocation of labor between the two sectors.
   **b.** Using the graph drawn for problem 2, determine the output of each sector. Then confirm graphically that the slope of the production possibility frontier at that point equals the relative price.
   **c.** Suppose that the relative price of good 2 falls to 1.3. Repeat (a) and (b).
   **d.** Calculate the effects of the price change from 2 to 1.3 on the income of the specific factors in sectors 1 and 2.

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

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

   Initially, there are 11 workers employed in Home, but only 3 workers in Foreign.
   Find the effect of free movement of labor from Home to Foreign on employment, production, real wages, and the income of landowners in each country.
6. Using the numerical example in problem 5, assume now that Foreign limits immigration so that only 2 workers can move there from Home. Calculate how the movement of these two workers affects the income of five different groups:
   **a.** Workers who were originally in Foreign
   **b.** Foreign landowners
   **c.** Workers who stay in Home
   **d.** Home landowners
   **e.** The workers who do move
7. Studies of the effects of immigration into the United States from Mexico tend to find that the big winners are the immigrants themselves. Explain this result in terms of the example in the question above. How might things change if the border were open, with no restrictions on immigration?

## FURTHER READINGS

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

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

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

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

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

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

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

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

# Further Details on Specific Factors

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

## Marginal and Total Product

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

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

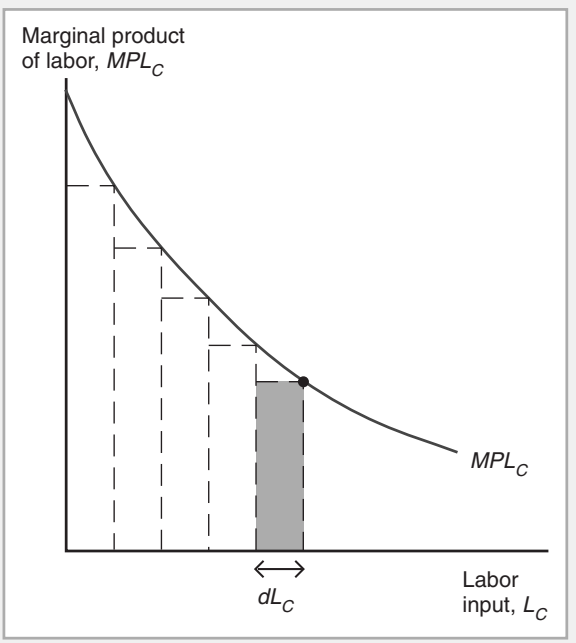
$$dL_C \times MPL_C,$$

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

**Figure 4A-1**

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

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



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

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

## Relative Prices and the Distribution of Income

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

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

**Figure 4A-2**

**The Distribution of Income Within the Cloth Sector**

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

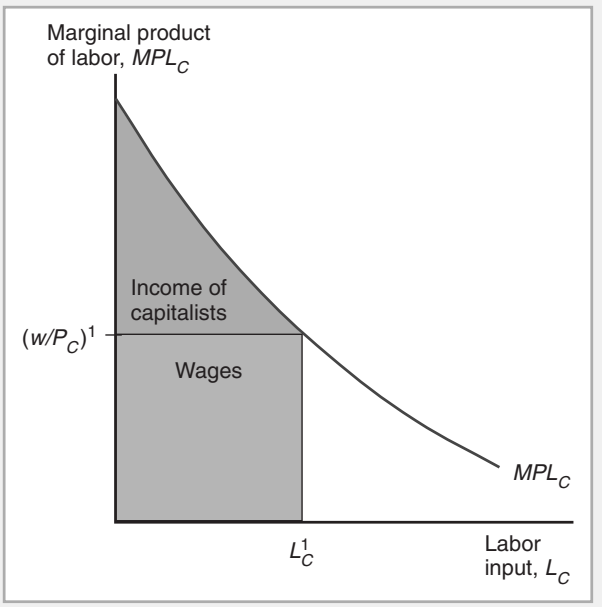


**Figure 4A-3**

**A Rise in $P_C$ Benefits the Owners of Capital**

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

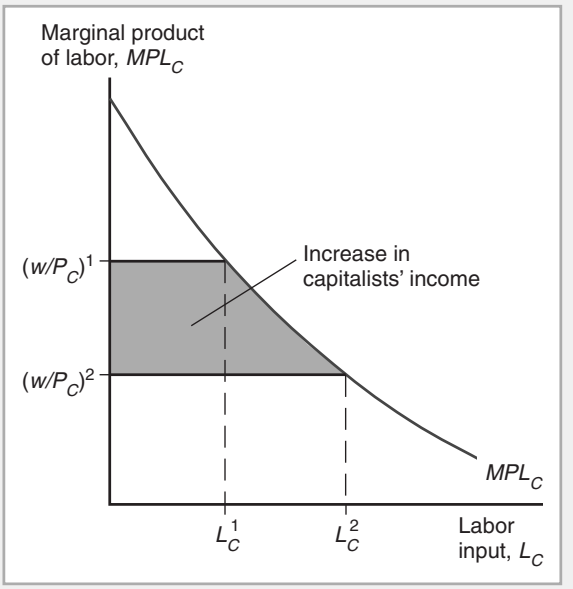
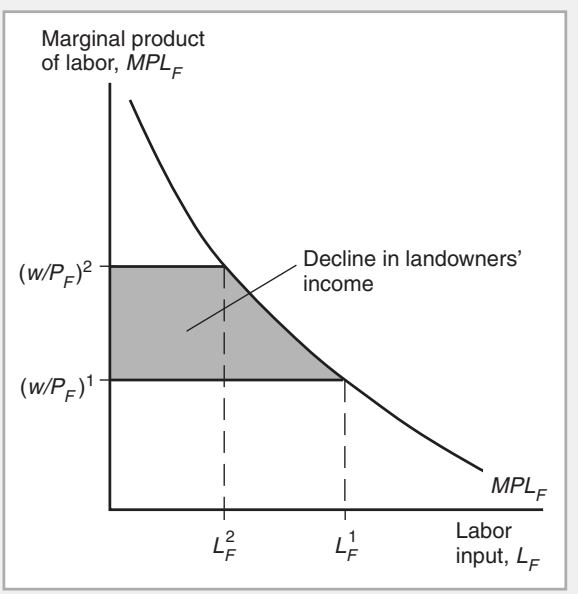



**Figure 4A-4**

**A Rise in $P_C$ Hurts Landowners**

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




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

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

CHAPTER 5

# Resources and Trade: The Heckscher-Ohlin Model

If labor were the only factor of production, as the Ricardian model assumes, comparative advantage could arise only because of international differences in labor productivity. In the real world, however, while trade is partly explained by differences in labor productivity, it also reflects differences in countries' *resources*. Canada exports forest products to the United States not because its lumberjacks are more productive relative to their U.S. counterparts but because sparsely populated Canada has more forested land per capita than the United States. Thus a realistic view of trade must allow for the importance not just of labor, but also of other factors of production such as land, capital, and mineral resources.

To explain the role of resource differences in trade, this chapter examines a model in which resource differences are the *only* source of trade. This model shows that comparative advantage is influenced by the interaction between nations' resources (the relative **abundance of factors** of production) and the technology of production (which influences the relative **intensity** with which different **factors** of production are used in the production of different goods). Some of these ideas were presented in the specific factors model of Chapter 4, but the model we study in this chapter puts the interaction between abundance and intensity in sharper relief by looking at long-run outcomes when all factors of production are mobile across sectors.

That international trade is largely driven by differences in countries' resources is one of the most influential theories in international economics. Developed by two Swedish economists, Eli Heckscher and Bertil Ohlin (Ohlin received the Nobel Prize in economics in 1977), the theory is often referred to as the **Heckscher-Ohlin theory**. Because the theory emphasizes the interplay between the proportions in which different factors of production are available in different countries and the proportions in which they are used in producing different goods, it is also referred to as the **factor-proportions theory**.

To develop the factor-proportions theory, we begin by describing an economy that does not trade and then ask what happens when two such economies trade with each other. Since the factor-proportions theory is both an important and a controversial theory, we conclude the chapter with a discussion of the empirical evidence for and against the theory.

## LEARNING GOALS

After reading this chapter, you will be able to:

- Explain how differences in resources generate a specific pattern of trade.
- Discuss why the gains from trade will not be equally spread even in the long run and identify the likely winners and losers.
- Understand the possible links between increased trade and rising wage inequality in the developed world.

# Model of a Two-Factor Economy

In this chapter, we'll focus on the simplest version of the factor-proportions model, sometimes referred to as "2 by 2 by 2": two countries, two goods, two factors of production. In our example we'll call the two countries Home and Foreign. We will stick with the same two goods, cloth (measured in yards) and food (measured in calories), that we used in the specific factors model of Chapter 4. The key difference is that in this chapter, we assume that the immobile factors that were specific to each sector (capital in cloth, land in food) are now mobile in the long run. Thus land used for farming can be used to build a textile plant, and conversely, the capital used to pay for a power loom can be used to pay for a tractor. To keep things simple, we model a single additional factor that we call capital, which is used in conjunction with labor to produce either cloth or food. In the long run, both capital and labor can move across sectors, thus equalizing their returns (rental rate and wage) in both sectors.

## Prices and Production

Both cloth and food are produced using capital and labor. The amount of each good produced, given how much capital and labor are employed in each sector, is determined by a production function for each good:

$$Q_C = Q_C(K_C, L_C),$$
$$Q_F = Q_F(K_F, L_F),$$

where $Q_C$ and $Q_F$ are the output levels of cloth and food, $K_C$ and $L_C$ are the amounts of capital and labor employed in cloth production, and $K_F$ and $L_F$ are the amounts of capital and labor employed in food production. Overall, the economy has a fixed supply of capital $K$ and labor $L$ that is divided between employment in the two sectors.

We define the following expressions that are related to the two production technologies:

$$a_{KC} = \text{capital used to produce one yard of cloth}$$
$$a_{LC} = \text{labor used to produce one yard of cloth}$$
$$a_{KF} = \text{capital used to produce one calorie of food}$$
$$a_{LF} = \text{labor used to produce one calorie of food}$$

These unit input requirements are very similar to the ones defined in the Ricardian model (for labor only). However, there is one crucial difference: In these definitions, we speak of the quantity of capital or labor *used* to produce a given amount of cloth or food, rather than the quantity *required* to produce that amount. The reason for this change from the Ricardian model is that when there are two factors of production, there may be some room for choice in the use of inputs.

In general, those choices will depend on the factor prices for labor and capital. However, let's first look at a special case in which there is only one way to produce each good. Consider the following numerical example: Production of one yard of cloth requires a combination of two work-hours and two machine-hours. The production of food is more automated; as a result, production of one calorie of food requires only one work-hour along with three machine-hours. Thus, all the unit input requirements are fixed at $a_{KC} = 2$; $a_{LC} = 2$; $a_{KF} = 3$; $a_{LF} = 1$; and there is no possibility of substituting labor for capital or vice versa. Assume that an economy is endowed with 3,000 units of machine-hours along with 2,000 units of work-hours. In this special case of no factor substitution in production, the economy's production possibility frontier can be derived using those two resource constraints for capital and labor. Production of $Q_C$ yards of cloth requires $2Q_C = a_{KC} \times Q_C$ machine-hours and $2Q_C = a_{LC} \times Q_C$ work-hours. Similarly, production of $Q_F$ calories of food requires $3Q_F = a_{KF} \times Q_F$ machine-hours and $1Q_F = a_{LF} \times Q_F$ work-hours. The total machine-hours used for both cloth and food production cannot exceed the total supply of capital:

$$a_{KC} \times Q_C + a_{KF} \times Q_F \leq K, \text{ or } 2Q_C + 3Q_F \leq 3{,}000 \quad \textbf{(5-1)}$$

This is the resource constraint for capital. Similarly, the resource constraint for labor states that the total work-hours used in production cannot exceed the total supply of labor:

$$a_{LC} \times Q_C + a_{LF} \times Q_F \leq L, \text{ or } 2Q_C + Q_F \leq 2{,}000 \quad \textbf{(5-2)}$$

Figure 5-1 shows the implications of (5-1) and (5-2) for the production possibilities in our numerical example. Each resource constraint is drawn in the same way that we drew the production possibility line for the Ricardian case in Figure 3-1. In this case, however, the economy must produce subject to *both* constraints. So the production possibility frontier is the kinked line shown in red. If the economy specializes in food production (point 1), then it can produce 1,000 calories of food. At that production point, there is spare labor capacity: Only 1,000 work-hours out of 2,000 are employed. Conversely, if the economy specializes in cloth production (point 2), then it can produce 1,000 yards of cloth. At that production point, there is spare capital capacity: Only 2,000 machine-hours out of 3,000 are employed. At production point 3, the economy is employing all of its labor and capital resources (1,500 machine-hours and 1,500 work-hours in cloth production, and 1,500 machine-hours along with 500 work-hours in food production).[1]

The important feature of this production possibility frontier is that the opportunity cost of producing an extra yard of cloth in terms of food is not constant. When the economy is producing mostly food (to the left of point 3), then there is spare labor capacity. Producing two fewer units of food releases six machine-hours that can be used to produce three yards of cloth: The opportunity cost of cloth is $^2/_3$. When the economy is producing mostly cloth (to the right of point 3), then there is spare capital capacity. Producing two fewer units of food releases two work-hours that can be used to produce one yard of cloth: The opportunity cost of cloth is 2. Thus, the opportunity cost of cloth is higher when more units of cloth are being produced.

[1] The case of no factor substitution is a special one in which there is only a single production point that fully employs both factors; some factors are left unemployed at all the other production points on the production possibilities frontier. In the more general case below with factor substitution, this peculiarity disappears, and both factors are fully employed along the entire production possibility frontier.

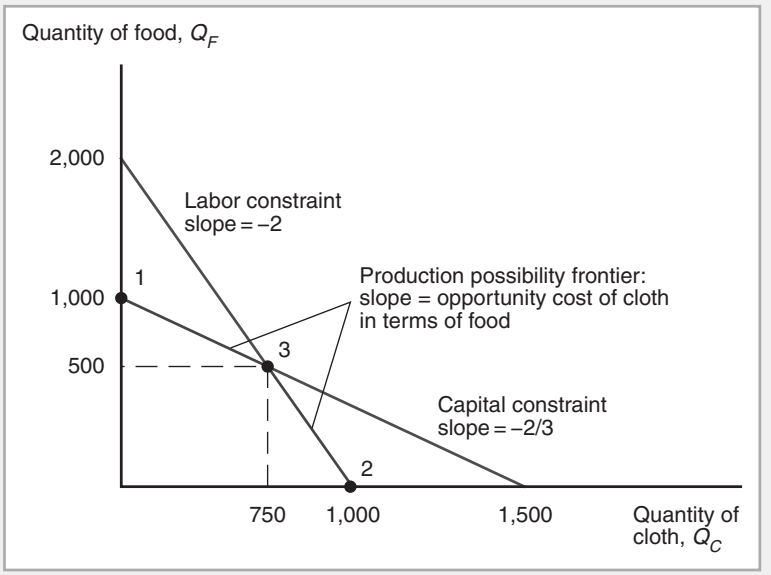



**Figure 5-1**

**The Production Possibility Frontier Without Factor Substitution: Numerical Example**

If capital cannot be substituted for labor or vice versa, the production possibility frontier in the factor-proportions model would be defined by two resource constraints: The economy can't use more than the available supply of labor (2,000 work-hours) or capital (3,000 machine-hours). So the production possibility frontier is defined by the red line in this figure. At point 1, the economy specializes in food production, and not all available work-hours are employed. At point 2, the economy specializes in cloth, and not all available machine-hours are employed. At production point 3, the economy employs all of its labor and capital resources. The important feature of the production possibility frontier is that the opportunity cost of cloth in terms of food isn't constant: It rises from $^2/_3$ to 2 when the economy's mix of production shifts toward cloth.

Now let's make the model more realistic and allow the possibility of substituting capital for labor and vice versa in production. This substitution removes the kink in the production possibility frontier; instead, the frontier *PP* has the bowed shape shown in Figure 5-2. The bowed shape tells us that the opportunity cost in terms of food of producing one more unit of cloth rises as the economy produces more cloth and less food. That is, our basic insight about how opportunity costs change with the mix of production remains valid.

Where on the production possibility frontier does the economy produce? It depends on prices. Specifically, the economy produces at the point that maximizes the value of production. Figure 5-3 shows what this implies. The value of the economy's production is

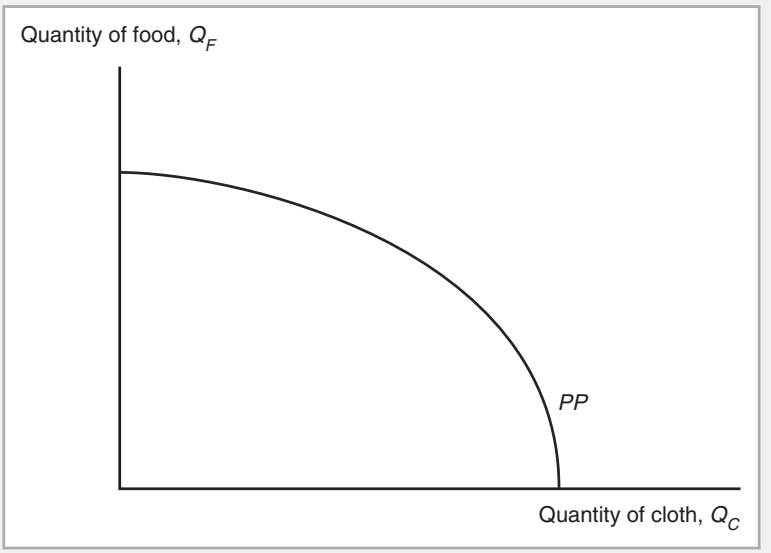
$$V = P_C \times Q_C + P_F \times Q_F,$$

where $P_C$ and $P_F$ are the prices of cloth and food, respectively. An isovalue line—a line along which the value of output is constant—has a slope of $-P_C/P_F$. The economy produces at the point $Q$, the point on the production possibility frontier that touches the highest possible isovalue line. At that point, the slope of the production possibility frontier is equal to $-P_C/P_F$. So the opportunity cost in terms of food of producing another unit of cloth is equal to the relative price of cloth.

**Figure 5-2**

**The Production Possibility Frontier with Factor Substitution**

If capital can be substituted for labor and vice versa, the production possibility frontier no longer has a kink. But it remains true that the opportunity cost of cloth in terms of food rises as the economy's production mix shifts toward cloth and away from food.




## Choosing the Mix of Inputs

As we have noted, in a two-factor model producers may have room for choice in the use of inputs. A farmer, for example, can choose between using relatively more mechanized equipment (capital) and fewer workers, or vice versa. Thus, the farmer can choose how much labor and capital to use per unit of output produced. In each sector, then, producers will face not fixed input requirements (as in the Ricardian model) but trade-offs like the one illustrated by curve *II* in Figure 5-4, which shows alternative input combinations that can be used to produce one calorie of food.

What input choice will producers actually make? It depends on the relative costs of capital and labor. If capital rental rates are high and wages low, farmers will choose to produce using relatively little capital and a lot of labor; on the other hand, if the rental rates are low and wages high, they will save on labor and use a lot more capital. If $w$ is the wage

**Figure 5-3**

**Prices and Production**

The economy produces at the point that maximizes the value of production given the prices it faces; this is the point that is on the highest possible isovalue line. At that point, the opportunity cost of cloth in terms of food is equal to the relative price of cloth, $P_C/P_F$.

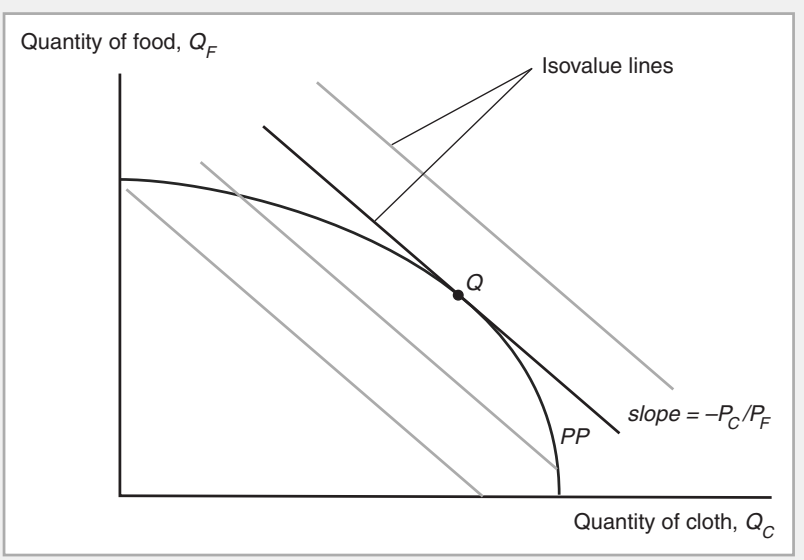
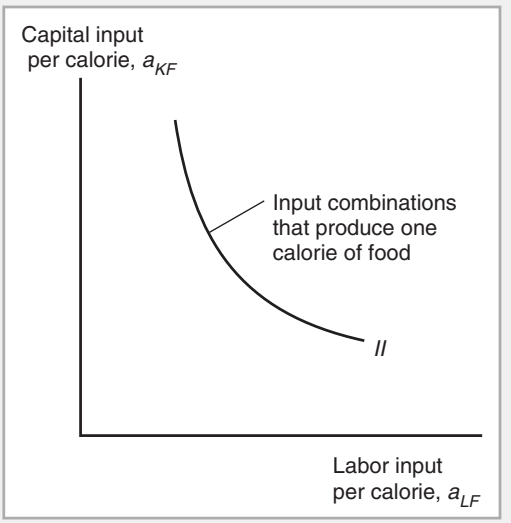


**Figure 5-4**

**Input Possibilities in Food Production**

A farmer can produce a calorie of food with less capital if he or she uses more labor, and vice versa.



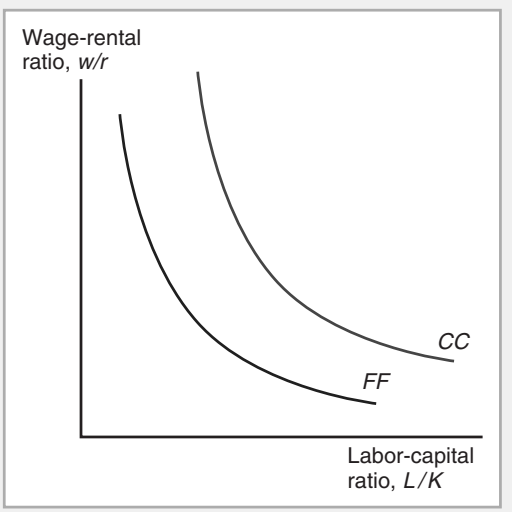

rate and $r$ the rental cost of capital, then the input choice will depend on the ratio of these two **factor prices,** $w/r$.[2] The relationship between factor prices and the ratio of labor to capital use in production of food is shown in Figure 5-5 as the curve *FF*.

There is a corresponding relationship between $w/r$ and the labor-capital ratio in cloth production. This relationship is shown in Figure 5-5 as the curve *CC*. As drawn, *CC* is shifted out relative to *FF*, indicating that at any given factor prices, production of cloth will always use more labor relative to capital than will production of food. When this is true, we say that production of cloth is *labor-intensive*, while production of food is *capital-intensive*. Notice that the definition of intensity depends on the ratio of labor to capital used in production, not the ratio of labor or capital to output. Thus a good cannot be both capital- and labor-intensive.

**Figure 5-5**

**Factor Prices and Input Choices**

In each sector, the ratio of labor to capital used in production depends on the cost of labor relative to the cost of capital, $w/r$. The curve *FF* shows the labor-capital ratio choices in food production, while the curve *CC* shows the corresponding choices in cloth production. At any given wage-rental ratio, cloth production uses a higher labor-capital ratio; when this is the case, we say that cloth production is *labor-intensive* and that food production is *capital-intensive*.




[2] The optimal choice of the labor-capital ratio is explored at greater length in the appendix to this chapter.

The *CC* and *FF* curves in Figure 5-5 are called relative factor demand curves; they are very similar to the relative demand curve for goods. Their downward slope characterizes the substitution effect in the producers' factor demand. As the wage *w* rises relative to the rental rate *r*, producers substitute capital for labor in their production decisions. The previous case we considered with no factor substitution is a limiting case, where the relative demand curve is a vertical line: The ratio of labor to capital demanded is fixed and does not vary with changes in the wage-rental ratio *w/r*. In the remainder of this chapter, we consider the more general case with factor substitution, where the relative factor demand curves are downward sloping.

## Factor Prices and Goods Prices

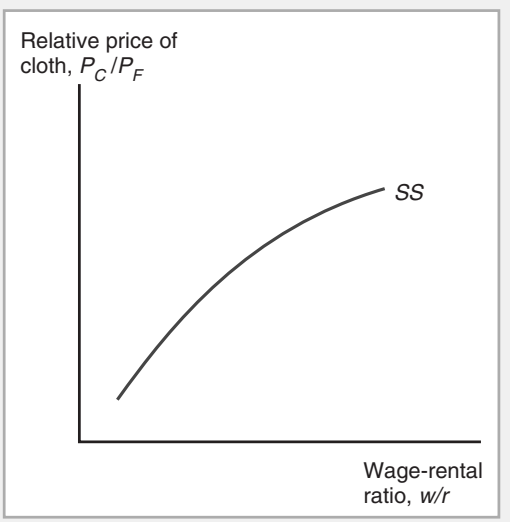
Suppose for a moment that the economy produces both cloth and food. (This need not be the case if the economy engages in international trade, because it might specialize completely in producing one good or the other; but let us temporarily ignore this possibility.) Then competition among producers in each sector will ensure that the price of each good equals its cost of production. The cost of producing a good depends on factor prices: If wages rise, then other things equal to the price of any good whose production uses labor will also rise.

The importance of a particular factor's price to the cost of producing a good depends, however, on how much of that factor the good's production involves. If food production makes use of very little labor, for example, then a rise in the wage will not have much effect on the price of food, whereas if cloth production uses a great deal of labor, a rise in the wage *will* have a large effect on the price. We can therefore conclude that there is a one-to-one relationship between the ratio of the wage rate to the rental rate, *w*/*r*, and the ratio of the price of cloth to that of food, $P_C/P_F$. This relationship is illustrated by the upward-sloping curve *SS* in Figure 5-6.[3]

**Figure 5-6**

**Factor Prices and Goods Prices**

Because cloth production is labor-intensive while food production is capital-intensive, there is a one-to-one relationship between the factor price ratio *w/r* and the relative price of cloth $P_C/P_F$; the higher the relative cost of labor, the higher must be the relative price of the labor-intensive good. The relationship is illustrated by the curve *SS*.




[3]This relationship holds only when the economy produces both cloth and food, which is associated with a given range for the relative price of cloth. If the relative price rises beyond a given upper-bound level, then the economy specializes in cloth production; conversely, if the relative price drops below a lower-bound level, then the economy specializes in food production.

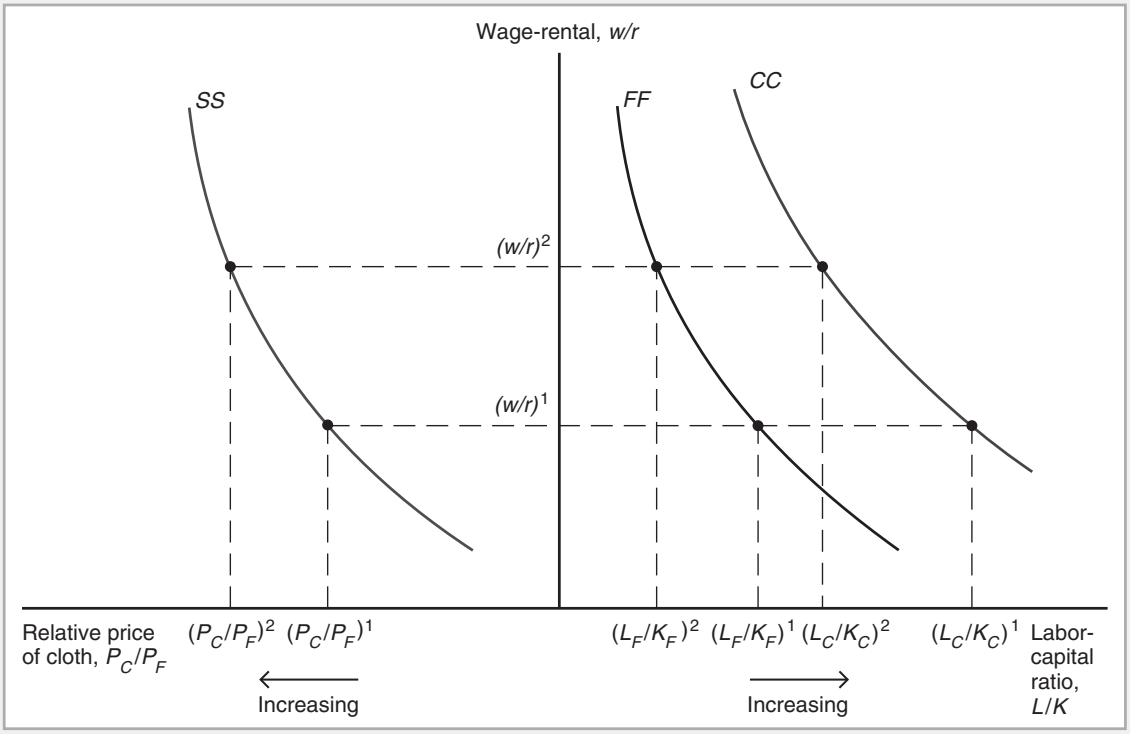



**Figure 5-7**

**From Goods Prices to Input Choices**

Given the relative price of cloth $(P_C/P_F)^1$, the ratio of the wage rate to the capital rental rate must equal $(w/r)^1$. This wage-rental ratio then implies that the ratios of labor to capital employed in the production of cloth and food must be $(L_C/K_C)^1$ and $(L_F/K_F)^1$. If the relative price of cloth rises to $(P_C/P_F)^2$, the wage-rental ratio must rise to $(w/r)^2$. This will cause the labor-capital ratio used in the production of both goods to drop.

Let's look at Figures 5-5 and 5-6 together. In Figure 5-7, the left panel is Figure 5-6 (of the *SS* curve) turned counterclockwise 90 degrees, while the right panel reproduces Figure 5-5. By putting these two diagrams together, we see what may seem at first to be a surprising linkage of the prices of goods to the ratio of labor to capital used in the production of each good. Suppose that the relative price of cloth is $(P_C/P_F)^1$ (left panel of Figure 5-7); if the economy produces both goods, the ratio of the wage rate to the capital rental rate must equal $(w/r)^1$. This ratio then implies that the ratios of labor to capital employed in the production of cloth and food must be $(L_C/K_C)^1$ and $(L_F/K_F)^1$, respectively (right panel of Figure 5-7). If the relative price of cloth were to rise to the level indicated by $(P_C/P_F)^2$, the ratio of the wage rate to the capital rental rate would rise to $(w/r)^2$. Because labor is now relatively more expensive, the ratios of labor to capital employed in the production of cloth and food would therefore drop to $(L_C/K_C)^2$ and $(L_F/K_F)^2$.

We can learn one more important lesson from this diagram. The left panel already tells us that an increase in the price of cloth relative to that of food will raise the income of workers relative to that of capital owners. But it is possible to make a stronger statement: Such a change in relative prices will unambiguously raise the purchasing power of workers and lower the purchasing power of capital owners by raising real wages and lowering real rents in terms of *both* goods.

How do we know this? When $P_C/P_F$ increases, the ratio of labor to capital falls in both cloth and food production. But in a competitive economy, factors of production are paid their marginal product—the real wage of workers in terms of cloth is equal to the marginal productivity of labor in cloth production, and so on. When the ratio of labor to capital falls in producing either good, the marginal product of labor in terms of that good increases—so workers find their real wage higher in terms of both goods. On the other hand, the marginal product of capital falls in both industries, so capital owners find their real incomes lower in terms of both goods.

In this model, then, as in the specific factors model, changes in relative prices have strong effects on income distribution. Not only does a change in the prices of goods change the distribution of income; it always changes it so much that owners of one factor of production gain while owners of the other are made worse off.[4]

## Resources and Output

We can now complete the description of a two-factor economy by describing the relationship between goods prices, factor supplies, and output. In particular, we investigate how changes in resources (the total supply of a factor) affect the allocation of factors across sectors and the associated changes in output produced.

Suppose that we take the relative price of cloth as given. We know from Figure 5-7 that a given relative price of cloth, say $(P_C/P_F)^1$, is associated with a fixed wage-rental ratio $(w/r)^1$ (so long as both cloth and food are produced). That ratio, in turn, determines the ratios of labor to capital employed in both the cloth and the food sectors: $(L_C/K_C)^1$ and $(L_F/K_F)^1$, respectively. Now we assume that the economy's labor force grows, which implies that the economy's aggregate labor to capital ratio, $L/K$, increases. At the given relative price of cloth $(P_C/P_F)^1$, we just saw that the ratios of labor to capital employed in both sectors remain constant. How can the economy accommodate the increase in the aggregate relative supply of labor $L/K$ if the relative labor demanded in each sector remains constant at $(L_C/K_C)^1$ and $(L_F/K_F)^1$? In other words, how does the economy employ the additional labor hours? The answer lies in the allocation of labor and capital across sectors: The labor-capital ratio in the cloth sector is higher than that in the food sector, so the economy can increase the employment of labor to capital (holding the labor-capital ratio fixed in each sector) by allocating more labor and capital to the production of cloth (which is labor-intensive).[5] As labor and capital move from the food sector to the cloth sector, the economy produces more cloth and less food.

The best way to think about this result is in terms of how resources affect the economy's production possibilities. In Figure 5-8 the curve $TT^1$ represents the economy's production possibilities before the increase in labor supply. Output is at point 1, where the slope of the production possibility frontier equals minus the relative price of cloth, $-P_C/P_F$, and the economy produces $Q_C^1$ and $Q_F^1$ of cloth and food. The curve $TT^2$ shows the production possibility frontier after an increase in the labor supply. The production possibility frontier shifts out to $TT^2$ After this increase, the economy can produce more of both cloth and food than before. The outward shift of the frontier is, however, much larger in the direction of cloth than of food—that is, there is a **biased expansion of production possibilities,** which occurs when the production possibility frontier shifts out much more in one direction than in the other. In this case, the expansion is so strongly biased toward cloth production that at unchanged relative prices, production moves from

[4] This relationship between goods prices and factor prices (and the associated welfare effects) was clarified in a classic paper by Wolfgang Stolper and Paul Samuelson, "Protection and Real Wages," *Review of Economic Studies* 9 (November 1941), pp. 58–73, and is therefore known as the *Stolper-Samuelson effect.*

[5] See the appendix for a more formal derivation of this result and additional details.

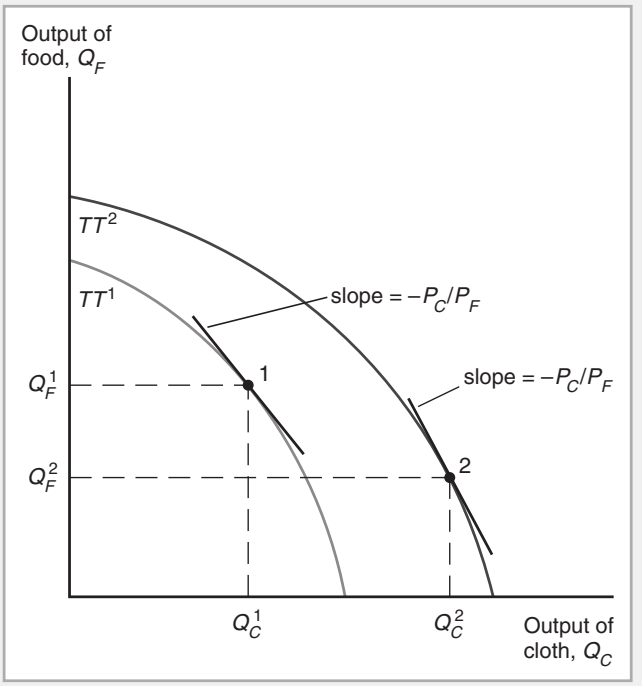



**Figure 5-8**

**Resources and Production Possibilities**

An increase in the supply of labor shifts the economy's production possibility frontier outward from $TT^1$ to $TT^2$, but does so disproportionately in the direction of cloth production. The result is that at an unchanged relative price of cloth (indicated by the slope $-P_C/P_F$), food production actually declines from $Q_F^1$ to $Q_F^2$.

point 1 to point 2, which involves an actual fall in food output from $Q_F^1$ to $Q_F^2$ and a large increase in cloth output from $Q_C^1$ to $Q_C^2$.

The biased effect of increases in resources on production possibilities is the key to understanding how differences in resources give rise to international trade.[6] An increase in the supply of labor expands production possibilities disproportionately in the direction of cloth production, while an increase in the supply of capital expands them disproportionately in the direction of food production. Thus an economy with a high relative supply of labor to capital will be relatively better at producing cloth than an economy with a low relative supply of labor to capital. *Generally, an economy will tend to be relatively effective at producing goods that are intensive in the factors with which the country is relatively well endowed.*

We will further see below that there is some strong empirical evidence confirming that changes in a country's resources lead to growth that is strongly biased toward the sectors that intensively use the factor whose supply has increased. We document this for the economies of Japan, South Korea, Taiwan, Hong Kong, and Singapore, which all experienced very rapid growth in their supply of skilled labor over the last half-century.

# Effects of International Trade Between Two-Factor Economies

Having outlined the production structure of a two-factor economy, we can now look at what happens when two such economies, Home and Foreign, trade. As always, Home and Foreign are similar along many dimensions. They have the same tastes and therefore have identical

[6]The biased effect of resource changes on production was pointed out in a paper by the Polish economist T. M. Rybczynski, "Factor Endowments and Relative Commodity Prices," *Economica* 22 (November 1955), pp. 336–341. It is therefore known as the *Rybczynski effect.*

relative demands for food and cloth when faced with the same relative prices of the two goods. They also have the same technology: A given amount of labor and capital yields the same output of either cloth or food in the two countries. The only difference between the countries is in their resources: Home has a higher ratio of labor to capital than Foreign does.

## Relative Prices and the Pattern of Trade

Since Home has a higher ratio of labor to capital than Foreign, Home is *labor-abundant* and Foreign is *capital-abundant.* Note that abundance is defined in terms of a ratio and not in absolute quantities. For example, the total number of workers in the United States is roughly three times higher than that in Mexico, but Mexico would still be considered labor-abundant relative to the United States since the U.S. capital stock is more than three times higher than the capital stock in Mexico. "Abundance" is always defined in relative terms, by comparing the ratio of labor to capital in the two countries; thus no country is abundant in everything.

Since cloth is the labor-intensive good, Home's production possibility frontier relative to Foreign's is shifted out more in the direction of cloth than in the direction of food. Thus, other things equal, Home tends to produce a higher ratio of cloth to food.

Because trade leads to a convergence of relative prices, one of the other things that will be equal is the price of cloth relative to that of food. Because the countries differ in their factor abundances, however, for any given ratio of the price of cloth to that of food, Home will produce a higher ratio of cloth to food than Foreign will: Home will have a larger *relative supply* of cloth. Home's relative supply curve, then, lies to the right of Foreign's.

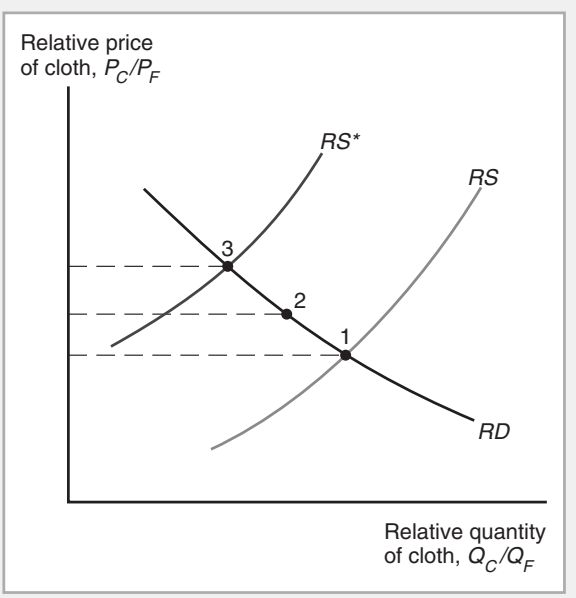
The relative supply schedules of Home (*RS*) and Foreign ($RS^*$) are illustrated in Figure 5-9. The relative demand curve, which we have assumed to be the same for both countries, is shown as *RD.* If there were no international trade, the equilibrium for Home would be at point 1, while the equilibrium for Foreign would be at point 3. That is, in the absence of trade the relative price of cloth would be lower in Home than in Foreign.

When Home and Foreign trade with each other, their relative prices converge. The relative price of cloth rises in Home and declines in Foreign, and a new world relative price of

**Figure 5-9**

**Trade Leads to a Convergence of Relative Prices**

In the absence of trade, Home's equilibrium would be at point 1, where domestic relative supply *RS* intersects the relative demand curve *RD.* Similarly, Foreign's equilibrium would be at point 3. Trade leads to a world relative price that lies between the pre-trade prices, that is, at point 2.



cloth is established at a point somewhere between the pretrade relative prices, say at point 2. In Chapter 4, we discussed how an economy responds to this trade opening based on the direction of the change in the relative price of the goods: The economy exports the good whose relative price increases. Thus, Home will export cloth (the relative price of cloth rises in Home), while Foreign will export food. (The relative price of cloth declines in Foreign, which means that the relative price of food rises there).

Home becomes an exporter of cloth because it is labor-abundant (relative to Foreign) and because the production of cloth is labor-intensive (relative to food production). Similarly, Foreign becomes an exporter of food because it is capital-abundant and because the production of food is capital-intensive. These predictions for the pattern of trade (in the two-good, two-factor, two-countries version that we have studied) can be generalized as the following theorem, named after the original developers of this model of trade:

> **Heckscher-Ohlin Theorem:** *The country that is abundant in a factor exports the good whose production is intensive in that factor.*

In the more realistic case with multiple countries, factors of production, and numbers of goods, we can generalize this result as a correlation between a country's abundance in a factor and its exports of goods that use that factor intensively: *Countries tend to export goods whose production is intensive in factors with which the countries are abundantly endowed.*[7]

## Trade and the Distribution of Income

We have just discussed how trade induces a convergence of relative prices. Previously we saw that changes in relative prices, in turn, have strong effects on the relative earnings of labor and capital. A rise in the price of cloth raises the purchasing power of labor in terms of both goods while lowering the purchasing power of capital in terms of both goods. A rise in the price of food has the reverse effect. Thus international trade can have a powerful effect on the distribution of income, even in the long run. In Home, where the relative price of cloth rises, people who get their incomes from labor gain from trade, but those who derive their incomes from capital are made worse off. In Foreign, where the relative price of cloth falls, the opposite happens: Laborers are made worse off and capital owners are made better off.

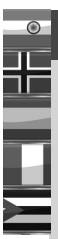
The resource of which a country has a relatively large supply (labor in Home, capital in Foreign) is the **abundant factor** in that country, and the resource of which it has a relatively small supply (capital in Home, labor in Foreign) is the **scarce factor**. The general conclusion about the income distribution effects of international trade in the long run is: *Owners of a country's abundant factors gain from trade, but owners of a country's scarce factors lose.*

This conclusion is similar to the one reached in our analysis of the case of specific factors. There we found that factors of production that are "stuck" in an import-competing industry lose from the opening of trade. Here we find that factors of production that are used intensively by the import-competing industry are hurt by the opening of trade. The theoretical argument regarding the aggregate gains from trade is identical to the specific factors case: Opening to trade expands an economy's consumption possibilities (see Figure 4-11), so there is a way to make everybody better off. However, there is one crucial difference regarding the income distribution effects in these two models. The specificity of factors to particular industries is often only a temporary problem: Garment makers cannot become computer manufacturers

[7]See Alan Deardorff, "The General Validity of the Heckscher-Ohlin Theorem," *American Economic Review* 72 (September 1982), pp. 683–694, for a formal derivation of this extension to multiple goods, factors, and countries.

overnight, but given time the U.S. economy can shift its manufacturing employment from declining sectors to expanding ones. Thus income distribution effects that arise because labor and other factors of production are immobile represent a temporary, transitional problem (which is not to say that such effects are not painful to those who lose). In contrast, effects of trade on the distribution of income among land, labor, and capital are more or less permanent.

We will see shortly that the trade pattern of the United States suggests that compared with the rest of the world, the United States is abundantly endowed with highly skilled labor and that low-skilled labor is correspondingly scarce. This means that international trade has the potential to make low-skilled workers in the United States worse off—not just temporarily, but on a sustained basis. The negative effect of trade on low-skilled workers poses a persistent political problem, one that cannot be remedied by policies that provide temporary relief (such as unemployment insurance). Consequently, the potential effect of increased trade on income inequality in advanced economies such as the United States has been the subject of a large amount of empirical research. We review some of that evidence in the box that follows, and conclude that trade has been, at most, a contributing factor to the measured increases in income inequality in the United States.



## Case Study

### North-South Trade and Income Inequality

The distribution of wages in the United States has become considerably more unequal since the late 1970s. In 1979, a male worker with a wage at the 90th percentile of the wage distribution (earning more than the bottom 90 percent but less than the top 10 percent of wage earners) earned 3.6 times the wage of a male worker at the bottom 10th percentile of the distribution. By 2005, that worker at the 90th percentile earned more than 5.4 times the wage of the worker at the bottom 10th percentile. Wage inequality for female workers has increased at a similar rate over that same time-span. Much of this increase in wage inequality was associated with a rise in the premium attached to education. In 1979, a worker with a college degree earned 1.5 times as much as a worker with just a high school education. By 2005, a worker with a college degree earned almost twice as much as a worker with a high school education.

Why has wage inequality increased? Many observers attribute the change to the growth of world trade and in particular to the growing exports of manufactured goods from newly industrializing economies (NIEs) such as South Korea and China. Until the 1970s, trade between advanced industrial nations and less-developed economies—often referred to as "North-South" trade because most advanced nations are still in the temperate zone of the Northern Hemisphere—consisted overwhelmingly of an exchange of Northern manufactures for Southern raw materials and agricultural goods, such as oil and coffee. From 1970 onward, however, former raw material exporters increasingly began to sell manufactured goods to high-wage countries like the United States. As we learned in Chapter 2, developing countries have dramatically changed the kinds of goods they export, moving away from their traditional reliance on agricultural and mineral products to a focus on manufactured goods. While NIEs also provided a rapidly growing market for exports from the high-wage nations, the exports of the newly industrializing economies obviously differed greatly in factor intensity from their imports. Overwhelmingly, NIE exports to advanced nations consisted of clothing, shoes, and other relatively unsophisticated products ("low-tech goods") whose production is intensive in unskilled

labor, while advanced-country exports to the NIEs consisted of capital- or skill-intensive goods such as chemicals and aircraft ("high-tech goods").

To many observers the conclusion seemed straightforward: What was happening was a move toward factor-price equalization. Trade between advanced countries that are abundant in capital and skill and NIEs with their abundant supply of unskilled labor was raising the wages of highly skilled workers and lowering the wages of less-skilled workers in the skill- and capital-abundant countries, just as the factor-proportions model predicts.

This is an argument with much more than purely academic significance. If one regards the growing inequality of income in advanced nations as a serious problem, as many people do, and if one also believes that growing world trade is the main cause of that problem, it becomes difficult to maintain economists' traditional support for free trade. (As we have previously argued, in principle taxes and government payments can offset the effect of trade on income distribution, but one may argue that this is unlikely to happen in practice.) Some influential commentators have argued that advanced nations will have to restrict their trade with low-wage countries if they want to remain basically middle-class societies.

While some economists believe that growing trade with low-wage countries has been the main cause of rising income inequality in the United States, however, most empirical researchers believed at the time of this writing that international trade has been at most a contributing factor to that growth, and that the main causes lie elsewhere.[8] This skepticism rests on three main observations.

First, the factor-proportions model says that international trade affects income distribution via a change in relative prices of goods. So if international trade was the main driving force behind growing income inequality, there ought to be clear evidence of a rise in the prices of skill-intensive products compared with those of unskilled-labor-intensive goods. Studies of international price data, however, have failed to find clear evidence of such a change in relative prices.

Second, the model predicts that relative factor prices should converge: If wages of skilled workers are rising and those of unskilled workers are falling in the skill-abundant country, the reverse should be happening in the labor-abundant country. Studies of income distribution in developing countries that have opened themselves to trade have shown that at least in some cases, the reverse is true. In Mexico, in particular, careful studies have shown that the transformation of the country's trade in the late 1980s—when Mexico opened itself to imports and became a major exporter of manufactured goods—was accompanied by rising wages for skilled workers and growing overall wage inequality, closely paralleling developments in the United States.

Third, although trade between advanced countries and NIEs has grown rapidly, it still constitutes only a small percentage of total spending in the advanced nations. As a result, estimates of the "factor content" of this trade—the skilled labor exported, in effect, by advanced countries embodied in skill-intensive exports, and the unskilled labor, in effect, imported in labor-intensive imports—are still only a small fraction of the total supplies of skilled and unskilled labor. This suggests that these trade flows cannot have had a very large impact on income distribution.

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[8]Among the important entries in the discussion of the impact of trade on income distribution have been Robert Lawrence and Matthew Slaughter, "Trade and U.S. Wages: Giant Sucking Sound or Small Hiccup?" *Brookings Papers on Economic Activity: Microeconomic* 2 (1993), pp. 161–226; Jeffrey D. Sachs and Howard Shatz, "Trade and Jobs in U.S. Manufacturing," *Brookings Papers on Economic Activity* 1 (1994), pp. 1–84; and Adrian Wood, *North-South Trade, Employment, and Income Inequality* (Oxford: Oxford University Press, 1994). For a survey of this debate and related issues, see Robert Lawrence, *Single World, Divided Nations?:* International Trade and OECD Labor Markets (Paris: OECD Development Centre, 1996).

What, then, *is* responsible for the growing gap between skilled and unskilled workers in the United States? The view of the majority is that the villain is not trade but rather new production technologies that put a greater emphasis on worker skills (such as the widespread introduction of computers and other advanced technologies in the workplace).

How can one distinguish between the effects of trade and those of technological change on the wage gap between skilled and unskilled workers? Consider the variant of the model we have described where skilled and unskilled labor are used to produce "high-tech" and "low-tech" goods. Figure 5-10 shows the relative factor demands for producers in both sectors: the ratio of skilled-unskilled workers employed as a function of the skilled-unskilled wage ratio (*LL* curve for low-tech and *HH* for high-tech).

We have assumed that production of high-tech goods is skilled-labor intensive so the HH curve is shifted out relative to the LL curve. In the background, there is an SS curve (see Figure 5-7) that determines the skilled-unskilled wage ratio as an increasing function of the relative price of high-tech goods (with respect to low-tech goods).

In panel (a), we show the case where increased trade with developing countries generates an increase in wage inequality (the skilled-unskilled wage ratio) in those countries (via an

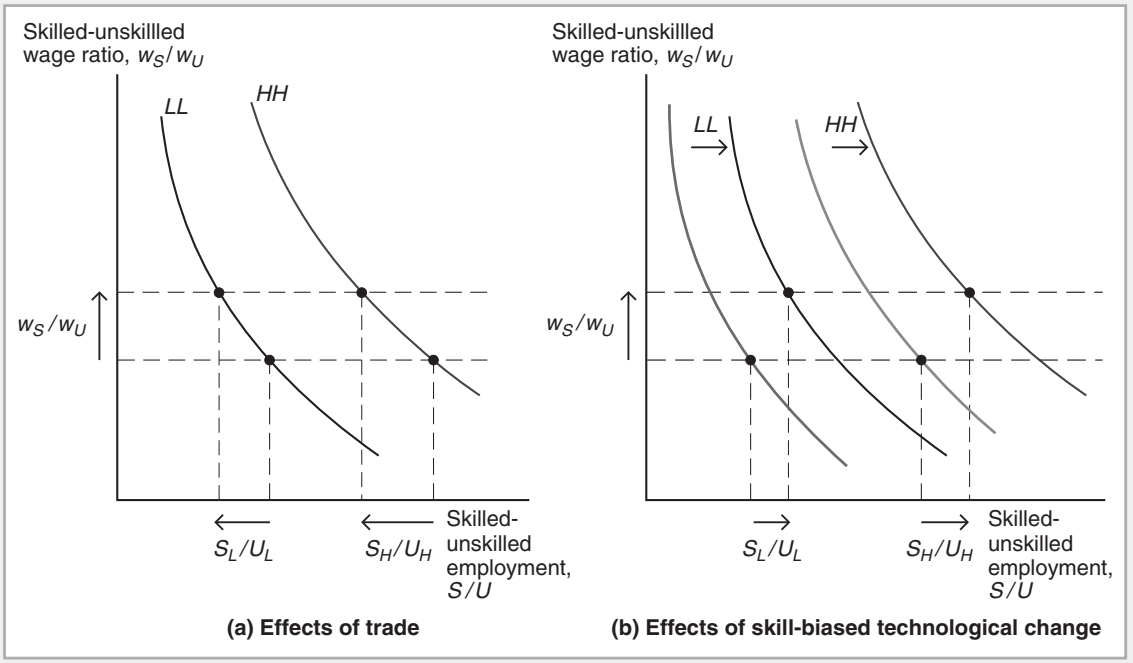


**Figure 5-10**

**Increased Wage Inequality: Trade or Skill-Biased Technological Change?**

The *LL* and *HH* curves show the skilled-unskilled employment ratio, *S/U*, as a function of the skilled-unskilled wage ratio, $w_S/w_U$, in the low-tech and high-tech sectors. The high-tech sector is more skill-intensive than the low-tech sector, so the *HH* curve is shifted out relative to the *LL* curve. Panel (a) shows the case where increased trade with developing countries leads to a higher skilled-unskilled wage ratio. Producers in both sectors respond by *decreasing* their relative employment of skilled workers: $S_L/U_L$ and $S_H/U_H$ both decrease. Panel (b) shows the case where skill-biased technological change leads to a higher skilled-unskilled wage ratio. The *LL* and *HH* curves shift out (increased relative demand for skilled workers in both sectors). However, in this case producers in both sectors respond by *increasing* their relative employment of skilled workers: $S_L/U_L$ and $S_H/U_H$ both increase.