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International Economics

THEORY & POLICY

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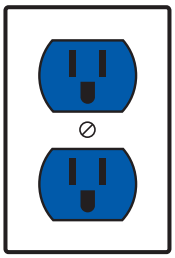

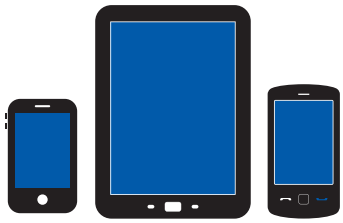

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International Economics

THEORY & POLICY

ELEVENTH EDITION

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New York, NY

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For my family—M.O.
For Clair, Benjamin, and Max—M.M.

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Brief Contents

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Preface

Years after the global financial crisis that broke out in 2007–2008, the world economy is still afflicted by tepid economic growth and, for many people, stagnating incomes. The United States has more or less returned to full employment, but it is growing more slowly than it did before the crisis. Nonetheless, it has been relatively fortunate. Europe's common currency project faces continuing strains and the European Union is itself under stress, given Britain's June 2016 vote to withdraw and a surge in anti-immigration sentiment. Japan continues to face deflation pressures and a sky-high level of public debt. Emerging markets, despite impressive income gains in many cases, remain vulnerable to the ebb and flow of global capital and the ups and downs of world commodity prices. Uncertainty weighs on investment globally, driven not least by worries about the future of the liberal international trade regime built up so painstakingly after World War II.

This eleventh edition therefore comes out at a time when we are more aware than ever before of how events in the global economy influence each country's economic fortunes, policies, and political debates. The world that emerged from World War II was one in which trade, financial, and even communication links between countries were limited. Nearly two decades into the 21st century, however, the picture is very different. Globalization has arrived, big time. International trade in goods and services has expanded steadily over the past six decades thanks to declines in shipping and communication costs, globally negotiated reductions in government trade barriers, the widespread outsourcing of production activities, and a greater awareness of foreign cultures and products. New and better communications technologies, notably the Internet, have revolutionized the way people in all countries obtain and exchange information. International trade in financial assets such as currencies, stocks, and bonds has expanded at a much faster pace even than international product trade. This process brings benefits for owners of wealth but also creates risks of contagious financial instability. Those risks were realized during the recent global financial crisis, which spread quickly across national borders and has played out at huge cost to the world economy. Of all the changes on the international scene in recent decades, however, perhaps the biggest one remains the emergence of China—a development that is already redefining the international balance of economic and political power in the coming century.

Imagine how astonished the generation that lived through the depressed 1930s as adults would have been to see the shape of today's world economy! Nonetheless, the economic concerns that drive international debate have not changed that much from those that dominated the 1930s, nor indeed since they were first analyzed by economists more than two centuries ago. What are the merits of free trade among nations compared with protectionism? What causes countries to run trade surpluses or deficits with their trading partners, and how are such imbalances resolved over time? What causes banking and currency crises in open economies, what causes financial contagion between economies, and how should governments handle international financial instability? How can governments avoid unemployment and inflation, what role do exchange rates play in their efforts, and how can countries best cooperate to achieve their economic goals? As always in international economics, the interplay of events and ideas has led to new modes of analysis. In turn, these analytical advances, however abstruse they may seem at first, ultimately do end up playing a major role in governmental policies, in international negotiations, and in people's everyday lives. Globalization has made

citizens of all countries much more aware than ever before of the worldwide economic forces that influence their fortunes, and globalization is here to stay. As we shall see, globalization can be an engine of prosperity, but like any powerful machine it can do damage if managed unwisely. The challenge for the global community is to get the most out of globalization while coping with the challenges that it raises for economic policy.

New to the Eleventh Edition

For this edition as for the last one, we are offering an Economics volume as well as Trade and Finance splits. The goal with these distinct volumes is to allow professors to use the book that best suits their needs based on the topics they cover in their International Economics course. In the Economics volume for a two-semester course, we follow the standard practice of dividing the book into two halves, devoted to trade and to monetary questions. Although the trade and monetary portions of international economics are often treated as unrelated subjects, even within one textbook, similar themes and methods recur in both subfields. We have made it a point to illuminate connections between the trade and monetary areas when they arise. At the same time, we have made sure that the book's two halves are completely self-contained. Thus, a one-semester course on trade theory can be based on Chapters 2 through 12, and a one-semester course on international monetary economics can be based on Chapters 13 through 22. For professors' and students' convenience, however, they can now opt to use either the Trade or the Finance volume, depending on the length and scope of their course.

We have thoroughly updated the content and extensively revised several chapters. These revisions respond both to users' suggestions and to some important developments on the theoretical and practical sides of international economics. The most far-reaching changes are the following:

- **Chapter 4, Specific Factors and Income Distribution** Import competition from developing countries—especially from China—is often singled out in both the press and by politicians as the main culprit for declines in manufacturing employment in the United States. This chapter's case study on trade and unemployment has been significantly expanded and discusses the potential links between these two trends. A new Case Study documents the trend toward greater wage convergence in the European Union following its expansion to the East.
- **Chapter 5, Resources and Trade: The Heckscher-Ohlin Model** Over the past half century, the compensation of capital owners relative to workers has increased in the United States. A new box reviews this evidence and explains why it is best explained by a process of technological change exhibiting capital-skill complementarity rather than by increased trade between the United States and newly industrializing economies.
- **Chapter 6, The Standard Trade Model** A new box discusses some recent evidence showing that the gains from trade have a pro-poor bias—because consumers with relatively lower incomes tend to consume a relatively higher share of their income on goods that are more widely traded.
- **Chapter 8, Firms in the Global Economy: Export Decisions, Outsourcing, and Multinational Enterprises** Increasingly, the goods we consume are produced in "Global Value Chains" that stretch around the world. A new box explains how this recent offshoring trend leads to very misleading statistics for bilateral trade deficits. Using the example of Apple's iPhone 7, the box describes how recorded imports of the iPhone from China (where it is assembled) actually represent imports from many

countries around the world (including the United States) that contribute key components used in the final assembly.

- **Chapter 10, The Political Economy of Trade Policy** Recent years have seen some significant setbacks to the march toward freer trade. The revised chapter reviews the failure of the Doha Round of trade negotiations to reach agreement, and the apparent failure of the Trans-Pacific Partnership. A new box discusses "Brexit," Britain's startling vote to leave the European Union.
- **Chapter 12, Controversies in Trade Policy** With the backlash against globalization achieving considerable political traction, a new section describes new research suggesting that rapid changes in international trade flows, such as the "China shock" after 2000, have larger adverse effects on workers than previously realized.
- **Chapter 14, Exchange Rates and the Foreign Exchange Market: An Asset Approach** China's currency, the yuan renminbi, is playing an increasingly important role in world currency markets. But its government has moved only gradually to integrate the local foreign exchange market with global markets, thereby allowing a separate offshore market in yuan to develop outside mainland China's borders. This chapter features a new box describing the offshore market and the relationship between the onshore and offshore exchange rates.
- **Chapter 17, Output and the Exchange Rate in the Short Run** The chapter includes a new box on the role of invoice currencies in exchange-rate pass-through.
- **Chapter 19, International Monetary Systems: An Historical Overview** The dangers of deflation are outlined in a new box.
- **Chapter 21, Optimum Currency Areas and the Euro** The chapter contains a new box on "Brexit"—the process through which Britain is likely to leave the European Union.
- **Chapter 22, Developing Countries: Growth, Crisis, and Reform** The chapter highlights the key role of commodities in developing-country growth, and the commodity "super cycle."

In addition to these structural changes, we have updated the book in other ways to maintain current relevance. Thus, we discuss the impact of the North American Free Trade Agreement (NAFTA) on car production in Canada, Mexico, and the United States (and what might happen if the trade agreement were revoked) (Chapter 8); we describe how the U.S. sugar industry has been able to keep the price of sugar in the United States substantially above the world price in recent years (Chapter 9); we discuss the role of negative interest rates in unconventional monetary policy (Chapter 17); and we highlight the increasingly important role of emerging market economies in driving global growth (Chapter 22).

About the Book

The idea of writing this book came out of our experience in teaching international economics to undergraduates and business students since the late 1970s. We perceived two main challenges in teaching. The first was to communicate to students the exciting intellectual advances in this dynamic field. The second was to show how the development of international economic theory has traditionally been shaped by the need to understand the changing world economy and analyze actual problems in international economic policy.

We found that published textbooks did not adequately meet these challenges. Too often, international economics textbooks confront students with a bewildering array

of special models and assumptions from which basic lessons are difficult to extract. Because many of these special models are outmoded, students are left puzzled about the real-world relevance of the analysis. As a result, many textbooks often leave a gap between the somewhat antiquated material to be covered in class and the exciting issues that dominate current research and policy debates. That gap has widened dramatically as the importance of international economic problems—and enrollments in international economics courses—have grown.

This book is our attempt to provide an up-to-date and understandable analytical framework for illuminating current events and bringing the excitement of international economics into the classroom. In analyzing both the real and monetary sides of the subject, our approach has been to build up, step by step, a simple, unified framework for communicating the grand traditional insights as well as the newest findings and approaches. To help the student grasp and retain the underlying logic of international economics, we motivate the theoretical development at each stage by pertinent data and policy questions.

The Place of This Book in the Economics Curriculum

Students assimilate international economics most readily when it is presented as a method of analysis vitally linked to events in the world economy, rather than as a body of abstract theorems about abstract models. Our goal has therefore been to stress concepts and their application rather than theoretical formalism. Accordingly, the book does not presuppose an extensive background in economics. Students who have had a course in economic principles will find the book accessible, but students who have taken further courses in microeconomics or macroeconomics will find an abundant supply of new material. Specialized appendices and mathematical postscripts have been included to challenge the most advanced students.

Some Distinctive Features

This book covers the most important recent developments in international economics without shortchanging the enduring theoretical and historical insights that have traditionally formed the core of the subject. We have achieved this comprehensiveness by stressing how recent theories have evolved from earlier findings in response to an evolving world economy. Both the real trade portion of the book (Chapters 2 through 12) and the monetary portion (Chapters 13 through 22) are divided into a core of chapters focused on theory, followed by chapters applying the theory to major policy questions, past and current.

In Chapter 1, we describe in some detail how this book addresses the major themes of international economics. Here we emphasize several of the topics that previous authors failed to treat in a systematic way.

Increasing Returns and Market Structure

Even before discussing the role of comparative advantage in promoting international exchange and the associated welfare gains, we visit the forefront of theoretical and empirical research by setting out the gravity model of trade (Chapter 2). We return to the research frontier (in Chapters 7 and 8) by explaining how increasing returns and product differentiation affect trade and welfare. The models explored in this discussion capture significant aspects of reality, such as intraindustry trade and shifts in trade

patterns due to dynamic scale economies. The models show, too, that mutually beneficial trade need not be based on comparative advantage.

Firms in International Trade

Chapter 8 also summarizes exciting new research focused on the role of firms in international trade. The chapter emphasizes that different firms may fare differently in the face of globalization. The expansion of some and the contraction of others shift overall production toward more efficient producers within industrial sectors, raising overall productivity and thereby generating gains from trade. Those firms that expand in an environment of freer trade may have incentives to outsource some of their production activities abroad or take up multinational production, as we describe in the chapter.

Politics and Theory of Trade Policy

Starting in Chapter 4, we stress the effect of trade on income distribution as the key political factor behind restrictions on free trade. This emphasis makes it clear to students why the prescriptions of the standard welfare analysis of trade policy seldom prevail in practice. Chapter 12 explores the popular notion that governments should adopt activist trade policies aimed at encouraging sectors of the economy seen as crucial. The chapter includes a theoretical discussion of such trade policy based on simple ideas from game theory.

Asset Market Approach to Exchange Rate Determination

The modern foreign exchange market and the determination of exchange rates by national interest rates and expectations are at the center of our account of open-economy macroeconomics. The main ingredient of the macroeconomic model we develop is the interest parity relation, augmented later by risk premiums (Chapter 14). Among the topics we address using the model are exchange rate "overshooting"; inflation targeting; behavior of real exchange rates; balance-of-payments crises under fixed exchange rates; and the causes and effects of central bank intervention in the foreign exchange market (Chapters 15 through 18).

International Macroeconomic Policy Coordination

Our discussion of international monetary experience (Chapters 19 through 22) stresses the theme that different exchange rate systems have led to different policy coordination problems for their members. Just as the competitive gold scramble of the interwar years showed how beggar-thy-neighbor policies can be self-defeating, the current float challenges national policymakers to recognize their interdependence and formulate policies cooperatively.

The World Capital Market and Developing Countries

A broad discussion of the world capital market is given in Chapter 20 which takes up the welfare implications of international portfolio diversification as well as problems of prudential supervision of internationally active banks and other financial institutions. Chapter 22 is devoted to the long-term growth prospects and to the specific macroeconomic stabilization and liberalization problems of industrializing and newly industrialized countries. The chapter reviews emerging market crises and places in historical perspective the interactions among developing country borrowers, developed country lenders, and official financial institutions such as the International Monetary

Fund. Chapter 22 also reviews China's exchange-rate policies and recent research on the persistence of poverty in the developing world.

Learning Features

This book incorporates a number of special learning features that will maintain students' interest in the presentation and help them master its lessons.

Case Studies

Case studies that perform the threefold role of reinforcing material covered earlier, illustrating its applicability in the real world, and providing important historical information often accompany theoretical discussions.

Special Boxes

Less central topics that nonetheless offer particularly vivid illustrations of points made in the text are treated in boxes. Among these are U.S. President Thomas Jefferson's trade embargo of 1807–1809 (Chapter 3); the astonishing ability of disputes over banana trade to generate acrimony among countries far too cold to grow any of their own bananas (Chapter 10); the role of currency swap lines among central banks (Chapter 20); and the rapid accumulation of foreign exchange reserves by developing countries (Chapter 22).

Captioned Diagrams

More than 200 diagrams are accompanied by descriptive captions that reinforce the discussion in the text and help the student in reviewing the material.

Learning Goals

A list of essential concepts sets the stage for each chapter in the book. These learning goals help students assess their mastery of the material.

Summary and Key Terms

Each chapter closes with a summary recapitulating the major points. Key terms and phrases appear in boldface type when they are introduced in the chapter and are listed at the end of each chapter. To further aid student review of the material, key terms are italicized when they appear in the chapter summary.

Problems

Each chapter is followed by problems intended to test and solidify students' comprehension. The problems range from routine computational drills to "big picture" questions suitable for classroom discussion. In many problems we ask students to apply what they have learned to real-world data or policy questions.

Further Readings

For instructors who prefer to supplement the textbook with outside readings, and for students who wish to probe more deeply on their own, each chapter has an annotated bibliography that includes established classics as well as up-to-date examinations of recent issues.

MyEconLab

MyEconLab

MyEconLab is the premier online assessment and tutorial system, pairing rich online content with innovative learning tools. MyEconLab includes comprehensive homework, quiz, test, and tutorial options, allowing instructors to manage all assessment needs in one program. Key innovations in the MyEconLab course for the eleventh edition of *International Economics: Theory & Policy* include the following:

- *Real-Time Data Analysis Exercises,* marked with , allow students and instructors to use the latest data from FRED, the online macroeconomic data bank from the Federal Reserve Bank of St. Louis. By completing the exercises, students become familiar with a key data source, learn how to locate data, and develop skills to interpret data.
- The Pearson *Enhanced eText* gives students access to their textbook anytime, anywhere. In addition to note-taking, highlighting, and bookmarking, the Pearson eText offers interactive and sharing features. Students actively read and learn through auto-graded practice, real-time data-graphs, figure animations, author videos, and more. Instructors can share comments or highlights, and students can add their own, for a tight community of learners in any class.
- *Current News Exercises*—Every week, current microeconomic and macroeconomic news articles or videos, with accompanying exercises, are posted to MyEconLab. Assignable and auto-graded, these multi-part exercises ask students to recognize and apply economic concepts to real-world events.

Students and MyEconLab

This online homework and tutorial system puts students in control of their own learning through a suite of study and practice tools correlated with the online, interactive version of the textbook and learning aids such as animated figures. Within MyEconLab's structured environment, students practice what they learn, test their understanding, and then pursue a study plan that MyEconLab generates for them based on their performance.

Instructors and MyEconLab

MyEconLab provides flexible tools that allow instructors easily and effectively to customize online course materials to suit their needs. Instructors can create and assign tests, quizzes, or homework assignments. MyEconLab saves time by automatically grading all questions and tracking results in an online gradebook. MyEconLab can even grade assignments that require students to draw a graph.

After registering for MyEconLab instructors have access to downloadable supplements such as an instructor's manual, PowerPoint lecture notes, and a test bank. The test bank can also be used within MyEconLab, giving instructors ample material from which they can create assignments—or the Custom Exercise Builder makes it easy for instructors to create their own questions.

Weekly news articles, video, and RSS feeds help keep students updated on current events and make it easy for instructors to incorporate relevant news in lectures and homework.

For more information about MyEconLab or to request an instructor access code, visit www.myeconlab.com.

Additional Supplementary Resources

A full range of additional supplementary materials to support teaching and learning accompanies this book.

- The Online Instructor's Manual—updated by Hisham Foad of San Diego State University—includes chapter overviews and answers to the end-of-chapter problems.
- The Online Test Bank offers a rich array of multiple-choice and essay questions, including some mathematical and graphing problems, for each textbook chapter. It is available in Word, PDF, and TestGen formats. This Test Bank was carefully revised and updated by Van Pham of Salem State University.
- The Computerized Test Bank reproduces the Test Bank material in the TestGen software that is available for Windows and Macintosh. With TestGen, instructors can easily edit existing questions, add questions, generate tests, and print the tests in a variety of formats.
- The Online PowerPoint Presentation with Tables, Figures, & Lecture Notes was revised by Amy Glass of Texas A&M University. This resource contains all text figures and tables and can be used for in-class presentations.
- The Companion Web Site at www.pearsonhighered.com/krugman contains additional appendices. (See page xviii of the Contents for a detailed list of the Online Appendices.)

Instructors can download supplements from our secure Instructor's Resource Center. Please visit www.pearsonhighered.com/irc.

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Although we have not been able to make each and every suggested change, we found reviewers' observations invaluable in revising the book. Obviously, we bear sole responsibility for its remaining shortcomings.

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January 2017

CHAPTER 1

Introduction

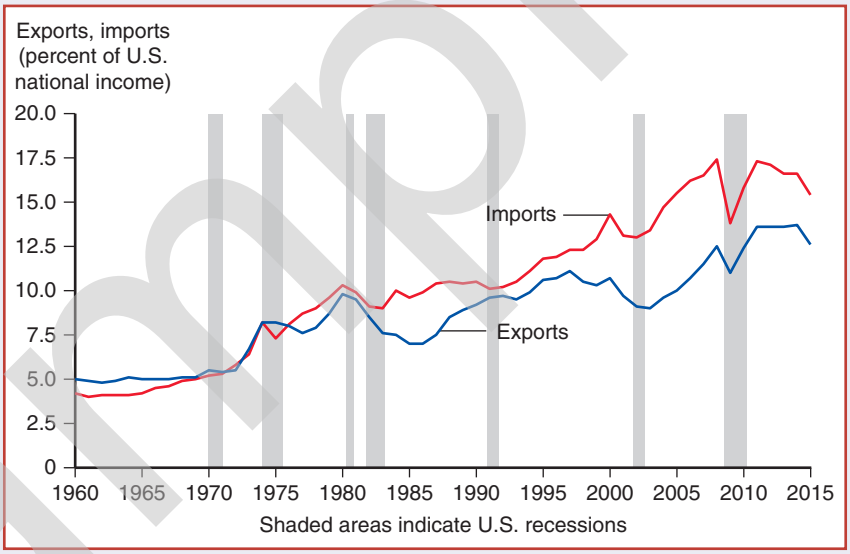
You could say that the study of international trade and finance is where the discipline of economics as we know it began. Historians of economic thought often describe the essay "Of the Balance of Trade" by the Scottish philosopher David Hume as the first real exposition of an economic model. Hume published 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 than ever before through trade in goods and services, flows of money, and investment in each other's economies. 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 2015. 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.



MyEconLab Real-time data

FIGURE 1-1

Exports and Imports as a Percentage of U.S. National Income (Shaded areas indicate U.S. recessions.)

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, 2015. research.stlouisfed.org

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 text introduces the main concepts and methods of international economics and illustrates them with applications drawn from the real world. Much of the text 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. In particular, the economic crisis that began in 2007 threw up major new challenges for the global economy. 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.

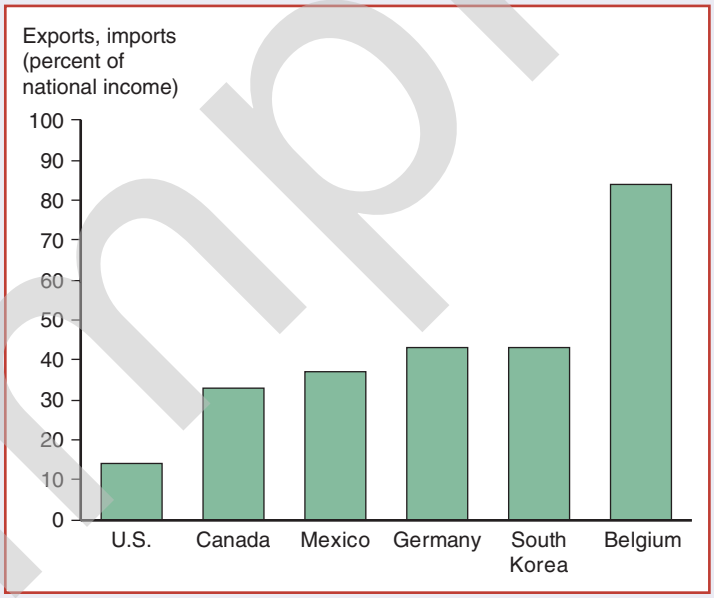


FIGURE 1-2

Average of Exports and Imports as Percentages of National Income in 2015

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

Source: World Bank.

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. For example, it is a common misconception that trade is harmful if large disparities exist 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 text 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 20). 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 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. We then discuss how this basic model must be extended in order to generate accurate empirical predictions for the volume and pattern of trade. Also, some international economists have proposed theories that suggest a substantial random component, along with economies of scale, 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 then, however, there has been considerable backlash against "globalization." In 2016, Britain shocked the political establishment by voting to leave the European Union, which guarantees free movement of goods and people among its members. In that same year, claims that competition from imports and unfair trade deals have cost jobs played an important role in the U.S. presidential campaign. One consequence of this anti-globalization backlash is that free trade advocates are under greater pressure than ever before to find ways to explain their views.

As befits both the historical importance and the current relevance of the protectionist issue, roughly a quarter of this text 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 Chapters 11 and 12.

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 every year since 1982.

Exchange Rate Determination

In September 2010, Brazil's finance minister, Guido Mantegna, made headlines by declaring that the world was "in the midst of an international currency war." The occasion for his remarks was a sharp rise in the value of Brazil's currency, the *real*, which was worth less than 45 cents at the beginning of 2009 but had risen to almost 60 cents when he spoke (and would rise to 65 cents over the next few months). Mantegna accused wealthy countries—the United States in particular—of engineering this rise, which was devastating to Brazilian exporters. However, the surge in the *real* proved short-lived; the currency began dropping in mid-2011, and by the summer of 2013 it was back down to only 45 cents.

A key difference between international economics and other areas of economics is that countries usually have their own currencies—the euro, which is shared by a number of European countries, being the exception that proves the rule. And as the example of the *real* 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 21 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 agreement 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. Attempts to formulate principles for international macroeconomic coordination date to the 1980s and 1990s and remain controversial to this day. 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

In 2007, investors who had bought U.S. mortgage-backed securities—claims on the income from large pools of home mortgages—received a rude shock: As home prices began to fall, mortgage defaults soared, and investments they had been assured were safe turned out to be highly risky. Since many of these claims were owned by financial institutions, the housing bust soon turned into a banking crisis. And here's the thing: It wasn't just a U.S. banking crisis, because banks in other countries, especially in Europe, had also bought many of these securities.

The story didn't end there: Europe soon had its own housing bust. And while the bust mainly took place in southern Europe, it soon became apparent that many northern European banks—such as German banks that had lent money to their Spanish counterparts—were also very exposed to the financial consequences.

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 currency fluctuations: If the euro falls against the dollar, U.S. investors who bought euro bonds suffer a capital loss. Another risk is 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. Fears of default by highly indebted European nations have been a major concern in recent years.

The growing importance of international capital markets and their new problems demand greater attention than ever before. This text devotes two chapters to issues arising from international capital markets: one on the functioning of global asset markets (Chapter 20) 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, transactions involving 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 text 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 text 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.

CHAPTER 2

World Trade: An Overview

In 2015, the world as a whole produced goods and services worth about $74 trillion at current prices. Of this total, about 30 percent was sold across national borders: World trade in goods and services exceeded $21 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 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 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 2015. (Data on trade in services are less well broken down by trading partner; we'll talk about the rising importance of trade in

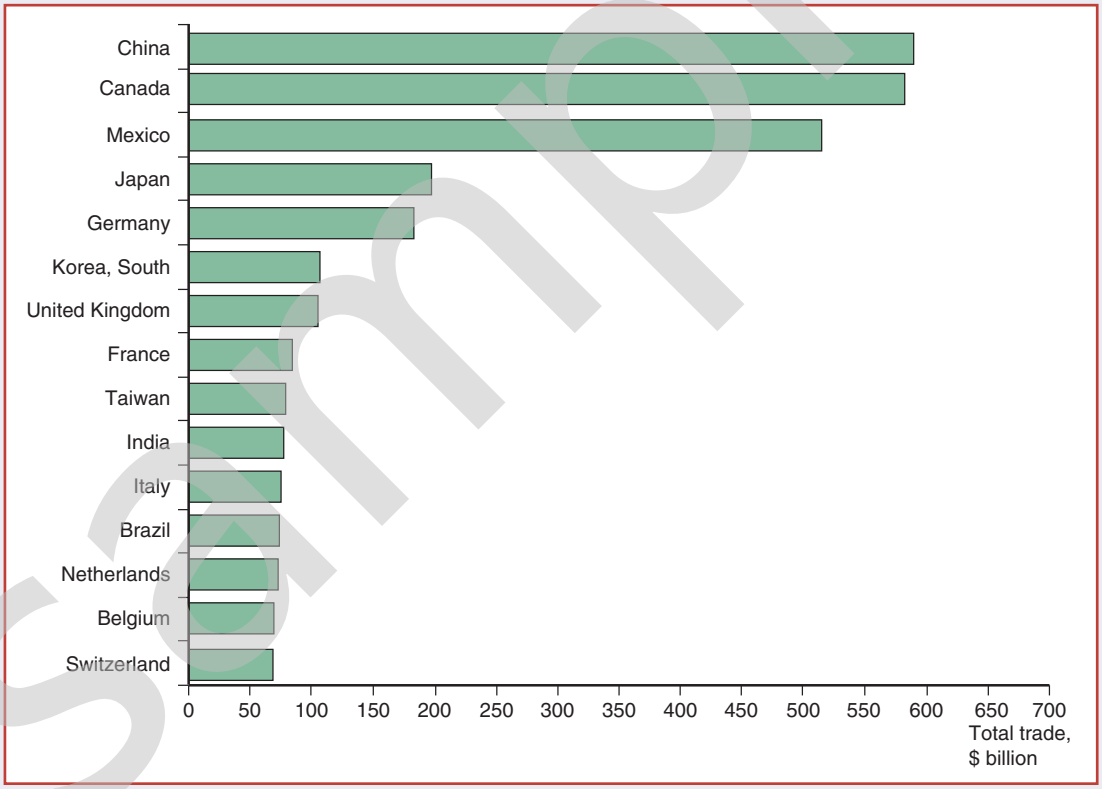


FIGURE 2-1

Total U.S. Trade with Major Partners, 2015

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 countries accounted for 75 percent of the value of U.S. trade in that year.

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

Size Matters: The Gravity Model

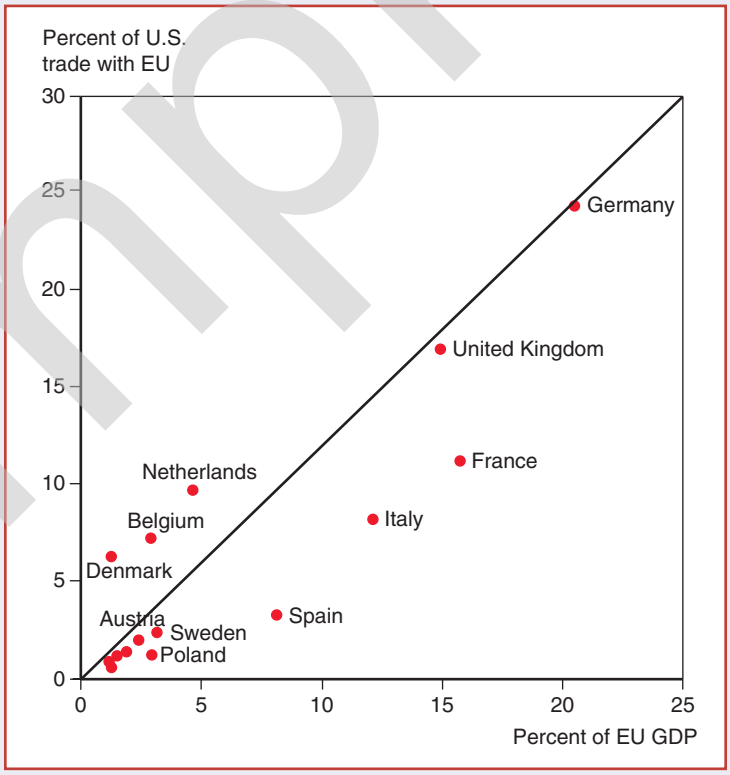
Three of the top 15 U.S. trading partners are European nations: Germany, the United Kingdom, and France. Why does the United States trade more heavily with these three European countries than with others? The answer is that these are the three largest European economies. That is, they have the highest 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 this relationship by showing the correspondence between the size of different European economies—specifically, America's 15 most important

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.



Western European trading partners in 2012—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 is 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 20 percent of Western European GDP; it also accounts for 24 percent of U.S. trade with the region. Sweden has a much smaller economy, accounting for only 3.2 percent of European GDP; correspondingly, it accounts for only 2.3 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_j 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:

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

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 2012 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.

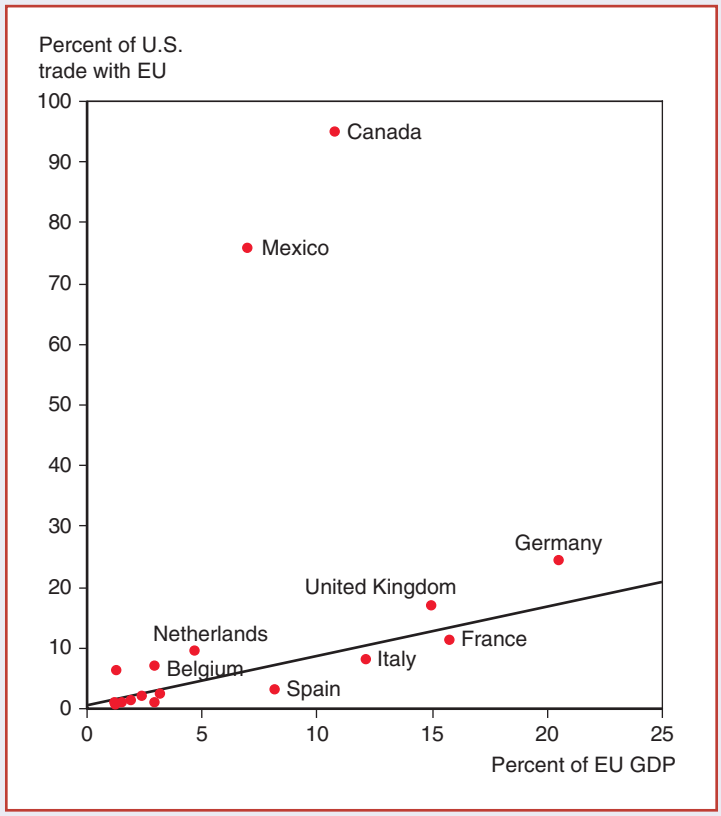
All estimated gravity models show a strong negative effect of distance on international trade; typical estimates say that a 1 percent increase in the distance between two countries is associated with a fall of 0.7 to 1 percent in the trade between those countries. This drop partly reflects increased 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.

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.



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 trade in Chapters 8 and 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 21 describes one recent focus of that research: an effort to determine

TABLE 2-1 Trade with British Columbia, as Percent of GDP, 2009

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: Statistics Canada, U.S. Department of Commerce.

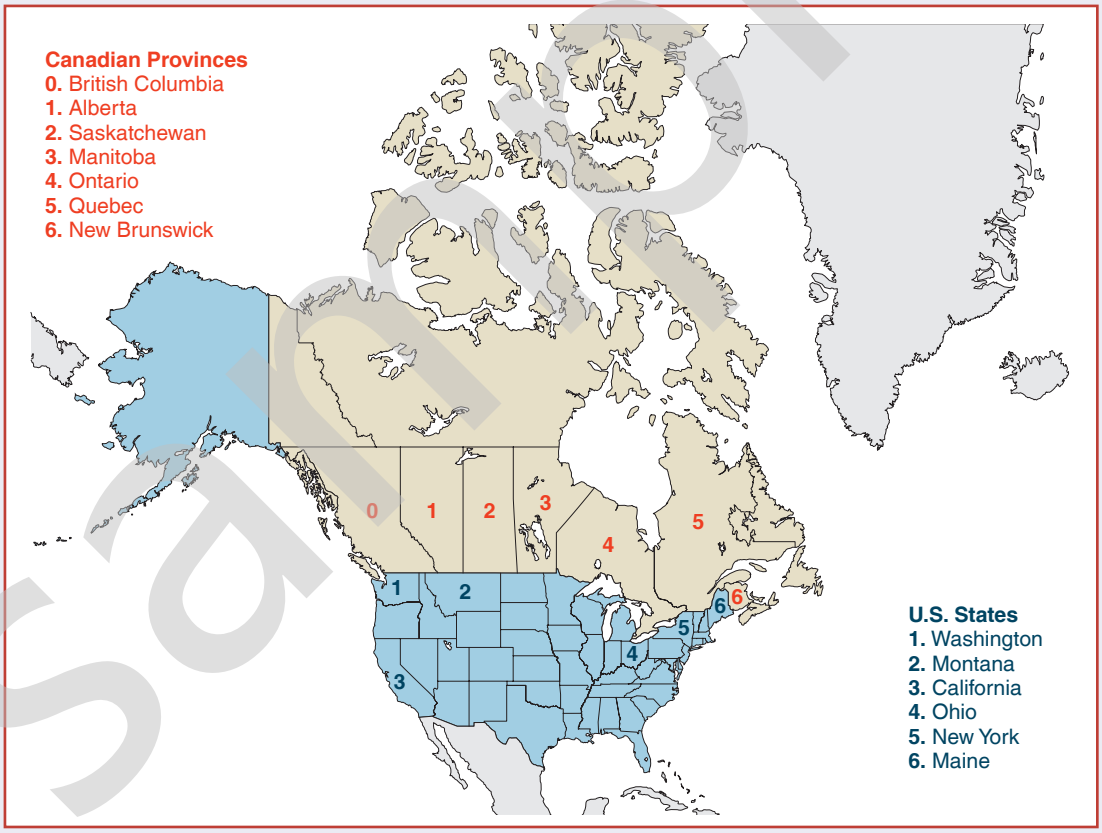


FIGURE 2-4

Canadian Provinces and U.S. States That Trade with British Columbia

Source: Statistics Canada, U.S. Department of Commerce.

how much effect the existence of separate national currencies has on international trade in goods and services.

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.

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. Figure 2-5 shows one measure

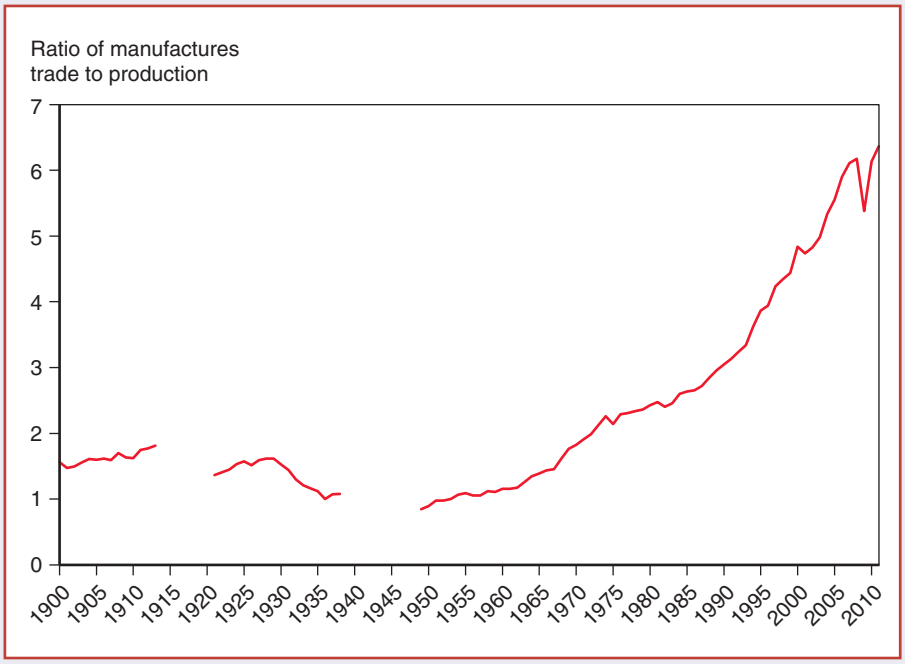


FIGURE 2-5

The Fall and Rise of World Trade

The ratio of world exports of manufactured goods to world industrial production—shown here as an index with 1953 = 1— rose in the decades before World War I but fell sharply in the face of wars and protectionism. It didn't return to 1913 levels until the 1970s but has since reached new heights.

Source: UN Monthly Bulletin of Statistics, World Trade Organization.

of international trade: the ratio of an index of world exports of manufactured goods to an index of world industrial production. World trade grew rapidly in the decades leading up to World War I but then fell significantly. As you can see, by this measure globalization didn't return to pre-World-War-I levels until the early 1970s.

Since then, however, world trade as a share of world production 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 2-6 shows the percentage breakdown of world exports in 2015. 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.

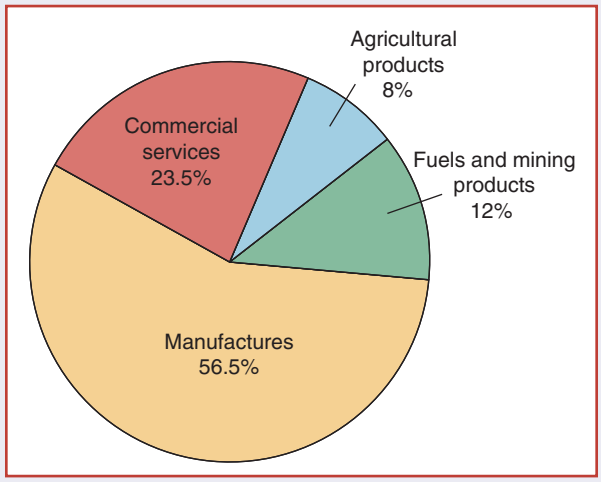
Meanwhile, service exports include traditional transportation fees charged by airlines and shipping companies, insurance fees received from foreigners, and spending by foreign tourists. In recent years, new types of service trade, made possible by modern telecommunications, have drawn a great deal of media attention.

FIGURE 2-6

The Composition of World Trade, 2015

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

Source: World Trade Organization.



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 2-2 shows the share of manufactured goods in the exports and imports of the United Kingdom and the United States in 1910 and 2015. 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 primary products were more important than manufactured goods on both sides to one in which manufactured goods dominate.

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 2-7 shows the shares of agricultural products and manufactured goods in developing-country exports from 1960 to 2001. 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.

TABLE 2-2 Manufactured Goods as Percent of Merchandise Trade

	United Kingdom		United States	
	Exports	Imports	Exports	Imports
1910	75.4	24.5	47.5	40.7
2015	72.3	73.6	74.8	78.4

Source: 1910 data from Simon Kuznets, *Modern Economic Growth: Rate, Structure and Speed.* New Haven: Yale Univ. Press, 1966. 2015 data from World Trade Organization.

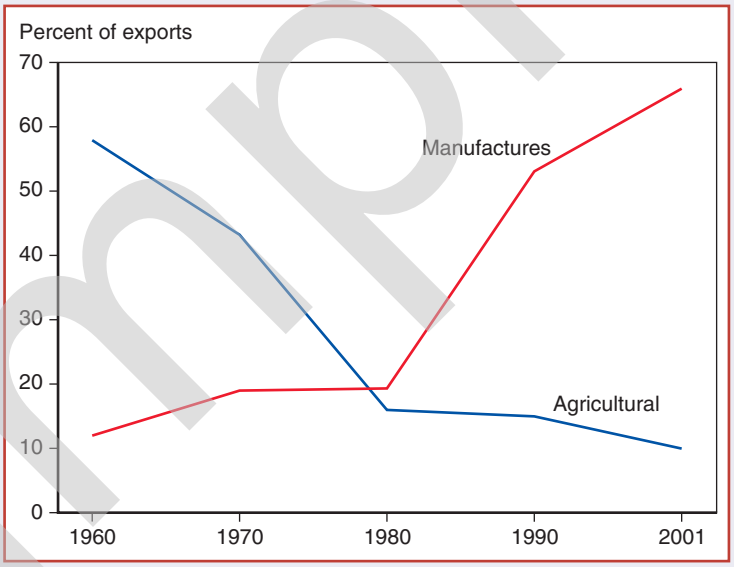


FIGURE 2-7

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.

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 2-8 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 tradable

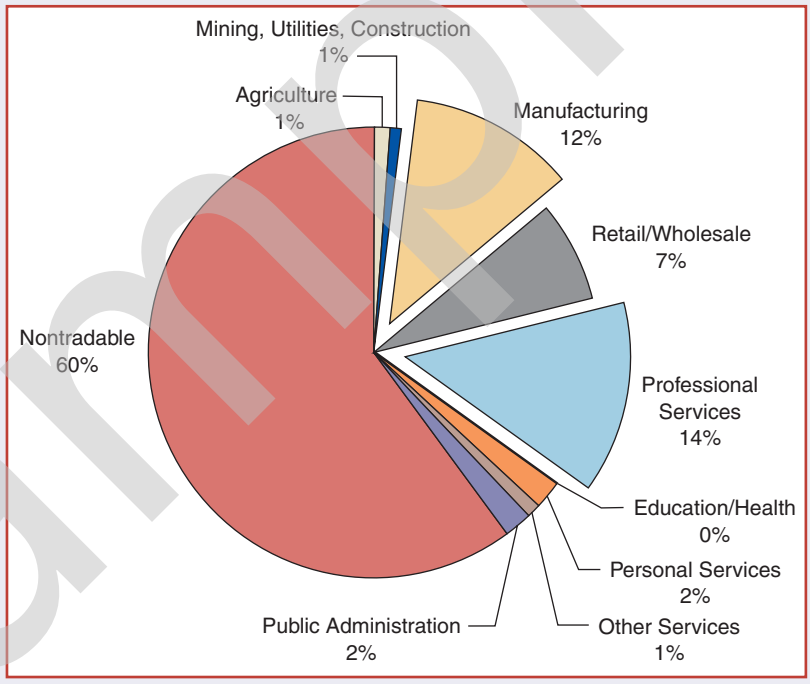


FIGURE 2-8

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.

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 2-6, may be only temporary. In the long run, trade in services, delivered electronically, may become the most important component of world trade. We discuss the implication of these trends for U.S. employment in Chapter 8.

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. 19
gravity model, p. 12
gross domestic product (GDP), p. 11
service offshoring (service outsourcing), p. 19
third world, p. 19
trade agreement, p. 15

PROBLEMS

MyEconLab

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.

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 and 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 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 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 and two hours to produce a gallon of wine. Notice, by the way, that we're defining unit labor requirements as the *inverse* of productivity—the more cheese or wine a worker

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

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

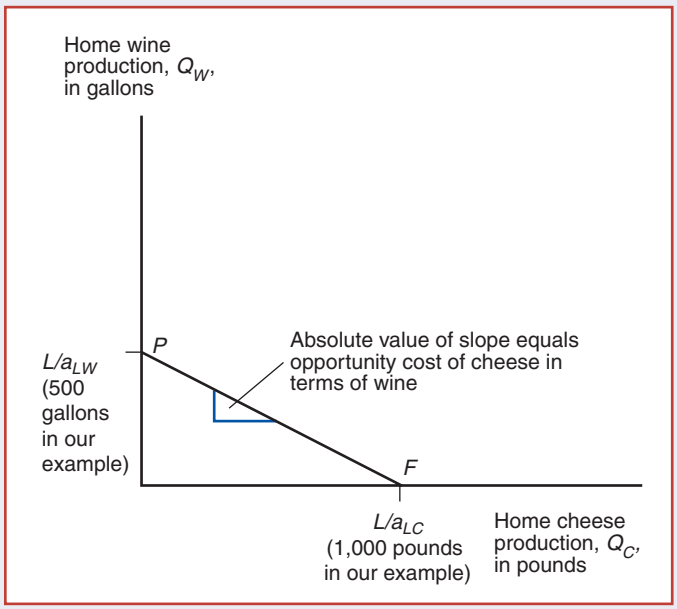
$$a_{LC}Q_C + a_{LW}Q_W \leq L. \tag{3-1}$$

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—1,000/2 = 500 gallons—of wine. And it can produce any mix of wine and cheese that lies on the straight line connecting those two extremes.

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.



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 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 text: 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.*

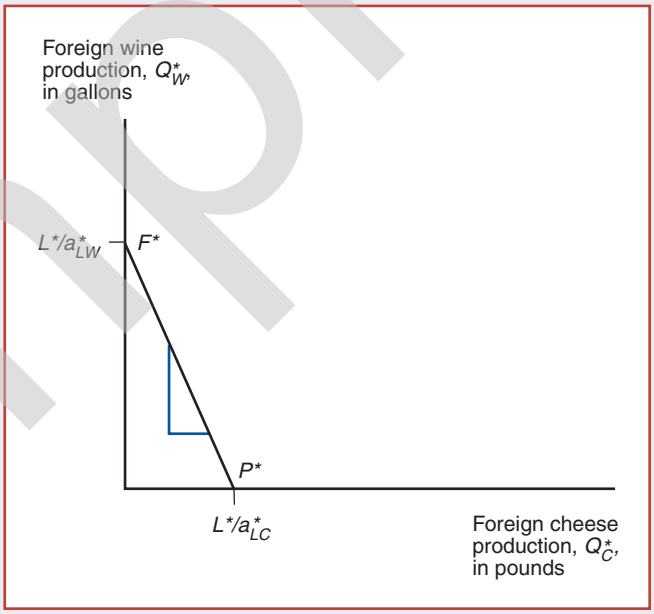
One point should be noted immediately: The condition under which Home has this comparative advantage involves all four unit labor requirements, not just two. You might think that to determine who will produce cheese, all you need to do is compare the two countries' unit labor requirements in cheese production, 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.

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.

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.



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 P^*F^* 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 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.

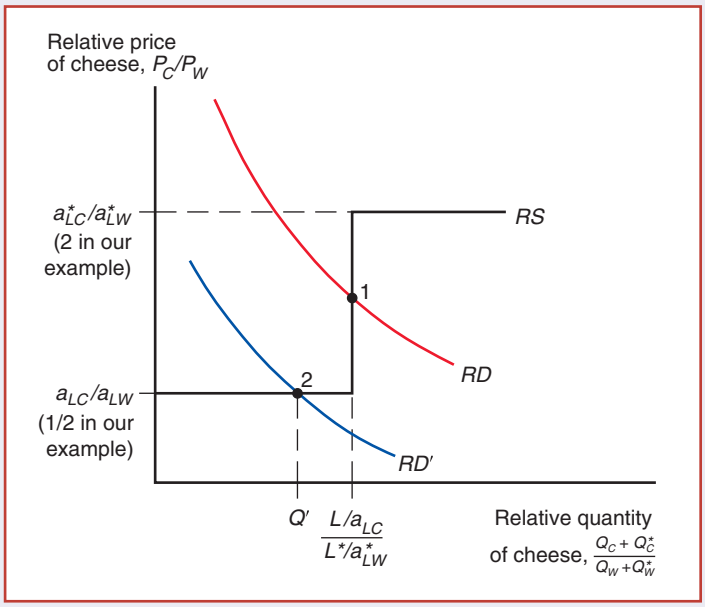
Next, when the relative price of cheese P_C/P_W is exactly a_{LC}/a_{LW}, we know that workers in Home can earn exactly the same amount making either cheese or wine. So Home will be willing to supply any relative amount of the two goods, producing a flat section to the supply curve.

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

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.



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

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.

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.

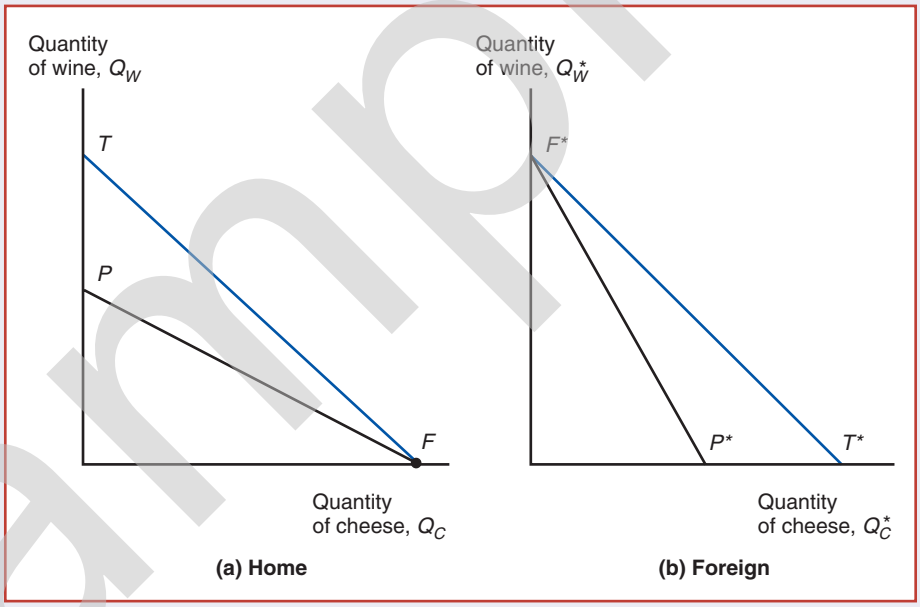


FIGURE 3-4

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 $6.50 per hour, compared with more than $35 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

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.

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.

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.

[2]Paul Kennedy, "The Threat of Modernization," *New Perspectives Quarterly* (Winter 1995), pp. 31–33. Used by permission of John Wiley & Sons, Ltd.

DO WAGES REFLECT PRODUCTIVITY?

In the numerical example that we use to puncture common misconceptions about comparative advantage, we assume 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 2015. 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 text, 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.

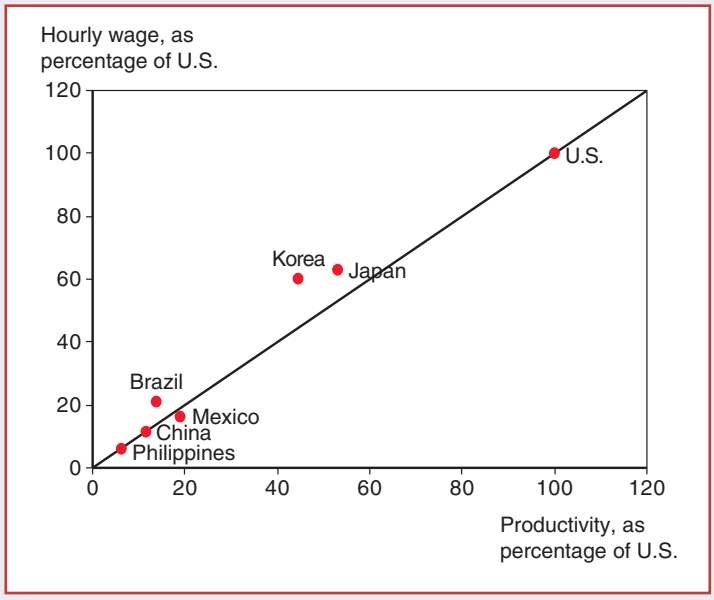
The low estimate of overall Chinese productivity may seem surprising, given all the stories one hears about Americans who find themselves competing with Chinese exports. The Chinese workers producing those exports don't seem to have extremely low productivity. But remember what the theory of comparative 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

Productivity and Wages

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

Source: International Monetary Fund and The Conference Board.



wages. Consider, for example, the case of South Korea. In 2015, South Korea's labor productivity was about half of the U.S. level, and so was its wage rate. 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 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.

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 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.

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

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

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 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

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

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

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

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 ($12/4 = 3$). 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 increased slightly from 3.99 to 4.01. This small further growth 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*.

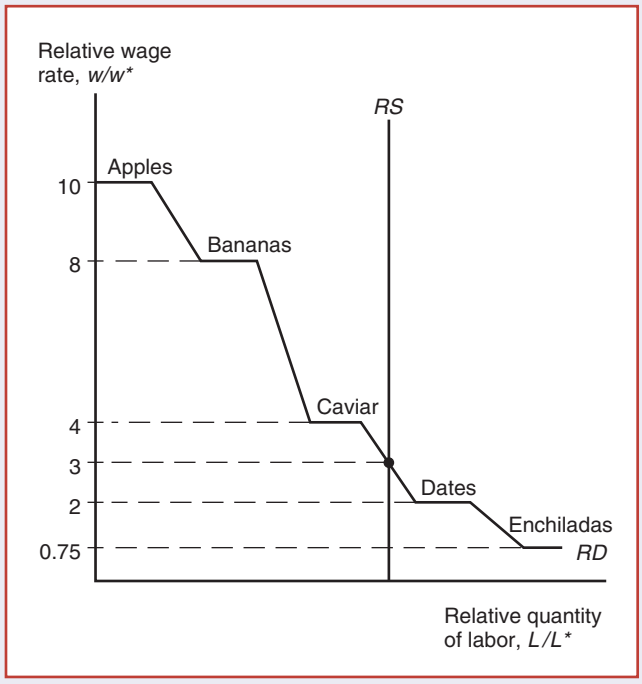
The relative supply of labor is determined by the relative sizes of Home's and Foreign's labor forces. Assuming the number of person-hours available does not vary with the wage, the relative wage has no effect on relative labor supply and *RS* is a vertical line.

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.

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*.



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 Chapters 4 and 5).
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]

[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.

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.

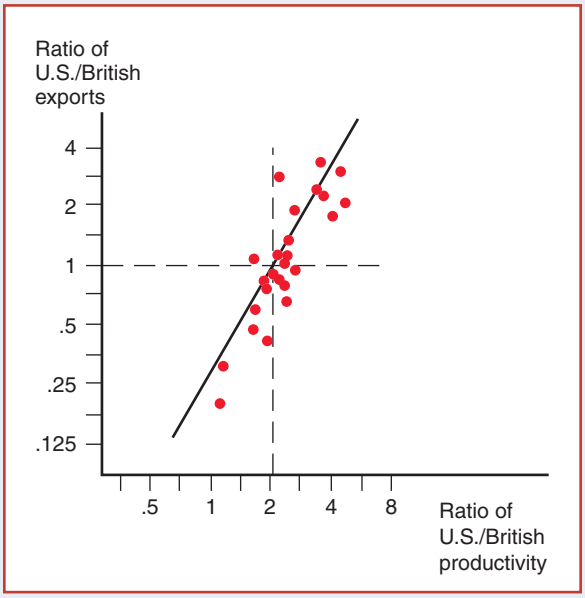
Ricardian theory would lead us broadly to expect that the higher the relative productivity in the U.S. industry, the more likely U.S. rather than U.K. firms would export in that industry. And that is what Figure 3-6 shows. In fact, the scatterplot lies quite close to an upward-sloping line, also shown 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. 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

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.



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 countries with very low overall productivity as export powerhouses in some industries. Consider, for example, the case of clothing exports from Bangladesh. The Bangladeshi clothing industry received the worst kind of publicity in April 2013, when a building housing five garment factories collapsed, killing more than a thousand people. The backstory to this tragedy, however, was the growth of Bangladesh's clothing exports, which were rapidly gaining on those of China, previously the dominant supplier. This rapid growth took place even though Bangladesh is a very, very poor country, with extremely low overall productivity even compared with China, which as we have already seen is still low-productivity compared with the United States.

What was the secret of Bangladesh's success? It has fairly low productivity even in the production of clothing—but its productivity disadvantage there is much smaller than in other industries, so that the nation has a comparative advantage in clothing. Table 3-3 illustrates this point with some estimates based on 2011 data.

Compared with China, Bangladesh still has an *absolute* disadvantage in clothing production, with significantly lower productivity. But because its relative productivity in apparel is so much higher than in other industries, Bangladesh has a strong comparative advantage in apparel—and its apparel industry is giving China a run for the money.

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

TABLE 3-3 Bangladesh versus China, 2011

	Bangladeshi Output per Worker as % of China	Bangladeshi Exports as % of China
All industries	28.5	1.0
Apparel	77	15.5

Source: McKinsey and Company, "Bangladesh's ready-made garments industry: The challenge of growth," 2012; UN Monthly Bulletin of Statistics.

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. 29
comparative advantage, p. 26
derived demand, p. 42
gains from trade, p. 34
general equilibrium analysis, p. 31
nontraded goods, p. 45
opportunity cost, p. 25
partial equilibrium analysis, p. 30
pauper labor argument, p. 39
production possibility frontier, p. 27
relative demand curve, p. 31
relative supply curve, p. 31
relative wage, p. 35
Ricardian model, p. 26
unit labor requirement, p. 26

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 be the price of apples in terms of bananas? 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. "It has been all downhill for the West since China entered the world market; we just can't compete with hundreds of millions of people willing to work for almost nothing." Discuss.
7. Despite major gains, Chinese manufacturing workers have much lower productivity than their U.S. counterparts. Chinese service workers are relatively more productive, but most services aren't tradable. So which matters for Chinese wages—manufacturing or service productivity?
8. The overall cost of living is a lot less in China than it is in the United States or Europe. Why might this be? (Think about your answer to problem 7.)
9. Modern communications technology is making it possible to perform many services—e.g., reading X-rays or even doing legal research—from remote locations. How does this affect the potential 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.)

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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 apparel, textiles, sugar, ethanol, and dairy products, among many other commodities. During presidential re-election cycles, punitive tariffs are often imposed on import of goods produced in key political swing states.[1] 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 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

[1]The latest examples are the 35 percent tariff imposed on tires (imported from China) during Barack Obama's first term and the 30 percent tariff imposed on steel imports during George W. Bush's first term. Production of both steel and tires is concentrated in Ohio, a key swing state in the past several U.S. presidential elections. In March 2016, a presidential election year, anti-dumping duties were imposed on steel producers from across the globe; Chinese producers drew the highest duties raising the cost to U.S. buyers by 266 percent.

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.[2] 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.

[2]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 two factors of production—land and capital—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 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 above).

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

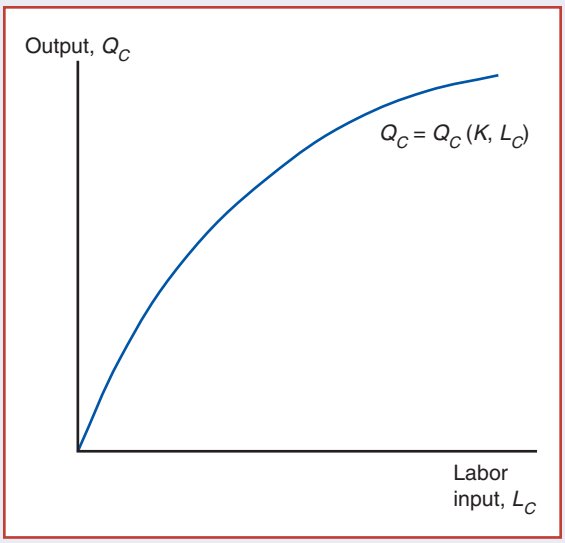
The specific factors model assumes that each of the specific factors, capital and land, can be used in only one sector, cloth and food, respectively. Only labor can be used in either sector. Thus, to analyze the economy's production possibilities, we need only to ask how the economy's mix of output changes 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 the 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, 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.[3]

FIGURE 4-1

The Production Function for Cloth

The more labor 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.



[3]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.

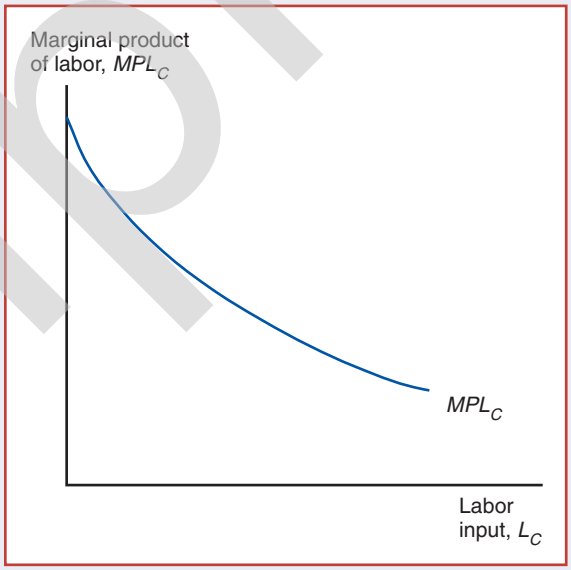


Figure 4-2 shows the same information a different way. In this figure, we directly plot the marginal product of labor as a function of the labor employed. (In the appendix to this chapter, we show that the area under the marginal product curve represents the total output of cloth.)

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

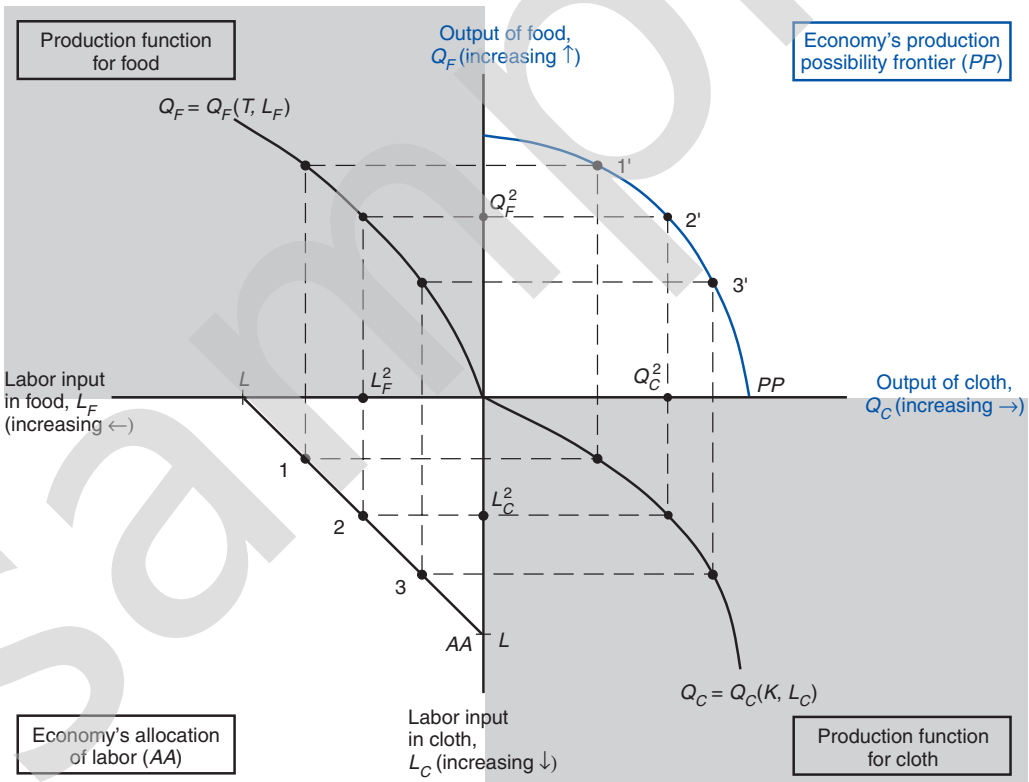


FIGURE 4-3

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 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 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's 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

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

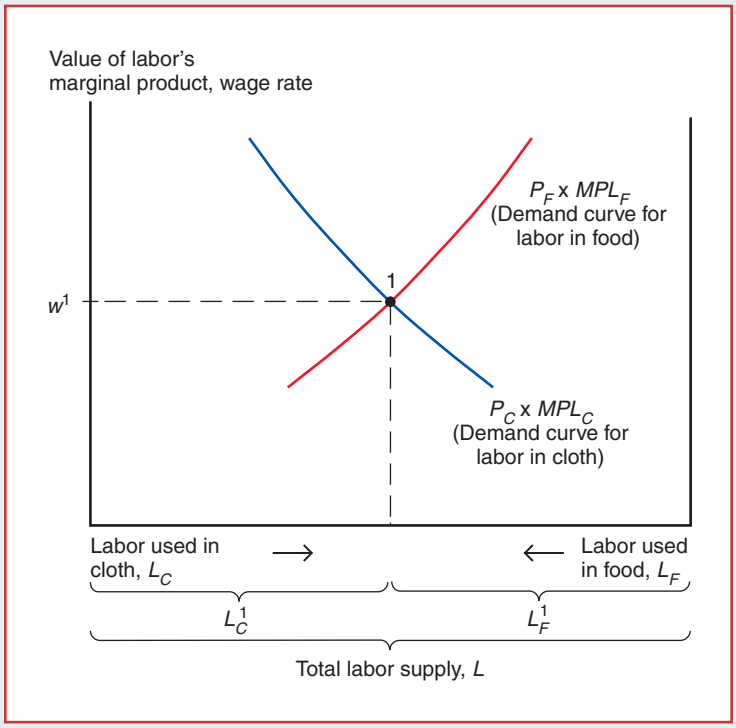
The wage rate w must be the same in both sectors because of the assumption that labor is freely mobile between sectors. That is, because labor is a mobile factor, it will move from the low-wage sector to the high-wage sector until wages are equalized. The wage rate, in turn, is determined by the requirement 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

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.



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.

A useful relationship between relative prices and output 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 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.

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.