## CONTENTS

*Preface iv*

### Part One
**Introduction to International Trade**
- **Chapter 1** Trade in the Global Economy 1

### Part Two
**Patterns of International Trade**
- **Chapter 2** Trade and Technology: The Ricardian Model 11
- **Chapter 3** Gains and Losses from Trade in the Specific-Factors Model 33
- **Chapter 4** Trade and Resources: The Heckscher-Ohlin Model 45
- **Chapter 5** Movement of Labor and Capital between Countries 63

### Part Three
**New Explanations for International Trade**
- **Chapter 6** Increasing Returns to Scale and Monopolistic Competition 83
- **Chapter 7** Offshoring of Goods and Services 101

### Part Four
**International Trade Policies**
- **Chapter 8** Import Tariffs and Quotas under Perfect Competition 117
- **Chapter 9** Import Tariffs and Quotas under Imperfect Competition 143
- **Chapter 10** Export Subsidies in Agriculture and High-Technology Industries 165
- **Chapter 11** International Agreements: Trade, Labor, and the Environment 185
PREFACE

The purpose of this Instructor's Manual is to provide supplemental materials for International Economics, Second Edition by Robert C. Feenstra and Alan M. Taylor. The chapters closely follow the layout of the chapters in the textbook. Each chapter is divided into sections:

- Notes to Instructor
- Lecture Notes
- Teaching Tips
- In-Class Problems

The Notes to Instructor section is further divided into two subsections: Chapter Summary and Comments. The Chapter Summary contains a brief overall synopsis of the chapter. The Comments provide suggestions for presenting the material to your students. This section also serves to highlight important aspects of the textbook chapter.

The Lecture Notes section corresponds directly to the outline of the chapter. In addition to a comprehensive summary of the textbook chapter, this section provides alternative examples, particularly in the numerical presentations.

The Teaching Tips consist of four or five activities per chapter that instructors can utilize in lectures, for in-class group work, or as take-home assignments.

The In-Class Problems section offers additional questions that may be used in class or assigned as homework. The problems will help your students understand the key concepts and apply the models presented in the textbook chapter. Detailed answers to these problems are provided at the end of each chapter.

I hope that the resources in this manual will be of help to you, and I welcome any suggestions and comments.

ACKNOWLEDGMENTS

Worth Publishers is indebted to Philip Luck (University of California, Davis) for authoring the second edition of the Instructor's Manual. We would like to thank Alyson Ma for authoring the first edition of the Instructor's Manual and for providing invaluable guidance for the second edition. Thanks also to Tony Lima (University of California, East Bay) for thoroughly reviewing this material, and to Jaclyn Castaldo, Stacey Alexander, and Laura McGinn for their assistance in producing this volume.
Trade in the Global Economy

Notes to Instructor

Chapter Summary
Chapter 1 introduces the concept of globalization, which involves the flow of goods, services, people, firms, and capital across borders. This chapter highlights the difference in the flow of goods and services as well as foreign direct investment across borders versus the movement of people. We learn in this chapter that a substantial portion of the world trade in goods and services occurs between industrial countries. This interdependence among the industrial countries is even more pronounced when we examine foreign direct investment. But motivated by concerns that the workers from low-wage countries moving to industrial countries will decrease the wages of their less-skilled workers, many wealthier nations have government policies that discourage migration. In addition, we also learn that globalization is not a new phenomena and that the world experienced tremendous trade growth in the late nineteenth and early twentieth centuries with improvements in transportation.

Comments
This chapter serves as an introduction to the international trade section of the textbook. You may also choose to skip over this first chapter because Chapter 2 is written as a secondary introduction with an example that is reexamined in later chapters. The topic of international trade could be motivated by asking the students to consider their typical day from the moment they wake up to the time they arrive at class. For example, the coffee they consume is made from beans grown in Brazil or Vietnam. The clothes they wear are assembled by workers in the Philippines. The iPod they listen to on the way to class is made in China, and so forth.
Lecture Notes

Introduction
The explosion of the Eyjafjallajökull in 2010 created a massive disturbance to international trade. By halting the transport of many goods, this geological event demonstrated the importance of trade in our global economy. It has been estimated that the disruption in air freight for two weeks generated lost revenues from $16 to $27 billion for goods imported to the United States from Europe, and $20 to $26 billion for goods exported from the United States to Europe; all of which is lost revenue from trade in goods. The lost revenue from canceled flights between the United States and Europe was roughly $3.2 billion in lost service trade. This book studies the trade in goods and services and studies the forces that determine these flows.

If we only consider merchandise goods, then the largest exporter in 2009 was China with $1.3 trillion. In second and third place were Germany ($1.17 trillion) and the United States ($900 billion), respectively. However, this is only part of international trade. In 2009, the United States exported $0.5 trillion in services exports. When we combine the export of goods and services, the United States was the largest exporter at $1.55 trillion. The next five countries in descending order were Germany, China, Japan, the United Kingdom, and France.

Countries engage in trade for many reasons. In Chapters 2 through 11, we find that nations benefit from international trade when there are differences in opportunity costs between trading partners. We examine the winners and losers of international trade when factors are specific to certain productions. We determine the impact of migration and flow of capital or foreign direct investment on wages at home and abroad. We also investigate actions taken by governments to encourage or discourage the flow of trade, migration, and foreign direct investment. The consequences of government interventions are discussed.

1 International Trade

The Basics of World Trade
Although it is easy to recognize Brazilian coffee beans shipped to the U.S. coffee market as an export, trade also occurs when services are performed on site. For example, one of the larger categories of service exports is travel and tourism. When a Canadian visits the Sydney Opera House, the money spent is a service export of Australia. Likewise, a Japanese tourist eating at one of the many restaurants along Waikiki contributes to the U.S. service exports.

The difference between a country’s total value of exports and imports with the rest of the world is its trade balance, where it has a trade surplus if export exceeds import. By contrast, when export is lower than import, a country runs a trade deficit. More often the bilateral trade balance between two countries is reported in the news. From 2006 to 2009, the U.S. trade deficit with China was worth over $200 billion every year.
In the first half of the textbook we assume that each country maintains a balanced trade. One of the reasons is that macroeconomic conditions dealing with high spending and low savings, which leads to a trade deficit, are discussed later in the textbook. The second reason is that there are issues in terms of the official statistics used to calculate the bilateral trade balance.

**HEADLINES**

An iPod Has Global Value. Ask the (Many) Countries That Make It

This article discusses the problems with reporting bilateral trade flows between countries due to the difference between the sale price of an export and the value a country adds. The example in this article is the Apple iPod, which are imported from China at a price around $150, yet most of the parts assembled in China are themselves imported from other countries. The assembly of the 451 parts that currently takes place in China accounts for only about $4 of the total cost of the iPod. This article demonstrates why the bilateral trade deficit between the U.S. and China may be a misleading statistic.

**APPLICATION**

Is Trade Today Different from the Past?

Both the volume and composition of international trade has changed greatly over the past century. The change in the composition of trade can be made clear by dividing trade into several groups, as is done in Figure 1-1. From Figure 1-1(a), we can see that U.S. trade has shifted away from agriculture and raw materials and toward manufactured goods. From 1925 to 2009, U.S. imports of food, feeds, and beverages and industrial supplies and materials declined from 90% to 35% of imports. From Figure 1-1(b), we see that the export share of these same categories also fell from 80% to 40% over the same period. Figure 1-1 also shows that the import and export of capital goods plus consumer goods grew steadily; imports rising from 10% to 65% and exports from 20% to 60%.

**Map of World Trade**

Figure 1-2 shows the world exports and imports flow of goods in 2006, where thicker lines indicate larger amounts of trade. In addition, trade flows within regions are noted by circles.

**European and U.S. Trade** More than a quarter of world trade occurred within Europe in 2006 with $3.7 trillion. Reasons for the large trade flows include proximity (many countries are located in the region) and the lack of (or low) import tariffs, which are taxes on international trade. With the continuing expansion of the European Union, trade within this region is expected to grow. If we include the internal trade among the European countries with the large trade flows between Europe and the United States, we find that about 37% of the $11.6 trillion in world-trade flows in 2006 can be accounted for by these industrially advanced trading partners. Motivations for
why countries with similar technological capabilities and consumption patterns may gain from trading with one another will be discussed in Chapter 4.

**Trade in the Americas** Total trade in goods between North, Central, and South America and the Caribbean accounts for 11% of the world-trade flows, with a large portion of the trade flows occurring between the North American Free Trade Area (NAFTA) partners, namely the United States, Mexico, and Canada.

**NETWORK**

The following table shows the world exports of goods and services from 1995 to 2005 in billions of current dollars.

<table>
<thead>
<tr>
<th>World Exports, 1995–2005</th>
<th>(In billions of U.S. current dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merchandise</td>
<td></td>
</tr>
<tr>
<td>Goods</td>
<td>5,164</td>
</tr>
<tr>
<td>Services</td>
<td>1,185</td>
</tr>
</tbody>
</table>

**Trade with Asia** The amount of trade that occurs between Europe and Asia and the United States and Asia is also considerable. In 2006, exports from Asia to the United States were $659 billion. China was the largest exporter to the U.S. in 2006 (selling $288 billion) followed by Japan ($148 billion) and South Korea ($46 billion). In addition, if we include trade in services we will find more exports from Asia to the United States (and Europe), given the increased use of outsourcing by American and European firms in countries such as India.

**Other Regions** The oil exported by countries in the Middle East, along with Russia’s export of oil and natural gas, contribute 9% to world trade. By contrast, the African countries add only 3% to world trade.

**Trade Compared with Gross Domestic Product**

Table 1-2 shows the ratio of trade to a country’s gross domestic product (GDP). Relative to its economic size, trade is a smaller portion of GDP for the United States (15% in 2008) than for countries such as Hong Kong (207% in 2008). The high trade-to-GDP ratio for Hong Kong is because of the city-state’s role as the middleman for firms in developing countries that outsource the assembly part of the production process to low-wage countries such as China. In contrast, large countries such as the United States tend to have more trade within border (i.e., among states) than across borders. Countries in the middle of the list are those that are large and located close to other major trading partners. Examples include European countries such as Germany, the United Kingdom, and France.

**Barriers to Trade**

Another reason why the trade/GDP ratio differs across countries is because there are factors that influence the amount of goods and services that are
traded internationally. These include trade barriers such as import tariffs, transportation costs, customs, laws, events such as wars, and so forth. Figure 1-3 shows the trade in goods and services relative to GDP for selected countries over time. The countries are Australia, Canada, Japan, the United Kingdom, the United States, and Europe, which is an average of Denmark, France, Germany, Italy, Norway, and Sweden.

**First “Golden Age” of Trade**
The “golden age” of international trade refers to the years 1890 to 1913, during which there were significant improvements in transportation because of steamship and railroad expansion.

**Inter-war Period**
Because of World War I and its aftermath, the trade to GDP ratio decreased between 1913 and 1920 for countries in Europe, as well as Australia. It continued to decline with the Great Depression in 1929 and World War II in 1939. To protect its farmers during this period, the United States passed the Smoot-Hawley Tariff Act in 1930, which raised tariffs on many goods imported from abroad. In retaliation, European countries, such as France, Italy, and Britain, as well as Canada, imposed their own tariffs and import quotas against American products. These trade barriers were eventually imposed against other countries in addition to the United States, leading to a dramatic decline in world trade. Concern about the high costs due to the loss in world trade is one of the reasons for the formation of international agreements such as the General Agreement on Tariffs and Trade, which is now the World Trade Organization.

**Second “Golden Age” of Trade**
With the end of World War II in 1945, countries such as the United Kingdom, Europe, and Australia regained their trade. In general, world trade improved after 1950 for some countries and by 1960 for others. Adding to the trade growth was the reduction in transportation costs that occurred with the invention of the shipping container in 1956. The world as a whole is enjoying a second “golden age” of international trade as the ratio of trade to GDP continues to increase. In 2005, ratio of trade relative to GDP was nearly 30%. But, at the end of the decade, in 2008 many countries trade to GDP ratios began to fall. This was a result of the financial crisis.

**The Financial Crisis**
The fall of 2008 saw the financial crisis, which started in the U.S. and spread quickly throughout the global economy. The crisis began with mortgage defaults and then spread to the whole financial system. Even though the cause of the crisis was unrelated to international trade, the impact on trade was substantial because it sent many countries into recession, leading to a fall in both exports and imports. This dramatic decrease in trade can be seen in Figure 1-5, which graphs the quarterly change in average trade flows. Figure 1-5 demonstrates a large and synchronized drop in trade of nearly 20% for all countries shown.
A Sea Change in Shipping 50 Years Ago
The introduction of shipping containers by Malcom McLean in 1956 dramatically reduced transportation costs, transforming international trade in merchandise goods. As an example, loading and unloading increased from 0.627 tons per man hour in 1959 to 4,234 tons per man hour in 1976, with the rates even higher today.

2 Migration and Foreign Direct Investment

Map of Migration
The number of individuals living legally or illegally in their nonnative country in 2005 is shown in Figure 1-6. In this figure, arrows from one country to another indicate the movements of individuals from one location to the other, with large (small) migration indicated by heavy (dashed) lines. Bold arrows denote the similar movements from World into Asia, Africa, and Latin America (for those whose country of origin is unknown).

Unlike like trade, in which the majority occurs between rich countries, more migration takes place among less wealthy nations. In 2005, 53.1 of the 195 million migrants were located in Asia, while another 17.1 million migrants called Africa home. It is likely that many of the immigrants relocated within the same continent in search of employment or for other reasons.

Although barriers to trade are decreasing over the years, this is not the case for migration. The flow of people across borders is highly restricted by immigration policies in Europe and the United States, partly because of fears that the migrants from low-wage countries will cause the wages for a country’s own less-skilled workers to decline. However, even with the limitation on migration, individuals in low-wage countries may improve their living standard by working in export industries in which international trade acts as a substitute for their movement of labor across borders.

European and U.S. Immigration With the increase in the number of countries joining the European Union, some of the original members are discouraging migration from the new lower-wage members by not accepting workers from these countries. Immigration policy is also a frequent topic of debate in the United States because of concerns that the influx of illegal immigrants from Mexico will drive wages down for American workers.

Map of Foreign Direct Investment
Similar to trade in merchandise goods, most of the stock of foreign direct investment (FDI) is within the OECD countries (i.e., $11.4 of the $12.4 trillion, or 93%). These flows are traced out in Figure 1-7, in which the width of the arrow corresponds to the amount of the FDI going into or out of the OECD countries. In addition, the inflow of FDI to Africa, Asia, and Latin America from unknown sources is denoted by arrows from the world.
Horizontal FDI When a firm in one industrialized country invests in another industrialized country by purchasing a foreign company, this form of investment is considered horizontal FDI. Examples include the purchase of the Rockefeller Center in New York in 1989 and Pebble Beach golf course in California in 1990 by Japanese investors. One of the reasons why companies choose to acquire firms located in industrialized countries is to avoid trade barriers such as tariffs and import quotas. To circumvent the limits on the number of Japanese cars allowed to enter the United States,

<table>
<thead>
<tr>
<th>Host Region/Economy</th>
<th>2004</th>
<th>2005</th>
<th>2006*</th>
<th>Growth Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>710.8</td>
<td>916.3</td>
<td>1230.4</td>
<td>34.3</td>
</tr>
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<td>Developed economies</td>
<td>396.1</td>
<td>542.3</td>
<td>800.7</td>
<td>47.7</td>
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<td>European Union</td>
<td>217.7</td>
<td>433.6</td>
<td>589.8</td>
<td>36.0</td>
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<td>EU-15</td>
<td>185.2</td>
<td>387.9</td>
<td>510.7</td>
<td>31.7</td>
</tr>
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<td>France</td>
<td>31.4</td>
<td>63.6</td>
<td>88.4</td>
<td>39.0</td>
</tr>
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<td>Germany</td>
<td>15.1</td>
<td>32.7</td>
<td>8.1</td>
<td>-75.1</td>
</tr>
<tr>
<td>Italy</td>
<td>16.8</td>
<td>20.0</td>
<td>30.0</td>
<td>50.2</td>
</tr>
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<td>United Kingdom</td>
<td>56.2</td>
<td>164.5</td>
<td>169.8</td>
<td>3.2</td>
</tr>
<tr>
<td>New 10 EU member states</td>
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<td>36.0</td>
<td>38.4</td>
<td>12.8</td>
</tr>
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<td>11.0</td>
<td>5.4</td>
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</tr>
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<td>4.7</td>
<td>6.7</td>
<td>6.2</td>
<td>-7.3</td>
</tr>
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<td>Poland</td>
<td>12.9</td>
<td>7.7</td>
<td>16.2</td>
<td>109.9</td>
</tr>
<tr>
<td>United States</td>
<td>122.4</td>
<td>99.4</td>
<td>177.3</td>
<td>78.2</td>
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<td>2.8</td>
<td>8.2</td>
<td>395.5</td>
</tr>
<tr>
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<td>367.7</td>
<td>10.0</td>
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<td>30.7</td>
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<td>26.5</td>
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<td>5.3</td>
<td>-1.9</td>
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<td>16.0</td>
<td>5.9</td>
</tr>
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<td>6.7</td>
<td>9.9</td>
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<td>Colombia</td>
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<td>10.2</td>
<td>4.9</td>
<td>-52.0</td>
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<td>Mexico</td>
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<td>18.9</td>
<td>18.9</td>
<td>0.0</td>
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<td>Asia and Oceania</td>
<td>157.3</td>
<td>200.0</td>
<td>229.9</td>
<td>15.0</td>
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<td>West Asia</td>
<td>18.6</td>
<td>34.5</td>
<td>43.3</td>
<td>25.5</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.8</td>
<td>9.7</td>
<td>17.1</td>
<td>76.3</td>
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<tr>
<td>South, East, and South-East Asia</td>
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<td>165.1</td>
<td>186.7</td>
<td>13.1</td>
</tr>
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<td>China</td>
<td>60.6</td>
<td>72.4</td>
<td>70.0</td>
<td>-3.3</td>
</tr>
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<td>Hong Kong, China</td>
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<td>35.9</td>
<td>41.4</td>
<td>15.4</td>
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<td>India</td>
<td>5.5</td>
<td>6.6</td>
<td>9.5</td>
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<td>Indonesia</td>
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<td>5.3</td>
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<td>7.2</td>
<td>0.5</td>
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<td>Malaysia</td>
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<td>3.9</td>
<td>-1.6</td>
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<td>Singapore</td>
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<td>20.1</td>
<td>31.9</td>
<td>58.8</td>
</tr>
<tr>
<td>Thailand</td>
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<td>3.7</td>
<td>7.9</td>
<td>114.7</td>
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<td>South-East Europe and CISb</td>
<td>39.6</td>
<td>39.7</td>
<td>62.0</td>
<td>56.2</td>
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<td>Russian Federation</td>
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<td>14.6</td>
<td>28.4</td>
<td>94.6</td>
</tr>
<tr>
<td>Romania</td>
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<td>6.4</td>
<td>8.6</td>
<td>34.1</td>
</tr>
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<td>Kazakhstan</td>
<td>4.1</td>
<td>1.7</td>
<td>6.5</td>
<td>275.5</td>
</tr>
</tbody>
</table>

*Preliminary estimates.
*Commonwealth of Independent States.
Note: World FDI inflows are projected on the basis of 76 economies for which data are available.
Japanese car manufacturers built plants in the United States. A second reason for horizontal FDI is that owning a foreign subsidiary allows companies to gain better access to the local economy. A third reason is that companies may draw on technical expertise available in the area by locating near other established firms.

**Vertical FDI**
Vertical FDI occurs when a firm in an industrial country builds or purchases a plant in a developing country. One of the advantages of establishing a plant in a developing country is to lower production costs by hiring low-wage workers.

**European and U.S. FDI**
Nearly one-half, or $5.6 trillion, of the total world stock of FDI was in Europe in 2006. Examples of European direct investments in the United States include the merger of Daimler-Benz and Chrysler corporations in 1998, which became DaimlerChrysler. Chrysler was then owned by an American financial company, Cerberus Capital Management, from 2007 until 2009, when it was once again a source of European direct investment when it was sold to Italian automaker Fiat. An example of an American direct investment in Europe is the acquisition of Jaguar and Volvo by Ford Motor Company in 1989 and 1999, respectively. The table on p. 7 shows FDI inflows from 2004 to 2006.

**FDI in the Americas**
There are also substantial stocks of FDI in the United States, Canada, and Latin America. Although high, they are substantially lower than the amount between Europe and the United States. Direct investment from the United States in Canada totaled $246 billion in 2006, while from Canada to the United States FDI was $159 billion. In addition, most of the $403 billion in FDI from the United States in Latin America is in Mexico. Another large recipient of FDI in Latin America is Brazil. FDI to Mexico and Brazil are examples of vertical FDI, in which firms in the United States, Japan, and Europe relocate the production process to the low-wage countries to reduce costs.

**FDI with Asia**
The stock of direct investment to Asia has been increasing, with the bulk of it going to China.

The United States and Europe have a direct investment stock of $151 and $130 billion, respectively, in the rest of Asia (which excludes Japan). These stocks are an example of vertical FDI.

In addition to receiving direct investments, there has also been a growing trend of FDI outflow from Asia to the United States and Europe. This reverse-vertical FDI is motivated by firms in developing countries such as China purchasing established companies based in industrial countries as ways to acquire management and technological knowledge.
3. Conclusion

The first half of this book, namely Chapters 1 to 11, focuses on the flow of goods, services, people, and capital across borders. We see that a substantial amount of trade occurs between industrial countries, although this amount is much less than the flow of foreign direct investment among these rich nations. We also learn that the movement of people across borders is greatly restricted as compared with trade in goods and services. We examine the impact of government policies on globalization. In the second half of this book, we explore financial aspects of the international economy. One of the topics we study is how macroeconomic policies influence exchange rates, which are the price of each country’s currency.

Teaching Tips

Tip 1: This chapter introduces students to trade; who trades, how much, and what they trade. To stimulate students’ thinking about the causes of trade, ask them to review Figure 1-2 and Table 1-1 and write down reasons why some regions trade more than others. Why do the United States and Canada trade so much? Why is trade with Africa so low? What explains the relatively high trade volume of the Middle East?

Tip 2: The financial crisis that began in 2008 is not a major part of this book, but its enormous impact on international trade warrants some discussion. Ask students to search for and read Richard Baldwin’s Vox article “The Great Trade Collapse: What Caused It and What Does It Mean?” or do other research on the “great trade collapse.” Then students can discuss their opinions regarding the cause of the trade collapse.

In-Class Problems

1. What is the difference between horizontal and vertical FDI?

Answer: Horizontal FDI refers to the type of direct investment between industrialized countries as ways to avoid trade barriers, gain better access to the local economy, or draw on technical expertise in the area by locating near other established firms. Vertical FDI, by contrast, occurs when a firm in an industrialized country lowers cost by relocating the production process to low-wage countries.

2. Provide reasons for the resurgence of trade that led to the second golden age.

Answer: Reasons include the end of World War II, reductions in tariffs following the formation of the General Agreement on Tariffs and Trade, and improvements in transportation with the invention of the shipping container.
Trade and Technology:  
The Ricardian Model

Notes to Instructor

Chapter Summary
Chapter 2 leads Part II on “Patterns of International Trade” by introducing the Ricardian model. The three key lessons of the Ricardian model are (1) comparative advantage determines the pattern of trade; (2) there are mutual gains from trade; and (3) wages are determined by absolute advantage. The snowboard example in the beginning of the chapter serves as an introduction to all the trade chapters (Chapters 2–7), allowing the instructor to skip Chapter 1 if desired.

Comments
Although most students may be familiar with the concept of comparative advantage from principles of microeconomics, it is a good idea to reintroduce this concept because many students find it challenging. This chapter also provides a more in-depth analysis of the Ricardian model by covering the determination of relative prices as well as the relationship between wages and absolute advantage. The latter is particularly interesting as it is not covered in most trade textbooks. A corresponding application provides convincing evidence regarding a country’s level of technology and wages.
Lecture Notes

Introduction
Most manufactured products are traded between countries, including the snowboard. In 2005, the United States imported 1.34 million snowboards worth $58.8 million from 20 different countries. In 2009, the value of snowboard imports to the United States fell to $38.4 million; this drop was due in part to the global recession. The top 12 countries selling snowboards to the United States are shown in Table 2-1, with China at the top of the list, followed by Austria, Canada, Mexico, Spain, Poland, Tunisia, France, Germany, Taiwan, Bulgaria, and Switzerland. But why does the United States purchase snowboards from these countries at all when it has the resources and technology to produce snowboards itself? To answer this question and understand why countries trade goods with each other, we examine the reasons for trade. These trade determinants include proximity (geographic distance between countries), natural resources (land, labor, and capital), offshoring, and differences in level of technology. This chapter focuses mainly on the latter reason, technology differences across countries, otherwise known as the “Ricardian model” after nineteenth-century economist David Ricardo. The level of technology used by a country determines the pattern of trade and the wages paid to labor.

1 Reasons for Trade

Proximity
The proximity of Canada to the United States means lower transportation costs relative to trade between the United States and countries in Asia or Europe. This close distance between the two neighboring countries may explain why Canada is not only one of the top exporters of snowboards to the United States but also its largest trading partner. Proximity may also be the reason why European countries mainly trade with each other, whereas Japan or China is the largest trading partner for many Asian countries. Countries located in close proximity of one another often join into a free-trade area to promote trade by eliminating barriers to trade such as tariffs and quotas.

Resources
Given the proximity between the United States and Mexico, we would expect the value of snowboard exports from Mexico to be greater than one half that of Canada, which is equally close to the United States. The reason may lie in the fact that, in contrast to Mexico, Canada has cold snowy mountains ideal for snowboarding. Canada’s geographic resource is another reason for trade. Other resources are land, which also provides minerals; labor resources of various education and skills; and capital, such as machinery and infrastructure. Land, labor, and capital are often referred to as factors of production because these resources are used to produce goods and services. Favorable geographic conditions also help to explain the appearance of some of
the other top 12 exporters of snowboards to the United States, namely, Aus-
tria, France, Switzerland, Spain, and Bulgaria.

Although Mexico and Taiwan may not have mountains with ski resorts
to help them develop a snowboarding industry, their low snowboard prices
may explain their place as the fourth and tenth largest sellers of snowboards
to the United States, respectively. In 2009 the price of snowboards from
Tunisia and Taiwan were $34 and $31, respectively, compared with Switzer-
land at $113, Germany at $227, and France at $27. Tunisia and Taiwan are
able to sell at considerably lower prices because the snowboards imported
from these countries are unfinished. The process of spreading production
across several countries by a company that imports the unfinished goods for
further processing is known as outsourcing.

Absolute Advantage
Although Germany also has a natural resource, given by the Alps on its south-
ern border, the reason it is the ninth largest exporter of snowboards to the
United States may be better explained by its advanced technology. As a world
leader in the production of many manufactured goods, Germany has an ab-
solute advantage in producing snowboards because it has the best technology
to produce the good. However, this raises the question as to why the United
States imports about four times more snowboards from China, a country with
less-advanced technology relative to Germany. Indeed it is also puzzling why
the United States, with technology equal to that of Germany, would import
snowboards from either country rather than producing snowboards on its own.

SIDEBAR

Can Comparative Advantage Be Created? The Case of “Icewine”

By incorporating the production of “icewine,” first developed in
Germany in 1794, to its cold climate of Niagara Falls, Canada is
able to create a new comparative advantage in producing this
sweet dessert wine.

Comparative Advantage
To determine trade patterns, we need to examine the relative rather than
absolute differences in technology between countries. To gain a better un-
derstanding of the topic, we turn to the concept of comparative advantage,
introduced by David Ricardo using a simple example consisting of two coun-
tries (Portugal and England) trading two goods (wine and cloth). Ricardo al-
lowed Portugal to have the best technology or absolute advantage in the
production of both goods. In contrast, although England is capable of pro-
ducing both goods, it is relatively more difficult for England to produce wine.
Given Ricardo’s assumption that England is better at producing cloth than
wine, England has a comparative advantage in the production of cloth and
should export cloth to Portugal. In exchange for the cloth from England, Por-
tugal should export wine because it has a comparative advantage in the pro-
duction of that good.
The concept of comparative advantage may explain why the United States imports more snowboards from China than Germany even though China has less-advanced technology in the production of snowboards relative to Germany or the United States. The remainder of the chapter provides more detail about this fundamental theory in international trade.

**SIDEBAR**

**David Ricardo and Mercantilism**

David Ricardo introduced the concept of comparative advantage as the basis for trade in response to the mercantilist school of thought that a country should actively export while preventing imports with high tariffs on foreign goods. Assuming that countries have balanced trade, Ricardo showed that these countries could benefit by engaging in free trade. Ricardo’s ideology of trade without barriers is the foundation of many international institutions such as the United Nations, World Bank, and World Trade Organization.

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**2 Ricardian Model**

This section provides a detailed example of the Ricardian model with the United States as the home country trading wheat and cloth. As a leading exporter of wheat, the model should show that the United States (Home) exports wheat and imports cloth.

**The Home Country**

To gain a better understanding of the main concepts of the Ricardian model, we simplify the example by assuming that labor is the only factor of production for both goods. We use the information that one worker at Home can produce 6 bushels of wheat or 4 yards of cloth per hour. The marginal product of labor (MPL) of each good per hour at Home is given by the following table:

<table>
<thead>
<tr>
<th></th>
<th>(\text{MPL}_w)</th>
<th>(\text{MPL}_c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bushels of Wheat Produced Per Hour</td>
<td>Home country 6</td>
<td></td>
</tr>
<tr>
<td>Yards of Cloth Produced Per Hour</td>
<td></td>
<td>4</td>
</tr>
</tbody>
</table>
**Home Production Possibilities Frontier** Suppose that there are $L = 50$ workers in the home country. We will begin by plotting Home’s **production possibilities frontier** (PPF). To graph the PPF, we calculate the maximum bushels of wheat Home could produce in an hour if all workers were employed in producing wheat. They could produce $Q_W = MPL_W \cdot L = 6 \cdot 50 = 300$ bushels of wheat per hour. If instead, all workers were employed in cloth then they could produce $Q_C = MPL_C \cdot L = 4 \cdot 50 = 200$ yards of cloth per hour. Connecting the two production points gives us the straight-line PPF unique to the Ricardian model, as shown in Figure 2-1. The PPF is a straight line because the marginal products of labors are constant, a result of the earlier assumption that production does not include land and capital.

The slope of the PPF, equal to the ratio of the marginal products in the two goods, gives the **opportunity cost** of one good (on horizontal axis) in terms of the other (on vertical axis).

$$\text{Slope of PPF} = -\frac{MPL_C \cdot L}{MPL_W \cdot L} = -\frac{MPL_C}{MPL_W} = -\frac{4}{6} = -\frac{2}{3}$$

The slope of the PPF gives the opportunity cost of 1 bushel of wheat in terms of cloth. The slope of $-2/3$ means that Home gives up $2/3$ yard of cloth in order to increase the output of wheat by 1 bushel. To see this, notice that home country must give up 10 minutes producing cloth to obtain 1 bushel of wheat. By shifting the 10 minutes from cloth to wheat, Home reduces cloth output by $2/3$ yard.

**Home Indifference Curve** To determine the level of wheat and cloth production, we examine Home’s demand for the two goods as represented by the country **indifference curves**. Similar to indifference curves representing individual preferences, an indifference curve for a country reflects higher levels of **utility** the further away it is from the origin. In addition, Home is indifferent between any two combinations of wheat and cloth on the same indifference curve.
**Home Equilibrium** Without international trade Home will produce at the point where the indifference curve is just tangent to the PPF, which acts like the country’s budget constraint. Figure 2-2 shows that Home achieves the most satisfaction at the “no-trade” or the “pre-trade” equilibrium denoted by Point $A$, at which $U_1$ represents the highest indifference curve Home can obtain by having its own firms produce and sell the two goods under perfect competition.

**Opportunity Cost and Prices** Under perfect competition, at the no-trade equilibrium, the opportunity cost and relative price of wheat (on horizontal axis) are equal. This result follows from assuming that labor is perfectly mobile between the two industries and that firms will hire labor up to the point where wage in an industry equals the price of the good times the marginal product of labor in the sector producing the good.

**Wages** With labor freely able to move between the industries, wages across the industries must be equal, which gives the equality of the price ratio with the ratio of the marginal products in the two goods. Setting wage equal in the two sectors

$$P_W \cdot MPL_W = wage = P_C \cdot MPL_C$$

and rearranging gives

$$P_W / P_C = MPL_C / MPL_W.$$  

The right side is the slope of the PPF, which also is the opportunity cost of wheat in terms of cloth, whereas the left side is the relative price of wheat. Substituting the marginal product of labor in wheat and cloth, we find that the relative price of wheat in the home country without international trade is equal to $2/3$ ($P_W / P_C = MPL_W / MPL_C = 2/3$).

---

**Figure 2-2**

![Home Equilibrium with No Trade](image-url)
The Foreign Country

In our model, the foreign country is assumed to have an inferior technology, or an absolute disadvantage in producing both wheat and cloth as compared with Home. In particular, the marginal product of labor in wheat and cloth in Foreign are $MPL^*_W = 3$ and $MPL^*_C = 3$, respectively.

With $L^* = 100$, Foreign is able produce a maximum of $MPL^*_W \cdot L^* = 300$ bushels of wheat per hour if all workers were producing wheat. If instead all workers were employed in cloth production, Foreign would be able to produce a maximum of $MPL^*_C \cdot L^* = 300$ yards of cloth per hour.

**Foreign Production Possibilities Frontier**

The Foreign PPF, given in Figure 2-3, is the straight line between the two Foreign production points. The slope of the Foreign PPF, measured by the ratio of the marginal products in the two goods, is $-1$. We will now turn to the concept of comparative advantage to understand why the United States, with its superior technology in the production of both wheat and cloth, would import most of its clothing from countries in Asia and Latin America.

<table>
<thead>
<tr>
<th>Opportunity Cost of</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Bushel of Wheat</td>
</tr>
<tr>
<td>(In Terms of Yards</td>
</tr>
<tr>
<td>of Cloth Given Up)</td>
</tr>
<tr>
<td>1 Yard of Cloth</td>
</tr>
<tr>
<td>(In Terms of Bushels</td>
</tr>
<tr>
<td>of Wheat Given Up)</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Home country</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>2/3</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3/2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$MPL^*_W$</th>
<th>$MPL^*_C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bushels of Wheat Produced Per Hour</td>
<td>Yards of Cloth Produced Per Hour</td>
</tr>
<tr>
<td>Foreign country</td>
<td>3</td>
</tr>
</tbody>
</table>
Comparative Advantage The opportunity cost of 1 bushel of wheat in terms of yards of cloth in the foreign country is equal to 1, as shown in the table below.

<table>
<thead>
<tr>
<th>Opportunity Cost of</th>
<th>1 Bushel of Wheat (In Terms of Yards of Cloth Given Up)</th>
<th>1 Yard of Cloth (In Terms of Bushels of Wheat Given Up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home country</td>
<td>2/3</td>
<td>3/2</td>
</tr>
<tr>
<td>Foreign country</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Notice that the opportunity cost of 1 bushel of wheat in terms of yards of cloth in the home country \(\frac{MPL_W}{MPL_C} = \frac{2}{3}\) is lower than that in the foreign country \(\frac{MPL_W^*}{MPL_C^*} = 1\). This means that Home gives up less cloth to produce 1 bushel of wheat than Foreign. Because Home has a lower opportunity cost of producing wheat than Foreign, Home has a comparative advantage in producing wheat, whereas Foreign has a comparative advantage in producing cloth \(\frac{MPL_C}{MPL_W} = \frac{3}{2} > \frac{MPL_C^*}{MPL_W^*} = 1\). We get this result despite the assumption that Home has an absolute advantage in the production of both goods.

Applying the same methodology for Home, we include Foreign’s preferences for wheat and cloth with indifference curves to obtain the no-trade equilibrium. Figure 2-4 shows that under competitive markets, Foreign will produce at point \(A^*\), at which it achieves the highest level of utility. The slope of the foreign PPF gives us the relative price as well as the opportunity cost of wheat without trade \(\frac{MPL_W^*}{MPL_C^*} = \frac{P_W^*}{P_C^*} = 1\). The comparative advantage that the home country has in the production of wheat is also re-
flected by the lower relative price of wheat at Home ($P_W / P_C = 2/3$) compared with Foreign.

**APPLICATION**

**Comparative Advantage in Apparel, Textiles, and Wheat**

Table 2-2 shows that a worker in the United States generates seven times more apparel sales and 16 times more textiles sales per year than a worker in China. With its absolute advantage in the production of both industries, why does the United States import apparel and textiles from China and other Asian countries? The answer has to do with the fact that a typical grain farmer in the United States is 275 times more productive than a farmer in China. With its absolute and comparative advantage in the production of grain, the United States exports grain to China in exchange for apparel and textiles.

**3 Determining the Pattern of International Trade**

**International Trade Equilibrium**

We now examine why the two countries participate in international trade. Because the relative price of wheat in the home country ($P_W / P_C = 2/3$) is lower than the relative price of wheat in the foreign country ($P_W^* / P_C^* = 1$), producers of wheat at Home would want to export wheat to Foreign. Conversely, producers of cloth in the foreign country would want to export cloth, since the relative price of cloth is higher in the home country ($P_C / P_W = 3/2$) than the foreign country ($P_C^* / P_W^* = 1$). Therefore, differences in no-trade prices provide an incentive for the two countries to trade. As predicted by the Ricardian model, both countries export the good in which they have a comparative advantage.

International trade between the two countries reaches equilibrium when the relative price of wheat (or cloth) is the same across the countries. This occurs because as Home exports wheat, the supply of wheat in the home country falls while the supply of wheat in the foreign country increases, leading to a higher relative price at Home and a lower relative price at Foreign. Similarly, the foreign country’s export of cloth drives up the relative price of cloth in Foreign as supply decreases and leads to a fall in the relative price at Home. In the next section, we will determine the relative price of wheat at the trade equilibrium and examine how the change in the relative price of wheat because of trade affects production and consumption in each of the countries.

**Change in Production and Consumption**

To determine what each of the countries will produce and consume, we begin by supposing that the international relative price of wheat is equal to 3/4, which is in-between Home (2/3) and Foreign’s (1) no-trade relative price. Given the higher international relative price of wheat, producers in the home country would want to export wheat abroad and all workers would want to work in the wheat industry. To see that workers at Home would receive a higher wage working in the wheat industry than the cloth industry, we compute the ratio of wages in the two industries using the international relative price of wheat ($3/4$), $MPL_C$ (4), and $MPL_W$ (6):
Because of the higher wages in the wheat industry, no cloth is produced and the home country fully specializes in the production of wheat.

International Trade Starting from Home’s production point (point B in Figure 2-5), we know that with the international relative price of wheat at 3/4, Home can export 1 bushel of wheat in exchange for 3/4 yard of cloth from Foreign. Tracing out Home’s international trade gives the international trade line shown as BC in Figure 2-5. The international trade line implies a “new” budget constraint for the home country that has a steeper slope than Home’s PPF. With the higher budget constraint (international trade line), Home is able to choose a consumption point (point C) that is on a higher indifference curve (U2). Therefore, Home gains from trade by obtaining a higher utility with international trade than under no-trade.

Pattern of Trade and Gains from Trade With the international relative price of wheat at 3/4, Home produces 300 bushels of wheat (point B) but consumes only 100 bushels (point C). The extra 200 bushels are exported to the foreign country in exchange for 150 yards of cloth. The value of the wheat in terms of cloth is determined by multiplying the international relative price of wheat by the amount of wheat export, \( \frac{3}{4} \times 200 = 150 \) yards of cloth. Because the value of exported wheat is equal to the value of imported cloth, trade in the home country is balanced.

The results for the foreign country produce trade patterns that are opposite those of the home country because the international relative price of wheat is less than the foreign no-trade relative price of wheat. Workers in the foreign country will flock to the cloth industry as producers in this industry take advantage of the higher international relative price of cloth (reciprocal of
the international relative price of wheat) to export cloth. Foreign becomes fully specialized in the production of cloth, denoted by point $B^*$ in Figure 2-6. Tracing out Foreign’s international trade at the exchange of $3/4$ yards of cloth for 1 bushel of wheat gives the international trade line, $B^*C^*$, which equals the negative of the slope of the international relative price of wheat and is flatter than Foreign’s PPF. The foreign country also gains from trade by acquiring a higher utility given by the tangency of indifference curve $U_2^*$ with the international relative price of wheat at point $C^*$.

Similar to the home country, trade in the foreign country is also balanced. By specializing in the production of cloth, Foreign produces 300 yards, 150 of which it keeps for consumption and the other 150 it exports to Home in exchange for 200 bushels of wheat. Note that the amount of cloth Foreign exports is exactly equal to the 150 yards that Home imports. Likewise, Foreign imports 200 bushels of wheat, which is the same amount that Home exports.

With international trade the home country exports wheat, in which it has a comparative advantage, and the foreign country exports cloth because it has
a comparative advantage in cloth. Both countries enjoy mutual gains from trade by consuming at a higher level of utility relative to their no-trade levels. These two findings are consistent with the Ricardian model.

**Solving for Wages across Countries**

In this section we examine the relationship between absolute advantage and how wages are determined across countries. At Home, workers are paid in terms of wheat because the home country produces and exports this good. The workers could either consume their “real” wage, measured in terms of wheat, or exchange for cloth with Foreign at the international relative price of $P_W / P_C = 3/4$. Wages at Home are summarized by the following:

\[
\text{Home wages} = \begin{cases} 
MPL_W &= 6 \text{ bushels of wheat} \\
(P_W / P_C) \cdot MPL_W &= 4.5 \text{ yards of cloth}
\end{cases}
\]

In the foreign country, workers are paid in terms of cloth as Foreign produces and exports cloth. The real wage of workers in Foreign is $MPL_C^* = 3$ yards of cloth, which they can either consume or trade for wheat in the international market. Foreign wages are summarized by the following:

\[
\text{Foreign wages} = \begin{cases} 
(P_C / P_W)^* \cdot MPL_C^* &= 4 \text{ bushels of wheat} \\
MPL_C^* &= 3 \text{ yards of cloth}
\end{cases}
\]

Wages across the countries depend on the marginal products of labor and the international trade relative price of the goods.

**Absolute Advantage** Home workers can afford to purchase more of wheat and cloth than Foreign workers because the home country has an absolute advantage in the production of both goods.

**APPLICATION**

**Labor Productivity and Wages**

Using value-added per hour as the measure for labor productivity, we see from Figure 2-7 that there is a relationship between labor productivity and wages. Of the seven countries presented, the United States has the highest level of productivity and enjoys the highest wage, whereas Taiwan has the lowest level of productivity and thus receives the lowest wage. Figure 2-8 shows the labor productivity and wages over time for each of the seven countries. The graphs show a close connection between labor productivity and wages, with both rising over time.

**4 Solving for International Prices**

Instead of assuming that the international relative price of wheat is between the two countries’ no-trade relative prices as we did in the previous section, we now solve for it using supply and demand curves, in which the world supply curve is derived from the Home export supply curve whereas the world demand curve is derived from the Foreign import demand curve. The intersection of the export supply curve and the import demand curve determines the international prices.
Home Export Supply Curve

We use panel (a) of Figure 2-9, which is a replica of Figure 2-5, to construct the Home export supply curve, in which the vertical axis measures the relative price of wheat and the horizontal axis measures the exports of wheat. The export supply curve of wheat is equal to zero when the international relative price of wheat is below the home country’s no-trade price ratio (2/3). When the international relative price of wheat is equal to the home country’s no-trade price ratio, the export supply curve is flat, starting from zero to the home country’s no-trade consumption point (points $A'$ and $B'$ in panel (b) of Figure 2-9 corresponding with points $A$ and $B$ in panel (a)). At this international relative price of wheat (3/4), Home could be entirely self-sufficient by producing and consuming at point $A$ or it could completely specialize in the production of wheat by producing 300 bushels at point $B$. Because Home consumes only 100 bushels of wheat, the rest are exported to Foreign in exchange for 150 yards of cloth. In addition, with wages equal across the two industries, workers can freely move from one industry to another so that Home would produce on any point on the PPF between $A$ and $B$. If the international relative price of wheat is 3/4, we know from the earlier analysis that Home exports 200 bushels of wheat, corresponding with point $C'$ in panel (b). The export supply curve rises as the relative prices of wheat increases.

Foreign Import Demand Curve

Using the same reasoning, the import demand curve for wheat is equal to zero when the international relative price of wheat is above the foreign no-trade relative price of wheat. If the international relative price of wheat is equal to
1, Foreign could either consume all of the wheat and cloth it produces on its own (points $A'$ and $A''$ in panels (a) and (b) of Figure 2-10, respectively) or specialize in the production of cloth by producing 300 yards and exporting 150 yards to the home country (points $B'$ and $B''$ in panel (a) and points $A'''$ and $B'''$ in panel (b)). Because wages are equal across the two industries, Foreign could produce anywhere on its PPF between points $A'$ and $B'$, which gives the flat segment of the import demand curve when the international relative price of wheat equals the foreign country’s no-trade relative price. As the relative price of wheat decreases, for example from 1 to $3/4$, the foreign country will specialize in cloth and import more wheat, leading to the downward-sloping import demand curve for wheat. The flat portion of the import demand is unique to the Ricardian model because of the straight-line production possibilities frontier.

**International Trade Equilibrium**

Combining the Home export supply curve and the Foreign import demand curve gives the world market for wheat as shown in Figure 2-11. The intersection of the world supply and demand curves, denoted by point $C'$, gives the international trade equilibrium, in which the Home export of wheat is equal to Foreign import of wheat at the equilibrium relative price of wheat.

**The Terms of Trade** Terms of trade is defined as the price of a country’s exports divided by the price of its imports. The home country’s terms of trade...
trade, defined by $P_W / P_C$, improves as the price of wheat increases or as the price of cloth falls. This means that the home country is able to purchase more cloth while exporting the same amount of wheat. For the foreign country, its terms of trade ($P_C / P_W$) rises following a higher price of cloth (its export) or a lower price of wheat (its imports).

**APPLICATION**

**The Terms of Trade for Primary Commodities**

In 1950, economists Raúl Prebisch and Hans Singer hypothesized that over time, the price of primary commodities such as agricultural products and minerals would decline relative to the price of manufactured goods. The decline of primary commodities would lead to a worsening of the terms of trade for developing countries, the source of most of these products. The three graphs in Figure 2-12 show that the relative price of primary commodities has increased, decreased, and remained roughly the same over time, depending on the product traded.

5 **Conclusion**

The Ricardian model consists of the simple concept that the pattern of trade is determined by comparative advantage. By exporting the good in which a country has the lowest opportunity cost relative to producing another good, the country could benefit from participating in international trade by con-
suming at a higher level of utility than it would under no-trade. In addition, the Ricardian model also shows that wages across countries are determined by absolute advantage, in which the country possessing the more advanced technology will enjoy higher real wages. Another result of the Ricardian model is that a small country will gain from trading with a large country but the larger country will neither gain nor lose from the trade. The reason is because the international equilibrium price ratio will equal the large country’s relative no-trade prices.

TEACHING TIPS

Tip 1: Comparative Advantage

Comparative advantage is perhaps the most important concept in international trade. Therefore, it warrants substantial treatment in this course. Ask students to break into groups or work on their own to come up with additional example of comparative advantage that need not relate to international trade. Discussing examples, such as lawyers paying landscapers to mow their lawns, may help students better grasp the concept.

Tip 2: An Introduction to Trade Data

To familiarize students with international trade data and sources have students explore the part of the United States International Trade Commission website that accesses trade data (http://dataweb.usitc.gov/prepared_reports.asp). Ask students to explore U.S. trade balances sectors, noting any trends they might find. Ask students to consider what role comparative advantage might play in the trends they observe.

Tip 3: Individual Products, Trade Flows, and Comparative Advantage

Yet another way to engage students in empirical international trade is to ask them to look up specific goods and the United States major trading partners. Ask students to go to the International Trade Administration of the U.S. Department of Commerce (http://www.trade.gov/mas/ian/otii/index.asp). Students can then follow the TradeStatsExpress link (under “Spotlights”), click on National Trade Data, then Global Patterns of U.S. Merchandise Trade.

Here students can pick their own goods to investigate U.S. imports, exports, and trade balance. Ask students to look up a good they expect the United States to have a comparative advantage or disadvantage in and to test their beliefs with current data.
Here are some examples of goods and their harmonized system codes for students. After students click the “Change” button under “Product,” tell them to be sure to click the “HS Radio” button before they look for “HS Codes.” To enter the six-digit codes below, they will need to click the “Product Code” tab in the “Select Products for Report” dialog box.

<table>
<thead>
<tr>
<th>Harmonized System Codes (HS Codes)</th>
<th>Product Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>880240</td>
<td>Airplanes and other aircraft, of an unladen weight exceeding 15,000 kilograms</td>
</tr>
<tr>
<td>480300</td>
<td>Toilet or facial tissue stock, towel or napkin stock and similar paper of a kind used for household or sanitary purposes, cellulose wadding and webs</td>
</tr>
<tr>
<td>660110</td>
<td>Garden or similar umbrellas</td>
</tr>
<tr>
<td>920300</td>
<td>Keyboard pipe organs; harmoniums and similar keyboard instruments with free metal reeds</td>
</tr>
<tr>
<td>180100</td>
<td>Cocoa beans (whole or broken)</td>
</tr>
</tbody>
</table>

**IN-CLASS PROBLEMS**

1. What determines the pattern of international trade between two countries in the Ricardian model?  
   **Answer:** The pattern of trade is determined by comparative advantage. The country with a comparative advantage in the production of a product will export the good.

2. Using the Ricardian model, explain why American workers receive higher wages in the production of automobiles than Chinese workers.  
   **Answer:** American automobile workers receive higher wages than Chinese automobile workers because the United States has an absolute advantage in the production of many goods, including automobiles.

3. Why is the production possibilities frontier a straight line in the Ricardian model?  
   **Answer:** The production possibilities frontier is a straight line in the Ricardian model because of the assumption that the marginal products of labor are constant. The Ricardian model ignores the role of land and capital so there are no diminishing returns.

   4. Refer to the following table and assume that the total labor supply in Taiwan is 4 and the total labor supply in Vietnam is 8.

<table>
<thead>
<tr>
<th>Absolute Advantage</th>
<th>Taiwan</th>
<th>Vietnam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of telephones produced per hour</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Number of radios produced per hour</td>
<td>50</td>
<td>10</td>
</tr>
<tr>
<td>Comparative advantage</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

   a. What is the opportunity cost of 1 unit of telephones in terms of radios in Taiwan? In Vietnam?
**Answer:** See the following table.

<table>
<thead>
<tr>
<th>Opportunity Cost of</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Telephone</td>
<td>1 Radio</td>
</tr>
<tr>
<td>(In Terms of Units of Radio Given up)</td>
<td>(In Terms of Units of Telephone Given up)</td>
<td></td>
</tr>
<tr>
<td>Taiwan</td>
<td>5</td>
<td>1/5</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2</td>
<td>1/2</td>
</tr>
</tbody>
</table>

b. Determine whether each of the following statements is true or false. Provide a brief explanation of why it is true or false.

i. **Taiwan has an absolute advantage in the production of both telephones and radios.**

**Answer:** TRUE: Taiwan can produce more of both goods per hour than Vietnam.

ii. **Vietnam has a comparative advantage in the production of telephones.**

**Answer:** TRUE: Vietnam has a lower opportunity cost of producing telephones relative to Taiwan.

g burned in 1 hour. Instead, two possible production combinations include \(\text{MPL}_{\text{radio}} \cdot \text{L} = 5 \cdot 8 = 40\) units of telephone per hour OR Vietnam \(\text{MPL}_{\text{radio}} \cdot \text{L} = 10 \cdot 8 = 80\) units of radio per hour.

**Answer:** FALSE: With a labor supply of 8, it is not possible for Vietnam to produce 40 units of telephone AND 80 units of radio in an hour. Instead, two possible production combinations include \(\text{MPL}_{\text{radio}} \cdot \text{L} = 5 \cdot 8 = 40\) units of telephone per hour OR Vietnam \(\text{MPL}_{\text{radio}} \cdot \text{L} = 10 \cdot 8 = 80\) units of radio per hour.

c. If the two countries engage in international trade, what will Taiwan produce and how many?

**Answer:** Because Vietnam has the lower opportunity cost in the production of telephones and hence comparative advantage in producing this good, Taiwan has a comparative advantage in the production of radios. Thus, Taiwan will specialize in the production of radios. Taiwan will produce \(50 \cdot 4 = 200\) per hour.

d. What is the real wage in Taiwan in terms of radio? What is the real wage in Vietnam in terms of telephone?

**Answer:** The real wage in Taiwan in terms of radio is \(\text{MPL}_{\text{radio}} = 50\) units of radio. The real wage in Vietnam in terms of telephone is \(\text{MPL}_{\text{telephone}} = 5\) units of telephone.

e. Will Taiwan and Vietnam trade if the international relative price of telephone is 3? Briefly explain why or why not.

**Answer:** Because the no-trade prices are \(P_{\text{telephone}}^{\text{US}} / P_{\text{telephone}}^{\text{VT}} = 5\) in Taiwan and \(P_{\text{telephone}}^{\text{US}} / P_{\text{telephone}}^{\text{VT}} = 2\) in Vietnam, two countries will engage in trade if the international relative price of telephone is 3. In particular, Vietnam will export telephones because the international relative price of telephone is higher than its no-trade equilibrium price. By contrast, Taiwan will import telephones because the international relative price of telephone is lower than its no-trade equilibrium price.

5. Refer to the following table in answering the questions that follow. Assume each country has 100 laborers.

<table>
<thead>
<tr>
<th>Opportunity Cost of</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 Pound of Beef</td>
<td>1 Bushel of Wheat</td>
</tr>
<tr>
<td>(In Terms of Bushels of Wheat Given up)</td>
<td>(In Terms of Pounds of Beef Given up)</td>
<td></td>
</tr>
<tr>
<td>Australia</td>
<td>3</td>
<td>1/3</td>
</tr>
<tr>
<td>United States</td>
<td>3</td>
<td>1/3</td>
</tr>
</tbody>
</table>
6. Would your answers to problem 5 be different if a worker in the United States became more productive and could produce 70 pounds of beef or 140 bushels of wheat per hour?

Answer: With the increase in productivity in the United States, the two countries now have differences in opportunity costs and will find trade mutually beneficial.

7. Answer the questions below using the information given in the following table.

<table>
<thead>
<tr>
<th>Opportunity Cost of</th>
<th>1 Pound of Beef</th>
<th>1 Bushel of Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(In Terms of Bushels of Beef Given Up)</td>
<td>(In Terms of Pounds of Wheat Given Up)</td>
</tr>
<tr>
<td>Australia</td>
<td>3</td>
<td>1/3</td>
</tr>
<tr>
<td>United States</td>
<td>2</td>
<td>1/2</td>
</tr>
</tbody>
</table>

a. Which country has a comparative advantage in the production of boots?

Answer: China has a comparative advantage in producing boots because it has a lower opportunity cost in producing boots ($MPL_{China}^B / MPL_{China}^W = 1/2 < MPL_{France}^B / MPL_{France}^W = 2$).

b. Provide the range of the international relative price of wine at which the two countries would trade.

Answer: The range of the international relative price of wine at which the two countries would trade would be between their no-trade relative prices, which are $P_{W}^{China} / P_{W}^{France} = 2$ and $P_{W}^{France} / P_{W}^{China} = 1/2$ in China and France, respectively.

c. Suppose that researchers in France discover a new technology that doubles the marginal product of labor in boots. Would China and France continue to trade? Briefly explain why.

Answer: Although the new technology would allow workers in France to be more productive, France will continue to trade with China as long as there are differences in opportunity costs between the two countries.

8. Some Americans fear that as countries such as China and India become more productive in industries such as computer and computer programming, once dominated by the United States, the wages of workers in the United States will fall. Should U.S. workers fear foreign competition? Briefly explain why or why not.

Answer: Suppose the initial productivity in China and the United States is given by the middle column in the table below. In this case, the United States has an absolute advantage in the production of both computer programs (programs) and wheat. China has a comparative advantage in producing wheat whereas the United States has a comparative advantage in the production of computer programs.

<table>
<thead>
<tr>
<th>France</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pairs of boots produced per hour</td>
<td>4</td>
</tr>
<tr>
<td>Bottles of wine produced per hour</td>
<td>2</td>
</tr>
<tr>
<td>Comparative advantage</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initial Opportunity Cost of</th>
<th>1 Number of Programs (In Terms of Bushels of Wheat Given Up)</th>
<th>1 Bushel of Wheat (In Terms of Numbers of Program Given Up)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>10</td>
<td>1/10</td>
</tr>
<tr>
<td>United States</td>
<td>5</td>
<td>1/5</td>
</tr>
</tbody>
</table>

Suppose that the world relative price of computer program is 8. Then the initial U.S. wage is given by the following:

Initial U.S. wage = \[
\left\{ \begin{array}{l}
MPL_p = 10 \text{ numbers of program} \\
\text{or} \\
(P_p / P_w) \cdot MPL_p = 80 \text{ bushels of wheat}
\end{array} \right.
\]
Now let’s assume that China becomes more productive in producing computer programs although everything else remains constant, as given by the column on the right in the above table. Now China has a comparative advantage in producing computer programs.

<table>
<thead>
<tr>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>1/2</td>
<td>1/5</td>
</tr>
</tbody>
</table>

Suppose the new world relative price of computer program is 4.

\[
\frac{P_W}{P_P} \cdot MPL_W = 12.5 \text{ numbers of program}
\]

\[
\text{New U.S. wage} = \frac{MPL_W}{50 \text{ bushels of wheat}}
\]

This example shows that when China increases productivity in computer programming, wages of workers in the United States fall in terms of wheat and rise in terms of computer programs. The gain in terms of number of computer programs results from the lower world relative price of computer programs.

9. Refer to the following table. Assume there are two workers in Mexico and three workers in the United States.

<table>
<thead>
<tr>
<th>Mexico</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottles of tequila produced per hour</td>
<td>7</td>
</tr>
<tr>
<td>Pounds of rice produced per hour</td>
<td>5</td>
</tr>
</tbody>
</table>

a. Determine the pretrade relative price of tequila in Mexico and the United States.

**Answer:** The pretrade relative price of tequila in Mexico and the United States are \(P_{\text{tequila}} / P_{\text{rice}} = 5 / 7\) and \(P_{\text{rice}} / P_{\text{tequila}} = 2\) in Mexico and the United States, respectively.

b. Given your answer in part (a), which country has a comparative advantage in the production of rice?

**Answer:** The United States has a comparative advantage in producing rice.

c. What is the lowest international relative price of tequila Mexico is willing to accept in order to engage in trade with the United States? Briefly explain why.

**Answer:** The international relative price of tequila must be at least 5/7 in order for Mexico to engage in trade. This is because Mexico’s no-trade relative price of tequila is 5/7.

10. Use the information provided in problem 9 but suppose the number of laborers in the United States is 300 while the number of laborers in Mexico remains the same at 2.

a. Determine the terms of trade for the United States.

**Answer:** The United States exports rice, so its term of trade is \(P_r / P_T\).

b. Which country gains more from trade? Briefly explain why.

**Answer:** Given the relative size of the two countries, the world relative price will be closer to the no-trade relative price of tequila in the United States so that Mexico gains more from trade.

11. Provide an example of how the mercantilist school of thought continues to exist today.

**Answer:** The mercantilist school of thought continues to exist in countries such as the United States in which certain groups favor limiting imports while pushing for exports.

12. Suppose there are two countries producing two goods using only labor. Refer to the following table to answer the questions.

<table>
<thead>
<tr>
<th>Italy</th>
<th>France</th>
<th>Absolute Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pairs of shoes produced per hour</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Bottles of wine produced per hour</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

a. Which country has absolute advantage in the production of shoes? Wine?

**Answer:** Italy has an absolute advantage in the production of shoes and wine.
b. Which country has a comparative advantage in the production of shoes? Wine?

**Answer:** Because the countries have the same opportunity costs in terms of shoes neither country has a comparative advantage in the production of shoes. Same goes for the production of wine.

c. Does Italy gain from trading with France? Briefly explain why or why not using the Ricardian model.

**Answer:** Without differences in opportunity costs, there are no gains from trade according to the Ricardian model.
Chapter Summary
Chapter 3 examines the gains and losses from trade for labor, capital, and landowners. We no longer assume that labor is the only factor of production. The model presented is the specific-factors model, in which labor and land are used in agriculture whereas labor and capital are used in manufacturing.

Comments
The video *Is Wal-Mart Good for America?*, available through PBS.org, provides an excellent example of winners and losers of trade. It begins with an annual shareholders meeting where everyone in attendance is excited about Wal-Mart. Then it takes a look at the impact on American suppliers and workers when Wal-Mart switches to Chinese suppliers in efforts to lower cost. Discussions after the video could be stimulated by asking questions such as whether Wal-Mart and other American businesses should be restricted from purchasing from foreign suppliers. Although some students may comment that most consumers at Wal-Mart are from lower-income households, it may be useful to remind them that the video also mentions that Chinese-made televisions are also sold in retail stores such as Best Buy and Circuit City.
**Lecture Notes**

**Introduction**

The chapter begins with an example of violent protests against Bolivia’s export of natural gas by its indigenous Indians. The protests led to the replacement of the president and a referendum ensuring more benefits to Bolivia’s people at the expense of foreign companies. The example brings up the issue that in the real world there are both winners and losers when a country engages in trade even though the overall gains from those who benefit from trade generally exceed the losses of those who are harmed.

## 1 Specific-Factors Model

### The Home Country

The specific-factors model consists of two industries, agriculture and manufacturing. Agriculture uses labor and land whereas manufacturing uses labor and capital. In the short run, land is specific to the agriculture sector, whereas capital is specific to the manufacturing sector. Unlike land and capital, labor is used in both sectors, meaning that it is not specific to either one. With diminishing returns, an increase in the amount of labor used in either sector results in the decline of the marginal product of labor as depicted in Figure 3-1. Because of the diminishing returns to labor in agriculture and manufacturing, the economy’s production possibilities frontier (PPF) is bowed-out, or concave, as shown in Figure 3-2.

### Production Possibilities Frontier

The slope of the PPF gives the opportunity cost of manufacturing in terms of the amount of food the economy has to give up to produce an additional unit of the manufacturing good. The slope between any two points on the PPF is given by the ratio $MPL_A / MPL_M$, where $MPL_A$ is the marginal product of labor in agriculture and $MPL_M$ is the marginal product of labor in manufacturing.

### Opportunity Cost and Prices

In addition, the slope of the PPF equals the price of manufacturing relative to the price of agriculture or the relative price of manufacturing, $P_M / P_A$. To see this, recall that wage $W$ in a competitive market is equal to the price of the good times the marginal product of labor in the producing the good or the value of the marginal product. Because labor is mobile between the two sectors, the wage in agriculture, $W = P_A \cdot MPL_A$, must equal to the wage in manufacturing, $W = P_M \cdot MPL_M$. If this is not the case, labor will continue to flow to the high-wage sector until the wages are equalized across the industries.

### The Foreign Country

We will forego a discussion on Foreign in this chapter and assume that the no-trade relative price of manufacturing at Home is lower than the Foreign relative price, $(P_M / P_A) < (P_M^* / P_A^*)$. In other words, Home has a comparative advantage in producing manufactured goods relative to the foreign country.
Overall Gains from Trade
In the absence of international trade, the economy produces and consumes at
the point on the PPF where the relative price of manufacturing is equal to
the slope of the PPF and the slope of the indifference curve for a representa-
tive consumer as shown in Figure 3-3. Suppose the country engages in trade
that leads to an increase in the relative price of the manufacturing good. The
higher relative price of manufacturing, given by the steeper international
price, line $BC$ in Figure 3-3, attracts workers to the manufacturing sector and
an increase in the production of manufactures from point $A$ to point $B$. With
the higher relative price of manufacturing, the country exports manufactures
in exchange for agricultural products and consumes at a higher indifference
curve given by $U_2$ at point $C$.

APPLICATION
How Large Are the Gains from Trade?
The United States experienced the reversal of gains from trade when the
U.S. Congress imposed an embargo on trade with Britain between Decem-
ber, 1807, and March, 1809. The gains from trade for the United States would
have been at least 5% of GDP without the embargo. Put another way, the em-
embargo cost the United States more than one third of the value of exports.

In another example, Japan experienced gains from trade when it engaged
in international trade in 1859 after 200 years of self-imposed autarky. Japan’s
gains from trade are estimated to be about 4% to 5% of GDP.

2 Earnings of Labor

Determination of Wages
To determine the impact of international trade on wages in the two sectors,
we put the marginal product of labor for agriculture and manufacturing on
the same graph, as shown in Figure 3-4. The horizontal axis denotes the to-
tal amount of labor, $L$, with the amount of labor used in manufacturing, $L_M$,
measured from left ($0_M$) to right, and the amount of labor used in agriculture,
$L_A$, measured from right ($0_A$) to left.

Equilibrium Wage The equilibrium wage is given by the intersection of the
marginal product of labor in each sector multiplied by its respective price.
With the equilibrium wage at point $A$, the economy uses $0_M L$ units of labor
in manufacturing and $0_A L$ units of labor in agriculture.

Change in Relative Price of Manufactures
We next examine how the higher relative price of manufactures resulting
from trade affects the wage and earnings of capital owners in manufacturing
and landowners in agriculture.

Effect on the Wage Suppose the higher relative price of manufactures is due
to an increase in the price of manufacturing, $P_M$. This shifts $P_M \cdot MPL_M$ up to
$P_M' \cdot MPL_M$, where the vertical rise is $\Delta P_M \cdot MPL_M$, as shown in Figure 3-6.
The intersection of $P_M' \cdot MPL_M$ and $P_A \cdot MPL_A$ gives the new equilibrium
wage, $W'$, at point $B$. With the new equilibrium wage, the amount of labor used in manufacturing increases from $0_nL$ to $0_nL'$ and the amount of labor used in agriculture falls from $0_nL$ to $0_nL'$.

**Effect on Real Wages** To understand the impact of the new equilibrium wage on labor, we note that workers can afford to buy more food because its price has not changed although wages have increased. Namely, the real wage has increased for labor in terms of food, $W' / P_A > W / P_A$.

To see whether labor gains or loses in terms of manufactures, we need to compare the increase in wage relative to the increase in the price of manufacture, $P_M$. From Figure 3-5 we see that the increase in wage from $W$ to $W'$ is less than the vertical increase of $P_A \cdot MPL_A$ given by $\Delta P_M \cdot MPL_M$ or $\Delta W < \Delta P_M \cdot MPL_M$. Dividing both sides by the initial wage $W$ gives

$$\frac{\Delta W}{W} < \frac{\Delta P_M \cdot MPL_M}{P_M \cdot MPL_M} = \frac{\Delta P_M}{P_M},$$

where the term on the left-hand side is the percentage change in wages and the term on the right-hand side is the percentage change in the price of manufactured goods. Because the percentage increase in wage is less than the percentage increase in the price of manufactured goods, the amount of manufactured goods workers can now purchase is less than that before the country engaged in trade. This means that the real wage has fallen for labor in terms of manufactures, $W' / P_M' < W / P_M$.

**Overall Impact on Labor** Whether labor is better off or worse off due to the increase in the price of manufactures depends on whether the individual prefers to purchase more manufacturing goods or food. The key point is that with the specific-factors model, an increase in the price of manufactured goods results in an ambiguous effect on the well-being of labor since the effect on real wage is undefined.

**Unemployment in the Specific-Factors Model** Although it is often cited in the news that international trade causes unemployment, we do not see this result in the specific-factors model. One possible reason is that this model does not incorporate unemployment, a macroeconomic phenomenon caused by business cycles. Another reason could be that people who lose their jobs due to import competition are able to find new jobs within a reasonable frame of time such that unemployment is not an issue.

**APPLICATION**

Manufacturing and Services in the United States: Employment and Wages across Sectors

In most industrial countries such as the United States, the service sector is large relative to manufacturing, particularly compared with agriculture. For the United States, employment continues to shift away from manufacturing and into the service sector. As shown in Figure 3-6, whether measured in terms of the number of workers or as a percentage of total employment, employment in manufacturing has been on the decline since the 1970s. From Figure 3-7 we see that, although the real hourly earning of production/manufacturing workers is higher than those of services as a whole, this is
not the case if we disaggregate information service from overall general services, which includes retail.

Moreover, a closer look at employment in manufacturing and services shows that between 2003 and 2005, 0.8 million workers were displaced or laid off in manufacturing as compared with 2.3 million in services. More notably, Table 3-1 shows that of the 64% of the manufacturing workers that were re-employed by January 2006, about half (49%) earned less in their new jobs, whereas 68% of the displaced workers in services that were re-employed by January 2006, 56% of them earned the same or more in their new jobs.

**APPLICATION**

**Trade Adjustment Assistance Programs:** 
**Financing the Adjustment Costs of Trade**

We often talk about how an economy can benefit by engaging in international trade. However, it is clear that not all sectors within the economy enjoy the overall gains from trade. The question then is whether it is the role of the government to temporarily assist those who lose their jobs due to foreign competition. In the United States, workers displaced by import competition may qualify for compensation through the Trade Adjustment Assistance (TAA) program. In addition, there is a special TAA program for those laid off due to competition from Canadian or Mexican imports under the North American Free Trade Agreement (NAFTA).

**HEADLINES**

**Service Workers Are Now Eligible for Trade Adjustment Assistance**

The Trade Adjustment Assistance (TAA) program, which was introduced by President Kennedy in 1962, was brought into the twenty-first century by the stimulus bill passed in 2009. TAA was changed in three major ways: more workers are now eligible and service workers are now fully eligible; training support was raised from $220 to $575 million; and the bill created a special Labor Department TAA office to ensure eligible workers are aware of their options.

**3 Earnings of Capital and Land**

In this section, we examine the effect of an increase in the relative price of manufactures on the rental of capital and land. In particular, which of the two specific factors gain when the economy engages in international trade according to the specific-factors model?

**Determining the Payments to Capital and Land**

Denoting $Q_{A}$ as the output in agriculture and multiplying by its price gives revenue earned in the industry. To determine the total payment to the specific factor, we subtract the wage payment, $W \cdot L_{A}$, from the revenue. Using the same method we obtain the payment to capital as follows:
Payments to capital = \( P_M \cdot Q_M - W \cdot L_M \)

Payments to land = \( P_A \cdot Q_A - W \cdot L_A \).

Letting \( T \) represent the quantity of land in acres and \( K \) signifying the number of physical capital, we can use the preceding equations to show the rental on capital (earning per capital), \( R_K \), and the rental on land (earning per acre), \( R_T \), by the following:

\[
R_K = \frac{\text{Payments to capital}}{K} = \frac{P_M \cdot Q_M - W \cdot L_M}{K},
\]

\[
R_T = \frac{\text{Payments to land}}{T} = \frac{P_A \cdot Q_A - W \cdot L_A}{T}.
\]

Alternatively, we could calculate the rentals by multiplying the marginal product of the specific factor by its price,

\[
R_K = P_M \cdot MPK_M \quad \text{and} \quad R_T = P_A \cdot MPT_A.
\]

Similar to the formulation for wage, \( MPK_M \) is the marginal product of capital in manufacturing although \( MPT_A \) is the marginal product of land in agriculture.

**Change in the Real Rental on Capital** To understand the effect of an increase in the price of manufactures on the rental on capital, holding agriculture price fixed, recall that due to the change in the relative price of manufactures, the wage rises throughout the economy. With the higher wage labor shifts from agriculture into manufacturing, which increases the marginal product of capital. Rewriting in notational format we have,

\[
P_M \uparrow \Rightarrow \begin{cases} L_M \uparrow, \text{ so that } MPK_M = R_K / P_M \uparrow \\ L_A \downarrow, \text{ so that } MPT_A = R_T / P_A \downarrow \end{cases}
\]

where the increase in the marginal product of capital implies that the real rental on capital in terms of the manufactured good, \( R_K / P_M \), also goes up. In addition to their gains in terms of manufactured good, capital owners enjoy a raise in the real rental on capital in terms of food, \( R_K / P_A \), because \( R_K \) has increased although \( P_A \) is fixed. Therefore, capital owners are clearly better off when the price of the good using their specific factor rises.

**Change in the Real Rental on Land** Contrary to the case for capital, the loss of labor to manufacturing leads to a fall in the marginal product of agriculture. It follows that the decline in \( MPT_A \) means that the real rental on land in terms of food has fallen. Moreover, landowners additionally suffer in terms of their ability to purchase manufactures because the price of the manufactured good has gone up. Consequently, landowners are clearly worse off when the price of the good not specific to their factor rises.

**Summary** The general conclusion is given by the following: *An increase in the relative price of an industry’s output will increase the real rental earned by the factor specific to that industry, but will decrease the real rental of factors specific to other industries.*

In other words, the factors specific to the export industries are winners when an economy engages in trade whereas the specific factors used in import industries are losers following the fall in the relative price of imports.
Numerical Example

Suppose the payments to labor and capital in manufacturing and agriculture are given by the following:

Manufacturing:
- Sales revenue $P_M \cdot Q_M = $50
- Payments to labor $W \cdot L_M = $30
- Payments to capital $R_K \cdot K = $20

Agriculture:
- Sales revenue $P_A \cdot Q_A = $50
- Payments to labor $W \cdot L_A = $30
- Payments to land $R_L \cdot T = $20

We will maintain the preceding assumption that the increase in the relative price of manufactures, $P_M / P_A$, is because of a rise in $P_M$, holding $P_A$ constant. Suppose the following price changes:

Manufacturing: Percentage increase in price $= \Delta P_M / P_M = 20\%$
Agriculture: Percentage increase in price $= \Delta P_A / P_A = 0\%$
Percentage increase in the wage $= \Delta W / W = 10\%$

Change in the Rental on Capital

Using the information given, we will determine the impact of the increase in the price of manufactures on the rentals on capital and land. We begin by rewriting the previous formula for the rental on capital in percentage change. Recall that the rental on capital is given as

$$R_K = \frac{P_M \cdot Q_M - W \cdot L_M}{K}.$$

By including the percentage changes in the price of manufacturing ($\Delta P_M / P_M$), wage ($\Delta W / W$), and rental on capital ($\Delta R_K / R_K$) to this equation we obtain:

$$\frac{\Delta R_K}{R_K} = \frac{\Delta P_M / P_M \cdot P_M \cdot Q_M - \Delta W / W \cdot W \cdot L_M}{R_K \cdot K}.$$

Substituting the information above gives,

$$\frac{\Delta R_K}{R_K} = \frac{20\% \cdot 50 - 10\% \cdot 30}{20} = 35\%.$$

We get that the percentage increase in the rental on capital, 35\%, is far greater than the percentage increase in the relative price of manufacturing, 20\%.

Change in the Rental on Land

To obtain the change in the rental on land, we start with its formula,

$$R_L = \frac{P_A \cdot Q_A - W \cdot L_A}{T},$$

and in a similar approach for the rental on capital, we include the percentage changes for the price of agriculture ($\Delta P_A / P_A$), wage ($\Delta W / W$), and rental
on land \((\Delta R_T / R_T)\). Given our assumption that the price of agriculture remains fixed, we can substitute in zero for the percentage change in the agriculture price and rewrite the equation for the percentage change in rental on land as

\[
\frac{\Delta R_T}{R_T} = -\frac{\Delta W}{W} \cdot \frac{W \cdot L_A}{R_K \cdot T}.
\]

Using the data for agriculture, we get that the fall in the land rent (15%) exceeds the percentage increase in the wage (10%) as follows:

\[
\frac{\Delta R_T}{R_T} = \frac{-10\% \cdot 30}{20} = -15\%.
\]

Note that had the share of revenue received by labor been lower than the share of revenue received by land, the decrease in the rental on land would have been smaller.

**General Equation for the Change in Factor Prices**  We can summarize our finding of the impact of a short-run change in factor prices with the following,

\[
\Delta R_T / R_T < 0 < \Delta W / W < \Delta P_M / P_M < \Delta R_K / R_K, \text{ for } \uparrow P_M
\]

and

\[
\Delta R_K / R_K < \Delta P_M / P_M < \Delta W / W < 0 < \Delta R_T / R_T, \text{ for } \downarrow P_M.
\]

In other words, due to an increase in the relative price of manufacturing, capital owners are better off because the real rental on capital rises by more than the hike in the percentage change in the price of manufactures. Wages also increase but by less than the percentage increase in the price of the manufactured goods, whereas the rental on land falls by a greater percentage than the rise in wages, which means that landowners are worse off with trade.

If instead the price of manufactures was to fall, the situation would be reversed such that landowners would be better off although capital owners would be worse off. Furthermore, landowners would also be better off if the price of agricultural good rises. In particular, we can summarize the effect as,

\[
\Delta R_K / R_K < 0 < \Delta W / W < \Delta P_A / P_A < \Delta R_T / R_T, \text{ for } \uparrow P_A.
\]

**What It all Means**

These general equations show that the specific factor in the sector whose price has increased gains, while the specific factor in the other sector loses. Moreover, the factor “caught in the middle,” namely labor, gains on one hand in terms of its ability to purchase one good and loses in terms of the other.
In other words, the changes in the earnings of the specific factors are dramatic when relative prices fluctuate due to international trade. The reason is that, unlike labor, which is mobile between the sectors, the specific factors can only be employment in the particular industry.

APPLICATION

Prices in Agriculture

The prices of agriculture products such as cotton, palm oil, rice, sugar, rubber, wheat, and wool have declined as countries become productive in growing crops, which results in an increase in the global supply. The specific-factors model predicts that landowners, like the farmers, lose in real terms due to the decrease in the relative price of agriculture.

Coffee Prices

The price of coffee fluctuates greatly because the beans are only grown in developing countries. Shown in Figure 3-8, the real, wholesale prices of coffee often fluctuate. The world coffee prices reached as high as $3.00 per pound in 1986 to a low of 50¢ per pound in 2001. The swing in the world coffee prices is due to excess exports from Vietnam and Brazil. As predicted by the specific-factors model, the dramatic fluctuation in the world price of coffee causes huge swings in the real incomes of land owners in coffee-growing regions in Central America and Asia.

Fair-Trade Coffee

To assist the coffee growers in the developing countries, TransFair USA, an import group, engages in “fair-trade coffee” by avoiding the middlemen and ensuring a minimum price for the farmers. The fixed-fair-trade price is a form of insurance against large fluctuations in the world price, thereby allowing the farmers a more stable source of income. The fair-trade price protects the farmers in a manner similar to the government policy in industrialized countries except that consumers have the option to purchase the higher-priced product.

HEADLINES

Rise in Coffee Prices—Great for Farmers, Tough on Co-ops

Fair-trade cooperatives had difficulties obtaining deliveries from member farmers when the price of coffee beans rose above their agreed fair-trade price of $1.26 per pound. The co-op’s leader convinced the farmers to deliver the coffee by drawing on their sense of loyalty.

4 Conclusion

The specific-factors model is a short-run model in which labor is perfectly mobile between industries although other inputs such as land and capital are specific to the industry in which the factor is used. Under these assumptions, the factor specific to the import-competing industry loses in terms of its ability to purchase the goods produced because of the drop in its relative price from opening to trade. Because the factor facing import competition is immobile, owners of the specific factor experience a fall in the real rental.
contrast, the factor specific to the export industry gains in real terms because its relative price rises when the economy opens to trade. Unlike the specific factors, labor avoids extreme changes in wage because it is able to move between industries. However, when an economy engages in trade, the impact of the change in the relative price has an ambiguous effect on labor. More specifically, for labor, whether there are gains or losses from international trade depends on its preferences because the real wage rises in terms of one good but falls in terms of the other good.

**TEACHING TIPS**

**Tip 1: Coffee Prices and Factor Returns in the Real World**
In this chapter, we discuss the affect of goods’ prices on returns to both fixed and mobile factors of production. Have students look up the most recently available world coffee prices published by the International Coffee Organization (http://www.ico.org/coffee_prices.asp). Ask your students to use this data to predict what has happened to factor return on land in coffee exporting countries.

**Tip 2: U.S. Employment Since the Global Recession**
A major part of this chapter focuses on unemployment and Trade Adjustment Assistance. When this book was written, the global economy was just beginning to recover from a major global recession that greatly affected international trade. Have students investigate the current characteristics of U.S. employment and unemployment. Ask students to visit the Bureau of Labor Statistics and investigate the Labor Force Statistics from the Current Population Survey at http://www.bls.gov/news.release/disp.toc.htm. Here students can explore the most current data on the characteristics of the U.S. employed and unemployed. Have students investigate this data and then discuss their findings in class.

**Tip 3: Discussion about the Global Economy**
Beginning in Chapter 1, there has been a focus on the changing face of trade. This emphasis was continued with our discussion of the TAA being extended to the service industry. Have students discuss why they think this change is important, and how greater global competition in services will affect them.
IN-CLASS PROBLEMS

1. Use the following information to answer the questions below.

**Computers:**
- Sales revenue = $P_c \cdot Q_c = 150$
- Payments to labor = $W \cdot L_c = 75$
- Payments to capital = $R_K \cdot K = 75$

**Barley:**
- Sales revenue = $P_b \cdot Q_b = 150$
- Payments to labor = $W \cdot L_b = 70$
- Payments to land = $R_L \cdot T = 80$

Holding the price of computers constant, suppose the percentage increase in the price of barley is 10% and the percentage increase in wage is 5%.

a. Determine the impact of the increase in the price of barley on the rentals on land.

**Answer:**

\[
\frac{\Delta R_L}{R_L} = \frac{(\Delta P_b / P_b) \cdot P_b \cdot Q_b - (\Delta W / W) \cdot W \cdot L_b}{R_L \cdot T} = \frac{10\% \cdot 150 - 5\% \cdot 70}{80} = 14.4\%.
\]

b. Determine the impact of the increase in the price of barley on the rentals on capital.

**Answer:**

\[
\frac{\Delta R_K}{R_K} = \frac{0 \cdot Q_c - \Delta W \cdot L_c}{K} = \frac{\Delta W \left( W \cdot L_c / R_K \cdot K \right)}{R_K} = -5\% \cdot \left( \frac{75}{75} \right) = -5\%.
\]

c. Determine the impact of the increase in the price on the welfare of labor.

**Answer:**

The impact of the increase in the price of barley on the welfare of labor is ambiguous because labor gains in terms of computers because the price of computers remained constant, while wages increased by 5% but lost in terms of barley because the percentage increase in barley is higher than the percentage change in wage.

2. Summarize your finding in problem 1 using notational format.

\[
\frac{\Delta R_k}{R_k} < 0 < \frac{\Delta W}{W} < \frac{\Delta P_b}{P_b} < \frac{\Delta R_T}{R_T},
\]

for $P_b$.

<table>
<thead>
<tr>
<th>Real rental on capital falls</th>
<th>Change in the real wage is ambiguous</th>
<th>Real rental on land rises</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{\Delta R_k}{R_k}$</td>
<td>$\frac{\Delta W}{W}$</td>
<td>$\frac{\Delta P_b}{P_b}$</td>
</tr>
</tbody>
</table>

3. If, instead of the situation given in problem 1, the price of computers was to fall, would landowners or capital owners be better off? Explain. How would the decrease in the price of computers affect labor? Explain.

**Answer:**

Similar to the situation given in problem 1, capital owners would be worse off because the rental on capital would fall by more than the decrease in the computer price. Landowners would be better off as the rental on land rises even without the increase in the price of barley. The effect on labor because of the decrease in the price of computers is ambiguous. Wages fall, so labor is worse off in terms of barley, but because the drop in wage is less than the percentage decrease in the manufactured good, labor gains in terms of computers.

\[
\frac{\Delta R_k}{R_k} < \frac{\Delta P_c}{P_c} < \frac{\Delta W}{W} < 0 < \frac{\Delta R_T}{R_T},
\]

for $P_b$.

<table>
<thead>
<tr>
<th>Real rental on capital falls</th>
<th>Change in the real wage is ambiguous</th>
<th>Real rental on land rises</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{\Delta R_k}{R_k}$</td>
<td>$\frac{\Delta W}{W}$</td>
<td>$\frac{\Delta P_c}{P_c}$</td>
</tr>
</tbody>
</table>

4. What is fair trade?

**Answer:**

Fair trade is the process by which non-governmental organizations such as TransFair USA assist farmers in developing countries by selling agricultural commodities such as coffee beans directly to consumers in industrial countries. By avoiding the local buyers, millers, shippers, and other middlemen, these import groups are able to ensure a minimum price for the farmers.
5. Ashland is considering whether to engage in the international trade of rice and furniture. Suppose that the world price of rice is lower than Ashland's no-trade price but its no-trade furniture price is lower than the world price. Assume that land is specific to the production of rice and that labor is free to move across sectors. Do you think the landowners will support the move to free trade? Explain.

**Answer:** Landowners will not support the move because the world price of rice is lower than Ashland's no-trade price. By engaging in trade, the landowners would be worse off because the rental on land will fall due to the decrease in the price of rice.

6. When labor shifts from agriculture to manufacturing, why does the marginal product of capital increase while the marginal product of land falls?

**Answer:** When labor shifts from agriculture to manufacturing, the marginal product of land falls because there are fewer laborers to work on each acre of land. By contrast, the increase in the quantity of labor used in manufacturing will raise the marginal product of the capital because there are more laborers available to work on the machinery.

7. Between 2005 and 2007, displaced workers in the service industries are better off relative to those in the manufacturing industries. Comment.

**Answer:** According to Table 3-1, although the number of workers displaced between 2005 and 2007 is significantly higher (more than double) in the service industries relative to the manufacturing industries, 68% of the workers in the service industry found employment by January 2008, with 56% of those newly employed workers earning the same or more in their new jobs. By contrast, 64% of the displaced workers in manufacturing were re-employed by January 2006 and only 51% received the same or higher pay in their new positions.

8. Assuming that labor is mobile, is it true that wages always must be equal across the sectors in the specific-factors model?

**Answer:** Yes, labor will continue to shift from the low-wage sector to the high-wage sector until the wages are equalized.

9. Home, a small, open economy, uses a mobile factor (labor) and two specific factors (drylands and wetlands) to produce two goods, cactus and rice. Dryland is only productive in growing cactus and wetlands can only grow rice. Suppose the world-relative price of cactus is higher than Home. Determine the effect of this price increase on the real wage and real returns on the different types of land.

**Answer:** Because the world-relative price of cactus is higher than Home, the small country will export cactus, which will lead to an increase in the real rental on drylands. Real wage will increase in terms of rice because of the increase in the price of cactus but will fall in terms of cactus because the percentage rise in the price of cactus is higher than the percentage increase in wage.
Trade and Resources:
The Heckscher-Ohlin Model

Notes to Instructor

Chapter Summary
This chapter presents the Heckscher-Ohlin model with two factors (capital and labor), two goods (computers and shoes), and two countries (Home and Foreign). A test of the model is discussed with Leontief's paradox. Additionally, this chapter, like the last, discusses the affect of trade on factor prices. The “sign test” in the Heckscher-Ohlin model is discussed in the Appendix.

Comments
Note that this chapter covers only two theorems of the Heckscher-Ohlin model—the Heckscher-Ohlin theorem and the Stolper-Samuelson theorem. The other two theorems—the Rybczynski theorem and Factor Price Insensitivity—are deferred to the next chapter, in an effort to break the material into smaller pieces.

Unlike the previous chapters, a discussion of the theory is followed by an empirical test. This concept is possibly new to students and could be highlighted to generate interest in the topic. Moreover, although students are quite familiar with graphing supply and demand from their principles course, place emphasis on teaching the export supply and import demand curves, particularly because the derivation of these curves requires an understanding of the relationship between the no-trade and free-trade relative prices. Sim-
ilarly, the topic of relative demand and supply may also benefit from additional attention as the shift of the curves due to changes in the relative price may not be immediately obvious to the students because the curves are in ratios (i.e., horizontal axis gives the ratio of labor to capital and the vertical axis has the ratio of wage to rental on capital).

**Lecture Notes**

**Introduction**

We begin the chapter with a comparison between the Ricardian model, in which trade occurs due to differences in technology between countries giving rise to their comparative advantage, and the Heckscher-Ohlin model, in which uneven distribution in resources leads countries to trade with one another. The Heckscher-Ohlin model also differs from the specific-factors model in that factors of production can move between industries because the model is set in the long run. The model was developed to explain the “golden age” of international trade between 1890 and 1914, during which there was an increase in the ratio of trade to gross domestic product (GDP) coinciding with improvements in transportation.

**1 Heckscher-Ohlin Model**

The Heckscher-Ohlin model consists of two factors (capital and labor), two goods (computers and shoes), and two countries (Home and Foreign). The total amount of capital \( K \) in an economy is given by the sum of the capital used in shoes, \( K_s \), and computers, \( K_c \). The total available labor \( L \) in the economy is synonymously equal to the labor used in shoes, \( L_s \), and computers, \( L_c \).

**Assumptions of the Heckscher-Ohlin Model**

The six assumptions of the Heckscher-Ohlin model are as follows:

**Assumption 1:** Both factors can move freely between the industries.

The implication of the first assumption is that the rental on capital, \( R \), is identical across the two industries. If one industry has a higher rental, it would attract capital from the industry with the lower rental, leading the rates to adjust until they are equal between the industries. The same reasoning also implies that the wage earned by labor, \( W \), is the same across the industries.

**Assumption 2:** Shoe production is labor-intensive, that is, it requires more labor per unit of capital to produce shoes than computers, so that \( L_s / K_s > L_c / K_c \).

The second assumption states how intensive the factors are in the production of each good. Namely, computer production is capital-intensive, requiring more capital per worker than the production of shoes. Because shoe production is labor-intensive, the relative demand curve in shoes, \( L_s / K_s \), is to the right of the relative demand curve in computers, \( L_c / K_c \), in Figure 4-1.
where the horizontal axis gives the ratio of labor to capital used in production and the vertical axis denotes the ratio of the labor wage to the capital rental.

**Assumption 3:** Foreign is labor abundant, by which we mean that the labor/capital ratio in Foreign exceeds that in Home, \( \frac{L^*}{K^*} > \frac{L}{K} \). Equivalently, Home is capital abundant, so that \( \frac{K}{L} > \frac{K^*}{L^*} \).

The third assumption distributes the resources unevenly across the two countries, with Home being capital-abundant whereas Foreign is labor-abundant.

**Assumption 4:** The final outputs, shoes and computers, can be traded internationally, but labor and capital do not move between countries.

The forth assumption allows the final goods to move between the countries but not the factors of production.

**Assumption 5:** The technologies used to produce the two goods are identical across the countries.

From the fifth assumption, we see that each good is produced using the same technology across the two countries. In other words, across both countries, each industry has the same factor intensity.

**Assumption 6:** Consumer tastes are the same across countries, and preferences for computers and shoes do not vary with a country’s level of income.

The sixth assumption implies that although the poorer country would consume less of both goods than the richer country, the ratio of shoes to computers expenditure is the same across both countries.

---

**APPLICATION**

**Are Factor Intensities the Same across Countries?**

In the United States, footwear production is more capital-intensive than call centers because of the expensive automated-manufacturing machines used by a New Balance plant. However, there is a “reversal” of factor intensities in India, where call centers are more capital-intensive than footwear production using labor-intensive sewing machines. Another example of a reversal of factor intensities between countries is in the agriculture sector. Although farmers in the United States use costly computerized equipment to cultivate their farms, their counterparts in developing countries use little or no mechanized equipment because labor is cheap relative to the cost of capital.

---

**NETWORK**

The New Balance Web site can be found through the following link: http://www.newbalance.com. In addition to producing shoes, the company makes apparel, eyewear, headwear, sport bags, fitness equipment, and shoe- and apparel-care products.
No-Trade Equilibrium

Production Possibility Frontiers Figure 4-2 shows the production possibility frontiers (PPFs) for Home in panel (a) and Foreign in panel (b). The bowed-out PPF is biased toward computer (on the horizontal axis) for Home because Home is capital-abundant and the production of computers is capital intensive. For Foreign, the PPF skews more toward shoes (on the vertical axis) because shoe production is labor intensive and Foreign is labor abundant.

Indifference Curves With the assumption of common consumer tastes across the countries, we add an identical indifference curve to each country’s PPF. The tangency of the indifference curve and the PPF gives the relative price of computers for Home, \((P_C / P_S)^A\), and Foreign, \((P_C^* / P_S^*)^{A*}\), in panels (a) and (b), respectively.

No-Trade Equilibrium Price The no-trade equilibrium for Home is at point \(A\), with production of computers and shoes given by \(Q_{C1}\) and \(Q_{S1}\). The no-trade equilibrium for Foreign is shown by point \(A^*\), at which outputs are denoted by \(Q^*_{C1}\) for computers and \(Q^*_{S1}\) for shoes. The slope of the price line is relatively steeper for Foreign than for Home, reflecting the higher relative price of computers in the labor-abundant country.

Free-Trade Equilibrium

Home Equilibrium with Free Trade With free trade, the equilibrium relative price of computers is between the no-trade relative prices found at Home and Foreign. More specifically, panel (a) of Figure 4-3 shows that the free-trade equilibrium price of computers, \((P_C / P_S)^W\), is steeper than the no-trade price at Home (see Figure 4-2) because its no-trade price is lower than that of the foreign country. Given the higher world relative price, Home further specializes in the production of computers by moving from point \(A\) to point \(B\), where \(Q_{C2} > Q_{C1}\) and \(Q_{S2} < Q_{S1}\). By engaging in trade, Home can consume on a higher indifference curve at point \(C\). Using points \(B\) and \(C\), we can create a “trade triangle,” where the height represents the amount of shoes imported \((Q_{S3} - Q_{S2})\) by Home and the base gives export of computers \((Q_{C2} - Q_{C1})\).

Panel (b) of Figure 4-3 shows the Home exports of computers versus the relative price. The Home relative price without trade given by point \(A\) in panel (a) corresponds to point \(A\) in panel (b) with zero computer exports. Given the higher free-trade relative price, Home exports the difference between the amounts produced and consumed, shown by point \(D\) in panel (b). Home export supply curve of computers is derived from connecting points \(A\) and \(D\).

Foreign Equilibrium with Free Trade In panel (a) of Figure 4-4, the Foreign no-trade equilibrium is at point \(A^*\). Because the Foreign no-trade relative price is higher than at Home, the world equilibrium price of computers, \((P_C / P_S)^W\), is flatter than the no-trade Foreign price, \((P_C^*/ P_S^*)^{A*}\). Facing a lower relative price of computers under free trade, Foreign will increase the production of shoes by moving from point \(A^*\), \((Q_{C1}, Q_{S1})\), to point \(B^*\), \((Q_{C2}, Q_{S2})\), such that \(Q_{S2} > Q_{S1}\) and \(Q_{C2} < Q_{C1}\). Engaging in trade at the world relative price, Foreign consumes at a higher indifference curve at point \(C^*\), \((Q^*_{C3}, Q^*_{S3})\). Connecting points \(B^*\) and \(C^*\), we form a “trade triangle” similar to that at Home except now the base is Foreign’s imports of computers and the height
is Foreign’s export of shoes. Foreign’s import demand curve for computers is given in panel (b) of Figure 4-4.

**Equilibrium Price with Free Trade** Putting together Home’s export supply curve for computers and Foreign’s import demand curve for computers gives the equilibrium relative price of computers with free trade as shown in Figure 4-5. At the world relative price of computers, the amount of computers imported by Foreign is exactly equal to the quantity exported by Home, \( (Q_{C2} - Q_{C3}) = (Q_{C3}^* - Q_{C2}^*) \). This implies that the trade triangles of the two countries are of identical size.

**Pattern of Trade** The pattern of trade can be determined from the free-trade equilibrium. Namely, a country will export the good that uses intensively the factor of which it has an abundance. This means that Home will export the capital-intensive good (computers) and Foreign will export the labor-intensive good (shoes) because Home is capital-abundant whereas Foreign is labor-abundant. This finding is summarized by the following Heckscher-Ohlin theorem.

**Heckscher-Ohlin Theorem** With two goods and two factors, each country will export the good that uses intensively the factor of production it has in abundance and will import the other good.

### 2 Testing the Heckscher-Ohlin Model

In this section, we investigate different methods to empirically test the Heckscher-Ohlin Model. We begin with one of the first such tests, and then move to more recent attempts.

**Testing the Heckscher-Ohlin Theorem: Leontief’s Paradox**

Using 1947 data for the United States, Leontief measured the amount of capital and labor required to produce $1 million worth of U.S. exports. The measurement indicated that the capital–labor ratio used in export production was $14,000 per worker. Applying U.S. technology to measure the labor and capital used in producing imports, Leontief found that the capital–labor ratio for imports was $18,200 per worker. Because the United States is believed to be abundant in capital in 1947, the Heckscher-Ohlin theorem predicts that the United States would export capital-intensive goods and import labor-intensive goods. Leontief’s findings, called the “Leontief’s paradox,” indicated that the U.S. imports were capital-intensive and U.S. exports were labor-intensive.

**Explanations** Many explanations have been offered to explain Leontief’s paradox, including the following:

- Technologies in the United States and rest of the world may not have been the same as the Heckscher-Ohlin Theorem assumes.
- Leontief’s test ignored other factors of production, such as land, in which the United States may have been abundant.
- Leontief did not distinguish between skilled and unskilled labor.
- The data for 1947 might be unusual due to World War II just ending and the rebuilding of Europe, in which the United States was engaged.
- The United States was not completely open to trade, as the Heckscher-Ohlin Theorem assumes.
Many of these explanations focus on the importance of more than two factors or the ability of factors (such as skilled vs. unskilled labor). In the remainder of this section, we discuss research aimed to redo Leontief’s test to incorporate these additional complexities.

**Endowments in the New Millennium**

The method for measuring factor abundance differs when we consider more than two factors of production. The general definition of factor abundance is given by the country’s share of that factor as compared with its share of world GDP. A country is **abundant in that factor** if its share of that factor exceeds its share of world GDP. Conversely, if its share of world GDP is greater than its share in the factor, the country is **scarce in that factor**.

**Capital Abundance** Using the general definition and data from Figure 4-6, we see that in 2000 the United States was physical-capital abundant because its share of the world’s capital was 24% and its share of world GDP was 21.6%. Of the seven selected countries, three were abundant in capital (United States, Japan, and Germany) and the other four were scarce in capital (China, India, France, and Canada).

**Labor and Land Abundance** Using a similar comparison, Figure 4-6 shows that the United States is abundant in research and development (R&D) scientists and skilled labor, but is scarce in less-skilled labor, illiterate labor, and arable land. As with the United States, China is abundant in R&D scientists. By contrast, India is scarce in R&D scientists but abundant in skilled labor, semiskilled labor, and illiterate labor. Relative to the other six countries, Canada is abundant in arable land.

**Differing Productivities across Countries**

Although the extended Heckscher-Ohlin model is better at predicting the pattern of international trade by allowing for many goods, factors, and countries, we can further examine the accuracy of the model by dropping the assumption of identical technologies across countries. By allowing for differences in productivities, we can calculate a country’s **effective labor force**, which measures how much output the labor force can produce.

**Measuring Factor Abundance Once Again** Measuring whether a country is **abundant in that effective factor** or **scarce in that effective factor** is similar to the method we used earlier except that we now compare its share of the effective factor endowment, defined as the actual amount of a factor found in a country multiplied by its productivity, with its share of world GDP.

**Effective R&D Scientists** To account for the differences in productivities across countries due to the availability of laboratory equipment, we measure effective R&D scientists by multiplying the actual number of R&D scientists by the amount of R&D spending per scientist. The first two columns of Figure 4-7 show each country’s share of world R&D scientists where the productivity differences are corrected for in the second bar. With the correction, the share of effective R&D scientists in the United States increases along with Japan and India. However, this share falls by half for China, suggesting that it is scarce in effective R&D scientists.
Effective Arable Land  The effective amount of arable land is defined as the actual arable land in a country times its productivity in agriculture. After accounting for the differing productivities in arable land, we find that the United States is neither abundant nor scarce in effective arable land because its share of the world total is about equal to its share of the world's GDP. This conclusion is verified by the data. From Table 4-2 we can see that even though the U. S. is a net exporter of agricultural goods, it is some years a net exporter and some years a net importer of food.

HEADLINES

China Drawing High-Tech Research from the United States

Applied Materials, a U.S. firm that is currently the world's largest supplier of equipment used to make semiconductors, has built its newest and largest research labs in Beijing, China. Applied Materials is just one of many firms tapping into China's huge markets and its abundant, cheap, and highly skilled engineers.

Leontief's Paradox Once Again

Going back to data from the time periods studied by Leontief, with our newly developed concepts of effective abundance we can redo Leontief's factor calculations, taking into account the productivity of the U. S. workforce. To do this we estimate productivity with wages, which we can see from Figure 4-9 is a defensible strategy. By this method, we see that in 1947 the United States actually had 43 percent of the world's "effective" labor and only 37 percent of world GDP, making the United States abundant in effective labor, and thus solving Leontief's Paradox.

3 Effects of Trade on Factor Prices

In this section, we determine the impact of trade on the wage and rental earned by labor and capital, respectively, when a country faces the world relative price, which differs from the no-trade relative price.

Effect of Trade on the Wage and Rental of Home

Economy-Wide Relative Demand for Labor  Recall that the total amount of labor (capital) in an economy is equal to the sum of the labor (capital) in each industry, i.e., \( L_c + L_s = L (K_c + K_s = K) \). Dividing total labor by total capital, we get the supply of labor relative to capital or relative supply:

\[
\frac{L}{K} = \frac{L_c + L_s}{K} = \frac{L_c}{K_c} \cdot \left( \frac{K_c}{K} \right) + \frac{L_s}{K_s} \cdot \left( \frac{K_s}{K} \right)
\]

Relative Supply  Relative Demand

The relative demand or demand for labor relative to capital, shown on the right-hand side, is a weighted average of the labor/capital ratio in each industry. The weighted average is calculated by multiplying the labor/capital ratio
for each industry \( (L_C / K_C \text{ and } L_s / K_s) \) by the shares of total capital employed in each industry \( (K_C / K \text{ and } K_s / K) \).

The equilibrium relative wage at Home is determined by the intersection of the relative supply and relative demand curves at point \( A \) as shown in Figure 4-10. Because the relative supply curve depends on the total amount of factor resources in the economy and not on the relative wage, it is represented by a vertical line. The economy-wide relative demand for labor (RD curve) is an average of the demand for labor relative to capital in each industry.

**Increase in the Relative Price of Computers** Because of free trade, Home faces a higher relative price of computers, which drives it to further specialize in the production of computers, shifting away resources from the production of shoes. The increase in the production of the capital-intensive good (computers) leads to a change in the relative demand for labor. More specifically, for the relative demand for labor in the economy, we put more weight toward computers, a rise in \( (K_C / K) \), and less weighted toward the shoe industry, a fall in \( (K_s / K) \), because capital has shifted to the computer industry. Figure 4-12 shows this change in the weights as a leftward shift of the relative demand curve from \( RD_1 \) to \( RD_2 \), giving the new equilibrium at point \( B \).

With production specializing in computers, the fall in the relative demand for labor in the shoe industry causes a decrease in the relative wage from \( (W / R) \) to \( (W / R) \). The lower relative wage in turn induces an increase in the number of workers hired per unit of capital in each industry, shown by the movement along the relative demand curves for shoes \( (L_s / K_s) \) to \( (L_s / K_s) \) and computers \( (L_C / K_C) \) to \( (L_C / K_C) \). Thus, the increase in the relative price of computers resulting from free trade leads to a rise in the labor/capital ratio in both industries. The rise in the labor/capital ratio in both shoes and computers results from labor being “freed up” as production shifts from shoes to computers. In particular, the additional labor per unit of capital released from the shoes exceeds the requirement necessary to operate the capital in computers. The change in the relative supply and relative demand due to an increase in the relative price of computers can be summarized by the following:

\[
\frac{\bar{L}}{\bar{K}} = \frac{L_C}{K_C} \cdot \left( \frac{K_C}{\bar{K}} \right) + \frac{L_s}{K_s} \cdot \left( \frac{K_s}{\bar{K}} \right)
\]

<table>
<thead>
<tr>
<th>Relative Supply</th>
<th>Relative Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change</td>
<td>( \uparrow )</td>
</tr>
</tbody>
</table>

**Determination of the Real Wage and Real Rental**

**Change in the Real Rental** The rental on capital in computers (shoes) is equal to its marginal product multiplied by the price of computers (shoes):

\[
R = P_C \cdot MPK_C \quad \text{and} \quad R = P_s \cdot MPK_s
\]

Because the labor/capital ratio increases in both industries due to the higher world relative price of computers, the marginal product of capital also increases in both shoes and computers. Rearranging the previous equations, we get

\[
MPK_C = \frac{R}{P_C} \uparrow \quad \text{and} \quad MPK_s = \frac{R}{P_s} \uparrow,
\]
where $R / P_C (R / P_S)$ gives the quantity of computers (shoes) a capital owner at Home can purchase with the rental. Because the marginal product of capital increases in both industries, we see that the real rental on capital increases in terms of shoes and computers. Namely, the capital owner benefits from the increase in the relative price of computers when Home engages in trade.

More generally, an increase in the relative price of a good (computers) will benefit the factor of production (capital) used intensively in producing that good (computers are capital-intensive).

**Change in the Real Wage** Similarly, the wage in computers (shoes) is equal to its marginal product multiplied by the price of computers (shoes):

$$W = P_C \cdot MPL_C$$

and

$$W = P_S \cdot MPL_S$$

However, unlike the case for capital, the law of diminishing returns tells us that the increase in the labor/capital ratio (i.e., more labor per unit of capital) will lead to a decrease in marginal produce of labor in both industries. Rearranging the preceding equations gives:

$$MPL_C = W / P_C \downarrow$$

and

$$MPL_S = W / P_S \downarrow$$

where we see that labor experiences a decrease in real wage in terms of the quantity of computers $(R / P_C)$ and shoes $(R / P_S)$ it can purchase at Home with its wage. Thus, labor is worse off in real terms as a result of the increase in the relative price of computers from free trade.

The situation for Foreign would be the opposite because it faces a lower world relative price of computers. More specifically, by opening up to trade, Foreign experiences a fall in real terms in rental on capital and a rise in real terms in wage. This means that labor in Foreign is better off with free trade and the capital owner is worse off. This finding is summarized by the following **Stolper-Samuelson theorem**:

**Stolper-Samuelson Theorem** In the long run, when all factors are mobile, an increase in the relative price of a good will increase the real earnings of the factor used intensively in the production of that good and decrease the real earnings of the other factor.

An alternative statement is that the abundant factor gains from trade, and the scarce factor loses from trade.

**Changes in the Real Wage and Rental: A Numerical Example**

Suppose the following:

**Computers:**

Sales revenue $= P_S \cdot Q_C = $150

Earnings of labor $= W \cdot L_C = $50

Earnings of capital $= R \cdot K_C = $100

**Shoes:**

Sales revenue $= P_S \cdot Q_S = $150

Earnings of labor $= W \cdot L_S = $100

Earnings of capital $= R \cdot K_S = $50

Note that shoes are more labor-intensive than computers because the share of total revenue paid to labor in shoes $(100 / 150 = 66.7\%)$ is more than that share in computers $(50 / 150 = 33.3\%)$. Under free trade, the relative price of computers rises as follows:
Computers: Percentage increase in price = $\Delta P_c / P_c = 5\%$

Shoes: Percentage increase in price = $\Delta P_s / P_s = 0\%$

To determine the impact of the higher relative price of computers on the rental on capital for each industry, we subtract the payments to labor from total sales revenue and divide the difference by the amount of capital:

$$R = \frac{P_c \cdot Q_c - W \cdot L_c}{K_c}, \text{ for computers}$$

$$R = \frac{P_s \cdot Q_s - W \cdot L_s}{K_s}, \text{ for shoes}$$

We now add in the information pertaining to the increase in the price of computers:

$$\Delta R = \frac{\Delta P_c \cdot Q_c - \Delta W \cdot L_c}{K_c}, \text{ for computers}$$

$$\Delta R = 0 - \frac{\Delta W \cdot L_s}{W \cdot K_s}, \text{ for shoes}$$

Rewriting the previous equations in terms of percentage changes, we have the following:

$$\frac{\Delta R}{R} = \left( \frac{\Delta P_c}{P_c} \right) \left( \frac{P_c \cdot Q_c}{R \cdot K_c} \right) - \left( \frac{\Delta W}{W} \right) \left( \frac{W \cdot L_c}{R \cdot K_c} \right), \text{ for computers}$$

$$\frac{\Delta R}{R} = 0 - \left( \frac{\Delta W}{W} \right) \left( \frac{W \cdot L_s}{R \cdot K_s} \right), \text{ for shoes}$$

where $\Delta P_c / P_c$ is the percentage change in the price of computers, $\Delta W / W$ is the percentage change in the wage, and $\Delta R / R$ is the percentage change in the rental on capital.

Substituting the numbers given and subtracting one equation from the other, we get:

$$\frac{\Delta R}{R} = 5\% \cdot \left( \frac{150}{100} \right) - \left( \frac{\Delta W}{W} \right) \left( \frac{50}{100} \right), \text{ for computers}$$

Minus: $$\frac{\Delta R}{R} = 0 - \left( \frac{\Delta W}{W} \right) \left( \frac{100}{50} \right), \text{ for shoes}$$

Equals: $$0 = 5\% \cdot \left( \frac{150}{100} \right) + \left( \frac{\Delta W}{W} \right) \left( \frac{150}{100} \right).$$

which gives the change in wages as

$$\left( \frac{\Delta W}{W} \right) = -\frac{7.5\%}{1.5} = -5\%.$$ 

In other words, a 5% increase in the price of computers resulting from free trade leads to a fall in the wage by 5%. This means that the real wage,
measured in terms of labor being able to purchase either computers or shoes, has fallen, so labor is worse off.

The change in the rental paid to capital \((\Delta R / R)\) can be found by substituting the percentage change in the wage \((-5\%)\) in the preceding equations for shoes or computers. For example,

\[
\frac{\Delta R}{R} = -(-5\%)(\frac{100}{50}), \text{ change in rental.}
\]

Solving the equation, we get that the rental on capital increases by 10% when the price of computers rises by 5%. The capital owner is better off from trade because the rental percentage increased by more than the percentage increase in the price of computers. In addition, with the price of shoes remaining constant while the rental on capital increases, the capital owner also gains in terms of shoe-purchasing power.

**General Equation for the Long-Run Change in Factor Prices** The long-run results due to an increase in the price of computers are given by the following:

\[
\frac{\Delta W}{W} / W < 0 < \frac{\Delta P_C}{P_C} < \frac{\Delta R}{R}
\]

Real wage falls

Real rental rises

A decrease in the price of computers would lead to a reverse of the inequalities so that the real rental falls whereas the real wage increases. For an increase in the price of shoes, the long-run results are

\[
\frac{\Delta R}{R} / R < 0 < \frac{\Delta P_S}{P_S} < \frac{\Delta W}{W}
\]

Real rental falls

Real wages increases

The preceding equations relating the changes in product prices to changes in factor prices are called the “magnification effect,” because changes in prices of goods have magnified effects on the earning of factors of production.

**APPLICATION**

**Opinions toward Free Trade**

Workers’ attitudes toward limitations on free trade depend on whether we are in the short run or long run. More specifically, assuming that workers earn a portion of the rental on the specific factor in their industry, the short-run specific-factor model predicts that workers in export industries will be against placing limits on free trade because the specific factor in their industry gains, whereas workers in import industries will favor limits on free trade because the specific factor in that industry loses. Therefore, in the short run, whether workers support or oppose free trade depends on the industry of employment. By contrast, from the long-run Heckscher-Ohlin model, an increase in the relative price of the good exported benefits the factor of production used intensively while harming the other factor, regardless of the industry in which the factors are employment.

In 1992, the National Election Studies (NES) conducted a survey asking Americans whether they support or oppose free trade. The results indicated that the industry of employment does not provide strong evidence in ex-
plaining the respondents’ attitudes toward free trade. Instead, workers’ skill level, measured by their wages or years of education, was more important. In other words, as predicted by the Heckscher-Ohlin model, skilled workers favor free trade and workers with lower wages or fewer years of education tend to support import restrictions.

In addition to skill level, the survey also shows that home ownership plays a role in workers’ attitudes toward limits on free trade. In particular, home-owning workers in communities facing import competition are more likely to oppose free trade. However, workers who own homes in communities where the industries benefit from export opportunities are likely to support free trade. By considering a house as a specific factor, the results of the NES survey supports the short-run specific-factors model in which workers value the returns on their housing asset similar to the way in which owners of specific-factors facing import competition are concerned about the rental earned by their factor of production.

4 Conclusion
By focusing on the relative amount of labor and capital used in production, the Heckscher-Ohlin model predicts the gainers and losers in each country when it engages in international trade. More specifically, the model suggests that the factor used intensively in the production of the export good experiences real term gains when its relative price increases as a result of trade, although the other factor suffers a real loss in terms of its ability to purchase either good.

TEACHING TIPS

Tip 1: Heckscher-Ohlin Game
This is most likely the first time students will be exposed to an international trade model such as the Heckscher-Ohlin model. To get students comfortable with the concept of factor endowments determining the patterns of international trade, have them play the Heckscher-Ohlin Trade game developed by Nobelprize.org. It can be found at http://nobelprize.org/educational/economics/trade/.

Tip 2: Discussion of Factor Intensity Reversal
One key assumption in the H-O model is the absence of Factor Intensity Reversal, such as is observed in New Balance factories in New England. Have students try to come up with other examples of Factor Intensity Reversal from their own lives.

Tip 3: Testing H-O with World Bank Data
In this chapter we attempted to test the predictions of the H-O model by comparing countries’ share of world GDP with their factor endowment to predict trade flows. Ask students to collect data similar to that shown in Fig-
1. What is paradoxical about the results of Leontief's test of the Heckscher-Ohlin model?

**Answer:** According to the Heckscher-Ohlin model, the United States, a capital-abundant country, is predicted to export the capital-intensive good. However, data for 1947 show that the capital/labor content of import for the United States was larger than its exports.

2. Suppose Indonesia and Canada trade in sarongs and beer. Use the following data for Canada to answer the questions:

**Sarongs:**
- Sales revenue = \( P_s \times Q_s = 80 \)
- Payments to labor = \( W \times L_s = 80 \)
- Payments to capital = \( R \times K_s = 40 \)
- Percentage increase in the price = \( \Delta P_s / P_s = 25\% \)

**Beer:**
- Sales revenue = \( P_B \times Q_B = 80 \)
- Payments to labor = \( W \times L_B = 30 \)
- Payments to capital = \( R \times K_B = 60 \)
- Percentage increase in the price = \( \Delta P_B / P_B = 0\% \)

**a.** Which industry is labor intensive?

**Answer:** Because \( W \times L_s / R \times K_s > W \times L_B / R \times K_B \), it implies that \( L_s / K_s > L_B / K_B \) so that sarongs are labor intensive.

**b.** Give the percentage change in the rental on capital.

**Answer:**

\[
\frac{\Delta R}{R} = \left[ \frac{(\Delta P_s / P_s) P_s Q_s - (\Delta W / W) WL_s}{R K_s} \right] = \left[ \frac{(25\%) (80) - (\Delta W / W)}{(80)} \right] / 40 \\
= 50\% - (\Delta W / W)(80/40)
\]

**For beer:**

\[
\frac{\Delta R}{R} = \left[ \frac{(\Delta P_B / P_B) P_B Q_B - (\Delta W / W) WL_B}{R K_B} \right] = \left[ \frac{(0\%) (80) - (\Delta W / W)}{(30)} \right] / 60 \\
= - (\Delta W / W)(30/60)
\]

Equating the sarong equation with the beer equation:

\[
- (\Delta W / W)(30 / 60) = 50\% - (\Delta W / W)(80 / 40) \\
1.5(\Delta W / W) = 50\%
\]

So that \( \Delta R / R = - (\Delta W / W)(30 / 60) = - 16.67\% \)

**c.** Compare the magnitude of the percentage in the rental on capital in part (b) with that of labor.

**Answer:** The percentage change in the rental of capital is lower than the percentage increase in the price of sarongs, although the percentage change for wages is higher. We can summarize the results as follows:

\[
\frac{\Delta R}{R} < 0 < \frac{\Delta P_s}{P_s} < \frac{\Delta W}{W}
\]

Real rental falls 
Real wage increases

**d.** Identify the factor that benefits from trade in real terms. Which factor loses?

**Answer:** Labor gains in real terms because the percentage increase in wage is higher than changes in price in either industry. By contrast, the real earnings on capital decrease because the price of beer remained the same although the price of sarongs increased.
3. Consider two countries, Spain and Italy, where the only two factors of production are capital and labor. Spain has 100 units of capital and 400 units of labor and Italy has 200 units of capital and 100 units of labor. Both countries produce two goods, cheese and suits. The labor share in total production costs is 75% for cheese but only 25% for suits. Show the following:

a. Italy is capital-abundant.
   **Answer:** Because the labor/capital ratio is higher in Spain than Italy (i.e., \( \frac{L}{K} \) is higher), we say that Spain is labor abundant and Italy is capital abundant.

b. Suits are capital intensive.
   **Answer:** Cheese is more labor-intensive than suits because the share of total revenue paid to labor in the former (75%) is more than that share in the latter (25%).

c. Under free trade, Italy will export suits.
   **Answer:** The no-trade relative price of suits in Italy is lower than the free-trade relative price because Italy is capital-abundant. According to the Heckscher-Ohlin theorem, when the two countries engage in trade, Italy will export the good that uses intensively the factor of production it has in abundance. Therefore, Italy will export suits.

4. Suppose two countries, Greece and Australia, produce wine and wheat using labor and capital as factors of production. Suppose Greece is capital-abundant and wheat production is labor-intensive. For each of the following, indicate whether there is an increase, decrease, no change, or unable to determine as the two countries shift from no-trade to free trade.

   **Answer:**

<table>
<thead>
<tr>
<th></th>
<th>Greece</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative price of wine</td>
<td>Increase</td>
<td>Decrease</td>
</tr>
<tr>
<td>Quantity of wine production</td>
<td>Increase</td>
<td>Decrease</td>
</tr>
<tr>
<td>Quantity of wheat production</td>
<td>Decrease</td>
<td>Increase</td>
</tr>
<tr>
<td>Quantity of wine exported</td>
<td>Unable</td>
<td>Unable</td>
</tr>
<tr>
<td>Quantity of wheat imported</td>
<td>Unable</td>
<td>Unable</td>
</tr>
</tbody>
</table>

5. Belgium is relatively well endowed with skilled workers compared with China, which is relatively well endowed with unskilled workers. Assume that the production of pharmaceutical products intensively uses skilled workers and the production of toys intensively uses unskilled workers.

a. Which country would you expect to have a higher relative wage in skilled labor with no trade?
   **Answer:** Belgium has a lower relative wage in skilled labor. This is because skilled workers are in relative great supply in Belgium and so their wages are relatively lower; vice versa for China: Skilled workers are in relatively low supply in China, so wages are relatively higher.

b. Which country has the higher relative price of pharmaceutical products prior to trading?
   **Answer:** Goods whose manufacture intensively uses skilled workers (pharmaceuticals) will be relatively less expensive in Belgium.

c. Under free trade, which country experiences an increase in the relative wage of skilled workers? Explain.
   **Answer:** Belgium experiences an increase in the relative wage of skilled workers because the world relative price of pharmaceuticals is higher than its no-trade relative price.

6. Consider two countries, Xeno and Zilo, engaging in free trade with one another. Each country uses two factors, capital and labor, to produce two goods, trains and hats. Assuming that Xeno exports trains and Zilo exports hats, reproduce Figures 4-2, 4-3, and 4-4 for each country and determine the world relative price of trains in a figure similar to Figure 4-5.

   **Answer:** See figures on following pages.
Chapter 4 ▪ Trade and Resources: The Heckscher-Ohlin Model

**Figure 4-2** No-Trade Equilibria in Xeno and Zilo

![Diagram of No-Trade Equilibria in Xeno and Zilo](image)

**Figure 4-3** International Free Trade Equilibrium at Xeno

![Diagram of International Free Trade Equilibrium at Xeno](image)

**Figure 4-4** International Free Trade Equilibrium in Zilo

![Diagram of International Free Trade Equilibrium in Zilo](image)
7. Compare the basis for trade between the Ricardian model and Heckscher-Ohlin model.
   a. List the main assumptions of each model.
      Answer: In the Ricardian model, the marginal products of labor are constant because production does not include land or capital. In the Heckscher-Ohlin model, factors of production include labor and capital: Both factors are free to move between the two industries but not across countries. Moreover, technologies used in the production of the two goods are identical across the countries.
   b. How do the assumptions lead to differences in the pattern of trade between countries in each of the models?
      Answer: In the Ricardian model, comparative advantage determines the pattern of trade. More specifically, the basis of trade is determined by differences in technologies used to produce the two goods across the countries. The country with the better technology, namely, lower opportunity cost and therefore the comparative advantage in the production of the particular good, will specialize and export that product. By contrast, factor endowments determine the pattern of trade in the Heckscher-Ohlin model because technologies are assumed to be identical across countries. In particular, a country will export the good that uses intensively the factor of which it has an abundance.

8. Consider two countries, Vietnam and China, producing two goods, textile and televisions. Suppose that textile is relatively labor-intensive. Vietnam has 20 units of capital and 16 units of labor and China has 300 units of capital and 150 units of labor.
   a. Which country is relatively capital-abundant? Explain.
      Answer: Vietnam is labor-abundant because the labor/capital ratio in Vietnam exceeds that in China. Namely, \( \frac{L}{K} \) Vietnam > \( \frac{L}{K} \) China.
   b. Which country will export textile? Explain.
      Answer: Vietnam will export textile because it is labor-abundant.
   c. In Vietnam the production of which good decreases under trade? In China?
      Answer: In Vietnam the production of televisions will decrease, whereas the production of textile will decrease in China.
   d. In China, is the relative price of televisions higher under free trade or no trade? Explain.
      Answer: The relative price of televisions is higher under free trade than no trade because China is capital-abundant relative to Vietnam and the production of television is capital-intensive.
   e. Which group benefits from trade in China? In Vietnam?
      Answer: From the Stolper-Samuelson theorem, the real rental on capital will increase so that capital owners in China and labor in Vietnam will benefit.

9. Suppose Ireland and Canada produce two goods, Y and X. Assume that good Y is labor intensive and good X is capital intensive.
Given the above PPFs, which country is relatively labor-abundant? Capital-abundant? Explain.

Answer: Canada is capital-abundant whereas Ireland is labor-abundant because Canada’s PPF is biased toward the capital-intensive good whereas Ireland’s PPF is biased toward the labor-intensive good.

b. Suppose the countries have identical preferences. Show the no-trade equilibrium and the free-trade equilibrium. Be sure to label the production and consumption points for both economies.

Answer: See the following figures in which the no-trade equilibrium is denoted by point A. The production and consumption points with trade are represented by B and C, respectively.

c. Which good will Ireland export? What about Canada? Explain.

Answer: Ireland will export the labor-intensive good, Y, because it has an abundance of labor whereas Canada will export good X, which uses intensively its capital abundance.

d. Compare the relative factor prices in the two countries before and after trade.

Answer: The Stolper-Samuelson theorem predicts that capital will experience an increase in real earnings in Canada due to the increase in the relative price of good X when the two countries trade. The situation would be reversed in Ireland, where the relative price of good X will decrease relative to its no-trade equilibrium price so that capital prices will decrease although wages will increase.

e. Comment on the overall welfare in both countries.

Answer: Although the factor not in abundance in each country will experience a loss when the two countries trade, overall both countries are better off with international trade because they are able to consume outside their production possibilities frontiers.

10. “Professionals and highly educated workers are more likely to oppose limits on free trade as compared with high-school-educated workers because they have a better understanding of international trade.” Comment.

Answer: This statement is likely to be incorrect for the United States because the United States is relatively abundant in skilled labor as compared with trading partners such as China or India.
Therefore, the Stolper-Samuelson theorem predicts that professionals and other skilled workers will gain in real earnings because the United States will export the goods that use intensively the factor of production it has in abundance (i.e., skilled labor).

11. Suppose two countries, France and Germany, use only capital and labor for production. France has 2,050 units of capital and 916 units of labor and Germany has 816 units of capital and 270 units of labor. Both countries produce two goods, cars and wine. In Germany, there are 366 units of capital and 135 units of labor employed in the wine industry. In France, there are 926 units of capital and 618 units of labor employed in the wine industry.

d. Now, suppose the two countries trade with one another. What will happen to the relative price of wine in France? In Germany?

Answer: With free trade, the relative price of wine will increase in France and decrease in Germany.

e. What is the effect of free trade on labor in France? On capital owners in France?

Answer: Wages in France will increase due to the rise in the relative price of wine. By contrast, the rental on capital will fall.

f. What are the effects of free trade on wage and rental on capital in Germany?

Answer: The situation would be reversed in Germany, where the decrease in the relative price of wine would lead to a decrease in wage and a rise in the rental on capital.

g. With the opening of trade, what is most likely to occur in terms of the production of cars in France? In Germany?

Answer: The production of cars is likely to decrease in France as it uses labor more intensively to increase the production of wine. For Germany, the production of cars will increase because it will export cars by intensively using its abundance of capital.
Chapter Summary
Chapter 5 studies the impact of immigration and foreign direct investment on wages and returns on rental of land and capital to the foreign and host countries. Using the short-run specific-factors model, we examine how the movement of labor between countries leads to a decline in the host country wage following the inflow of labor. By contrast, the long-run model shows that the increase in foreign labor supply does not result in a change in the host country wage. The short- and long-run models also explain the returns to capital due to foreign direct investment.

Comments
This chapter covers the Rybczynski theorem and Factor Price Insensitivity, which were not covered in the previous chapter. Note that Factor Price Equalization is not dealt with except in problems 7 and 8.

This chapter bridges the gap between the short-run model (the specific-factors from Chapter 3) and the long-run model (the Heckscher-Ohlin model from Chapter 4). This allows an optional discussion of policies issues early on. Immigration is not often discussed in textbooks and is exciting to teach. As part of the lecture on foreign direct investment (FDI), it may be useful to read out loud the article by Paul Krugman titled, “The Myth of Asia’s Miracle.”
The students may think that the article is about Bill Clinton after he was newly elected and the race between East and West, where the East is Asia. However, toward the end they realize that it is actually in reference to John Kennedy and the East is the Soviet Union. This leads to a discussion of how Singapore, similar to the Soviet Union, experienced a depressed rate of return to capital as a result of the inflow of FDI.

Lecture Notes

Introduction

During May and September, 1980, 125,000 Cubans left the port of Mariel, Cuba, for Miami, which increased the host city's population by about 7%. Despite the large supply of low-skilled immigrants from Cuba, the wages of low-skilled workers in Miami did not vary much relative to the national trend.

Another example contradicting the fall in wages is the migration of 670,000 Russian Jews to Israel from late 1989 to 1996. The rise in the supply of highly skilled immigrants from Russia not only increased Israel's population by 11% but also led to an increase in the wages of high-skilled workers in Israel during the same period. A similar rise in the supply of highly skilled workers occurred in Europe and the United States between the 1800s and 1900s: In the following section, we examine whether these two cases provide evidence contrary to the basic principles of supply and demand.

1 Movement of Labor Between Countries

To understand the impact of migration on wages and rentals paid to capital and land in the host country, we return to the specific-factors model presented in Chapter 3. We begin with the short-run case in which capital and land are fixed and labor is mobile between industries and countries. We assume that the prices of goods, determined by the world markets, and wages are fixed.

Effects of Immigration in the Short Run: Specific-Factors Model

Similar to Chapter 3, we assume that the economy has two sectors: agriculture, where land is the specific factor, and manufacturing, which uses capital as the specific factor. Figure 5-1 shows that the total amount of labor in the economy, $L = L_M + L_A$, is divided between the two industries, with the amount of labor used in manufacturing, $L_M$, measured from left ($\theta_M$) to right; whereas the amount used in agriculture, $L_A$, is measured from right ($\theta_A$) to left.

Determining the Wage The curve representing the value of the marginal product of labor in manufacturing (agriculture) comes from multiplying the marginal product of labor in manufacturing (agriculture) with its price, $P_M(P_A)$. The curve is downward (upward) sloping, reflecting the decline in the marginal product of labor in manufacturing (agriculture) as we add more labor to the sector, moving from left to right (right to left). The intersection
of the two marginal product curves gives the Home equilibrium wage and shows that $0_mL$ units of labor are used in manufacturing and $0_rL$ units of labor are used in agriculture. Because wages are equalized across the two sectors, there is no incentive for labor to move between the industries.

**Effect of Immigration on the Wage in Home** As a contrast, we assume that the wage in Foreign, $W^*$, is less than that at Home, $W$. The higher wage entices Foreign workers to move to Home, thereby increasing the Home workforce by the number of immigrants, $\Delta L$. The increase in the amount of labor from Foreign is shown as the expansion of the horizontal axis in Figure 5.2, where the origin for the agriculture industry shifts rightward from $0_A$ to $0_A'$ by the amount $\Delta L$. Coinciding with the rightward movement of the agriculture origin is a parallel shift of the marginal product curve $P_A \cdot MPL_A$ to $(P_A \cdot MPL_A)'$ by the amount of the increase in Home workforce, $\Delta L$. The intersection of $(P_A \cdot MPL_A)'$ and $P_M \cdot MPL_M$ gives the new equilibrium Home wage at point $B$. Because both sectors absorb the additional workers ($0_mL' > 0_mL$ and $0_r'L' > 0_rL$), the marginal product of labor in both industries declines, leading to a lower wage relative to premigration.

**APPLICATION**

**Immigration to the New World**

In 1870, the real wages of the “New World,” which included countries in North and South America and Australia, were nearly three times higher than the “Old World,” or Europe, as shown in Figure 5-3. Encouraged by the high wages and new opportunities, about 30 million Europeans migrated to the New World between 1870 and 1913. Due to the large influx of new workers, the wages in the New World grew slower relative to those of the Old World. By 1913, European wages increased to half that of the New World. Figure 5-3 also shows forecasts of the real wages without the immigration. The comparison of the estimated wage growth with the actual indicates that wages in the New World grew slower and wages in Europe increased faster due to emigration.

**APPLICATION**

**Immigration to the United States and Europe Today**

Immigration continues to take place today, but rather than from Europe to the New World, workers are moving from developing countries to the richer industrialized countries. Policies toward immigration have changed over the years in the wealthier host countries. For example, during the 1960s and 1970s, some European countries welcomed workers to fill shortages in unskilled jobs. The more recent policy in the European Union continues to recruit workers but the aim is for high-skilled labor.

The policy toward immigration is also hotly debated in the United States. Although most of the focus has been on the influx of illegal immigrants to the country, many unskilled workers enter under the special visa programs to fill voids in the agriculture sector as crop harvesters. In addition, a number of skilled workers such as engineers and scientists are granted special privileges to work in the United States.

The pattern between the number of immigrants and educational level is shown in Figure 5-4 for the United States. The graphical analysis indicates that contrary to the public debates, immigrants scarcely compete with most
domestic workers with mid levels of education. Instead, the foreign workers vie for jobs primarily held by the lowest and highest ends of the educational levels. In other words, although illegal immigrants may pose a threat to the lowest-educated workers, those with the highest educational level are in competition with legal migrants under the special H-1B visas.

Using an extension of the specific-factors model to accommodate for labor with different educational levels, we find that between 1990 and 2004 the inflow of workers to the United States resulted in a drop in wages of high-school dropouts by 9%. The wages of college graduates fell by 5% whereas most U.S. workers with mid-level educations saw their wages fall by 1% to 2.4% for those with some college versus high school degree, respectively.

HEADLINES

Europe Sours on Labor Migration

Following the expansion of the European Union in 2004 to include many Eastern European countries, thousands of migrant workers from Asia found work in Eastern European countries like Poland and the Czech Republic. These vacancies were created when countries like Great Britain and Ireland welcomed the inflow of cheap Polish and Czech labor to work in industries like construction and services. Wages paid were modest by the standards of developed Europe and yet were often three times as high as wages garnered back in Eastern Europe. A system that worked so well for all involved has seen its first major test in the recent global economic crisis. With high unemployment plaguing Great Britain, Spain, and other European countries, governments are under pressure to limit if not reverse migrations flows.

Other Effects of Immigration in the Short Run

Rentals on Capital and Land  We can compute the effect of immigration on the earnings of capital and land by subtracting the payment to labor from the revenue earned in each sector. Because wages are lower due to the influx of foreign workers, the rentals to capital and land are higher. Additionally, the rise in the rentals on capital and land occurs because the increase in labor hired in each industry raises the marginal product of both capital and land. Thus, owners of capital and land generally oppose policies that restrict immigration for ones that would allow foreign workers to freely work in their industries, whereas workers, particularly unions, support stricter immigration laws to lessen competition for jobs and decreases in their wages.

Effect of Immigration on Industry Output  In addition to the impact on returns to capital and land, the inflow of workers increases total output in both agriculture and manufacturing as shown in Figure 5–5. Given our assumption

NETWORK

According to the U.S. Citizenship and Immigration Services, “the H-1B is a nonimmigrant classification used by an alien who will be employed temporarily in a specialty occupation or as a fashion model of distinguished merit and ability.” In fiscal year (FY) 2004, the law limited the number of foreigners who may be issued an H-1B visa to 65,000.
of constant prices and fixed specific factors in the short run, Home will produce at point $B$ on the new PPF.

**Effects of Immigration in the Long Run**

We will now determine the long-run effects of the movement of labor between countries. To simplify the model, we assume only two factors of production (capital and labor), both of which are freely mobile between two industries (computers and shoes). The total amount of capital available at Home is denoted by $K$, where $K_C$ units of capital are allocated to the production of computers and $K_S$ units are used in producing shoes. Similarly, the total available labor at Home is represented by $L$, with $L_C$ employed in the production of computers and $L_S$ devoted to shoe production. In addition, we assume that shoe production is labor-intensive relative to computer production. Namely, the labor/capital ratio in shoes is higher than that in computers ($L_S / K_S > L_C / K_C$). It follows that the capital/labor ratio is higher in the computer industry because the production of computers is capital-intensive as compared with shoes ($K_C / L_C > K_S / L_S$). Figure 5-6 shows Home’s PPF.

**Box Diagram** Figure 5-7 illustrates a “box diagram” where the horizontal (vertical) axis measures the total amount of Home labor, $L$ (capital, $K$). Reading from the bottom left-hand corner, $O_S L$ units of labor and $O_S K$ units of capital are employed in shoes production; whereas from the top right corner, $O_C L$ units of labor and $O_C K$ units of capital are used in the production of computers. In other words, the line $O_C A$ represents the quantity of labor and capital allocated to the production of shoes. Similarly the endowments allocated to computer production are given by the line $O_C A$. The line $O_C A$ is steeper than the line $O_S A$ because the capital/labor ratio in shoes ($O_S K / O_S L$) is lower than that in the computers industry ($O_C K / O_C L$).

**Determination of the Real Wage and Real Rental** The real wage and real rental is given by the line along $O_S A$ because it represents the amount of labor and capital used, namely the capital/labor ratio for shoe manufacture.

**Increase in the Amount of Home Labor** Suppose the inflow of foreign workers is given by the amount $\Delta L$, then the total available labor at Home is now higher at $L' = L + \Delta L > L$. The increase in amount of labor is illustrated by the expansion of the horizontal axis in Figure 5-8. The additional labor finds employment in the labor-intensive shoe industry. With the increase in the number of workers available per unit of capital in the shoe industry, the marginal product of labor decreases but the marginal product of capital rises. This leads to an increase in the rentals on capital in the shoe industry, which draws some capital away from the computer industry. The movement of capital from computers to shoes raises the wage in the shoe industry. Consequently, some labor will also leave the computer industry. This movement of labor and capital between the two industries continues until the labor/capital ratio in each industry returns to the premigration level.

The new allocation of labor is illustrated in Figure 5-8, where the amount of capital and labor devoted to the production of shoes are given by $O'_S K'$ and $O'_S L'$, respectively. Given the new equilibrium denoted by point $B$, the endowments dedicated to shoes production has increased ($O'_S K' > O_S K$ and $O'_S L' > O_S L$). By contrast, the units of capital ($O_C K'$) and labor ($O_C L'$)
employed in the computer industry have declined \((O_cK' < O_cK\text{ and } O_cL' < O_cL)\). Because the movement of labor and capital between shoes and computers leaves the labor/capital ratio unchanged, the line \(O'B\) parallels the line \(O_cA\) and has the same slope. More important, the constant labor/capital ratios across the two industries imply that the marginal products of labor and capital remain unchanged. Thus, contrary to the short-run case, the inflow of labor does not change wage and rentals on capital in the long run where all factors of production are mobile.

**Effect of Immigration on Industry Outputs** Furthermore, in the short-run, in which the specific factors are fixed, an increase in the supply of labor leads to an increase in the output of both goods. By comparison, because the increase in labor endowment is absorbed entirely into the labor-intensive industry in addition to some capital and labor from the capital-intensive industry, the output of shoes rises in the long run and computer production falls. The increase in shoe output is reflected by the new Home equilibrium at point \(B\) in Figure 5-9, where the unchanged relative price of computers is just tangent to the outermost PPF. Note that this new PPF is biased in the direction of shoes because of the increase in the endowments devoted to the shoes industry. The long-run result of factor movement on output is given by the following theorem:

**Rybczynski theorem:** An increase in the amount of a factor found in an economy will increase the output of the industry using that factor intensively, and decrease the output of the other industry.

**Effect of Immigration on Factor Prices** By absorbing additional units of the increased factor via output expansion in the industry which uses the factor intensively and contracting the output of the other industry, factor prices remain unchanged. This result is referred to as:

**Factor Price Insensitivity:** In the Heckscher-Ohlin model with two goods and two factors, an increase in the amount of a factor found in an economy can be absorbed by changing the outputs of the industries, without any change in the factor prices.

**APPLICATION**

**The Effects of the Mariel Boat Lift on Industry Output in Miami**

Recall that the Cuban refugees arriving in Miami in 1980 were predominately less skilled relative to those in the Host city. With the large inflow in unskilled workers, according to the Rybczynski theorem there should be an increase in the outputs of the unskilled-labor-intensive industries in Miami and a fall in the production of the skilled-intensive industries. Figure 5-10 shows the real-value-added per capita for Miami and the average for comparison cities in the apparel industry and high-skilled industries in panels (a) and (b), respectively.

Panel (a) provides some evidence of the results predicted by the Rybczynski theorem. Namely, although the real-value-added per capita in the apparel industry fell between 1972 and 1996, the rate of decline was slower for Miami relative to the comparison cities after the boatlift in 1980. Support for the Rybczynski theorem can also be found in panel (b), which shows that the real-value-added per capita in skilled-intensive industries experienced a greater drop in Miami after 1980 as compared with similar cities.
However, another reason why wages did not change in Miami could be that the city adopted the use of computers more slowly relative to the rest of the country during the period of “skill-biased technological change.” Although the national trend led to an increase in the demand for high-skilled workers and a reduction in the employment of low-skilled workers in the 1980s, many industries in Miami employed low-skilled workers such as the Mariel refugees instead of moving to computer technologies. Therefore it is possible that the absorption of the refugees in the apparel industry as well as other industries such as manufacturing and services caused the wage to remain unchanged rather than the explanation offered by the Rybczynski theorem.

**APPLICATION**

**Immigration and U.S. Wages, 1990 to 2004**

The impact of migrants on the wages of U.S. workers by education attainment is presented in Table 5-1 for years 1990 to 2004. Part A gives the estimated effect due to total migration and part B provides the estimates due only to illegal immigrants. The findings offered in the first row of part A are calculated based on the short-run specific-factors model, where capital and land are fixed across industries. The estimates indicate that the inflow of foreign labors have the largest negative impact on workers with less than 12 years of education, followed by those with a college education. On average, the impact of immigration on U.S. wages is $-3.2\%$.

The results are different when we remove the short-run assumption by allowing capital to grow in each industry such that the real rental on capital remains constant. By employing the additional workers with increased capital, the estimated effect of immigration on U.S. wages is only negative on high-school dropouts and those with a college education. More important, rather than declining, U.S. wages increased by an average of 0.3% as a result of the immigration. These estimates are available in the second row of part A.

Turning to part B, the estimates suggest that only wages of those least educated are negatively impacted by the inflow of illegal immigrants. With the absorption of the illegal workers along with capital growth in each industry, all U.S. workers with at least a high-school degree gain from illegal immigration.

2. **The Movement of Capital between Countries: Foreign Direct Investment**

In this section we study the movement of capital across countries, also known as foreign direct investment (FDI). A country experiences an inflow of FDI when a foreign company builds or buys property including plant and equipment in its land. FDI is considered greenfield investment when the foreign company builds a plant in the host country. The investment is called acquisition when the foreign company buys an existing plant.

One motivation for companies investing abroad is to take advantage of lower wages in the foreign country. By transferring some of their capital to the Host country, companies from high-wage countries can combine their expertise to produce goods more cheaply using low-wage workers. Examples include the purchase of plants by Western European firms that were once state-owned in Eastern European countries such as the Czech Republic.
According to CzechInvest, the Investment and Business Development Agency, the Czech Republic has received approximately U.S. $40 billion in FDI since 1990. The following table shows the inflow of FDI between 2003 and 2005. Most FDIs have been made by Western European countries.

### FDI into the Czech Republic by Country, 2006–2008

(millions of U.S. dollars)

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>%</td>
<td>$</td>
</tr>
<tr>
<td>WORLD</td>
<td>123,431.3</td>
<td>100%</td>
<td>211,943.7</td>
</tr>
<tr>
<td>EUROPE</td>
<td>122,832.1</td>
<td>100%</td>
<td>187,237.9</td>
</tr>
<tr>
<td>EU-27</td>
<td>110,429.7</td>
<td>89%</td>
<td>166,478.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>-606.3</td>
<td>0%</td>
<td>5,480.1</td>
</tr>
<tr>
<td>France</td>
<td>6,044.4</td>
<td>5%</td>
<td>1,102.9</td>
</tr>
<tr>
<td>Italy</td>
<td>-1,031.5</td>
<td>-1%</td>
<td>1,133.4</td>
</tr>
<tr>
<td>Germany</td>
<td>43,522.0</td>
<td>35%</td>
<td>24,471.9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>-9,698.1</td>
<td>-8%</td>
<td>45,007.6</td>
</tr>
<tr>
<td>Austria</td>
<td>22,567.7</td>
<td>18%</td>
<td>22,306.5</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>5,936.0</td>
<td>5%</td>
<td>-10,840.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>-4,363.1</td>
<td>-4%</td>
<td>6,891.1</td>
</tr>
<tr>
<td>Cyprus</td>
<td>4,826.6</td>
<td>4%</td>
<td>16,463.4</td>
</tr>
<tr>
<td>Hungary</td>
<td>873.8</td>
<td>1%</td>
<td>731.9</td>
</tr>
<tr>
<td>Poland</td>
<td>959.2</td>
<td>1%</td>
<td>3,429.5</td>
</tr>
<tr>
<td>Slovenia</td>
<td>9,397.5</td>
<td>8%</td>
<td>7,790.1</td>
</tr>
<tr>
<td>Slovakia</td>
<td>5,936.0</td>
<td>5%</td>
<td>5,806.5</td>
</tr>
<tr>
<td>EFTA</td>
<td>13,148.0</td>
<td>11%</td>
<td>21,296.5</td>
</tr>
<tr>
<td>Switzerland</td>
<td>12,008.5</td>
<td>10%</td>
<td>19,670.7</td>
</tr>
<tr>
<td>ASIA</td>
<td>1,087.8</td>
<td>1%</td>
<td>25,338.4</td>
</tr>
</tbody>
</table>


In addition, most of the FDI flowed into the manufacturing sector as shown in the following table:

### FDI into the Czech Republic by Sector, 2006–2008

(millions of U.S. dollars)

<table>
<thead>
<tr>
<th>Economic Activity</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>%</td>
<td>$</td>
</tr>
<tr>
<td>Total</td>
<td>123,431.3</td>
<td>100%</td>
<td>211,943.7</td>
</tr>
<tr>
<td>Agriculture, hunting and forestry, fishing</td>
<td>1,466.3</td>
<td>1%</td>
<td>193.8</td>
</tr>
<tr>
<td>Mining and quarrying</td>
<td>-1,879.1</td>
<td>-2%</td>
<td>-12,438.7</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>38,306.1</td>
<td>31%</td>
<td>78,437.0</td>
</tr>
<tr>
<td>Electricity, gas, and water supply</td>
<td>-592.0</td>
<td>0%</td>
<td>-4,658.7</td>
</tr>
<tr>
<td>Construction</td>
<td>3,218.0</td>
<td>3%</td>
<td>716.5</td>
</tr>
<tr>
<td>Wholesale and retail trade; repair of motor vehicles, motorcycles, and personal and household goods</td>
<td>28,055.3</td>
<td>23%</td>
<td>22,427.3</td>
</tr>
<tr>
<td>Hotels and restaurants</td>
<td>1,227.7</td>
<td>1%</td>
<td>3,120.4</td>
</tr>
<tr>
<td>Transport, storage, and communication</td>
<td>-2,721.7</td>
<td>-2%</td>
<td>15,522.2</td>
</tr>
<tr>
<td>Financial intermediation</td>
<td>14,066.4</td>
<td>11%</td>
<td>46,841.9</td>
</tr>
<tr>
<td>Real estate, renting, and business activities</td>
<td>32,573.7</td>
<td>26%</td>
<td>56,774.0</td>
</tr>
</tbody>
</table>

Greenfield Investment
In the following sections we focus on greenfield investments rather than acquisitions. We treat the purchase of a new foreign building in the same way as the movement of labor between countries. Doing so allows us to determine the impact of cross-country capital flows on the wage and rentals on land and capital.

FDI in the Short Run: Specific-Factors Model
Effect of FDI on the Wage We begin with the short-run specific-factors model in which labor is mobile and capital and land are used exclusively in manufacturing and agriculture, respectively. Under these assumptions, the additional capital is only employed in the manufacturing industry. The rise in the amount of capital available per worker raises the marginal product of labor in manufacturing. Holding prices constant, the inflow of capital shifts the $P_M \cdot MPL_M$ curve rightward to $P_M' \cdot MPL'_M$ as illustrated in Figure 5-11. Due to the shift, the equilibrium wage increases in the manufacturing sector, drawing out some labor from agriculture. The labor movement between the two industries continues until the wages are equalized across the two sectors at $W' > W$.

Effect of FDI on the Industry Outputs The combination of increased capital and additional labor employed in the manufacturing sector means that the output of manufactures increases after the inflow of FDI. In contrast, agriculture production decreases because the amount of labor available to work on the land has declined. The biased output growth caused by the inward FDI is shown in Figure 5-11, where the equilibrium outputs shift from point $A$ to point $B$ as prices are held constant.

Effect of FDI on the Rentals To determine the impact of FDI on the rental on land, note that the decrease in workers employed in agriculture implies that the marginal product of land falls. Consequently, the rental on land, $R_T = P_A \cdot MPT_A$, drops because the price of agricultural goods is unchanged. For the rental on capital, we use an alternative method that is measured by the difference between the revenue earned in manufacturing and payments to labor. In Figure 5-12, we hold wage constant and let the amount of capital and labor used in manufacturing increase in equal proportions from points $A$ to $C$. Given that the labor/capital ratio in manufacturing, $L_M / K_M$, is the same at points $A$ and $C$, then the rental on capital is also fixed. Next, we will continue to hold the capital usage constant but allow the wage to increase from points $C$ to $B$ along the $P_M \cdot MPL'_M$ curve. With higher payments to labor, the rental on capital falls as the marginal product of capital decreases.

FDI in the Long Run
To examine the effect of FDI in the long run, we return to the simplified model with two industries (computers and shoes) using two factors of production (labor and capital), where computers are capital-intensive and shoes are labor intensive (i.e., $K_C / L_C > K_S / L_S$). Point $A$ of the “box diagram” illustrated by Figure 5-13 gives the initial allocation of endowments between the two industries. In particular, the lower left corner shows that $O_L$ units of labor and $O_K$ units of capital are used in the production of shoes, whereas
the upper right corner denotes that the amount of labor and capital devoted to computers is measured by \( O_C L \) and \( O_C K \), respectively.

Suppose that the amount of capital in the economy increases due to an inflow of FDI. The increase expands the right and left sides of the box in panel (a) of Figure 5-13 and shifts the origin up to \( O_C' \). The new allocation of factors between the industries is shown at point B. Now the labor and capital used in the shoe industry are measured by \( O_B S \), which is shorter than the line \( O_A S \). Therefore, less labor and less capital are used in the production of footwear, and shoe output falls. The labor and capital used in computers are measured by \( O_C' B \), which is longer than the line \( O_C A \). Therefore, more labor and more capital are used in computers, and the output of that industry rises.

**Effect of FDI on Outputs and Factor Prices** The increase in the amount of capital due to inward FDI is represented by the expansion of the vertical axis where the origin for the computer industry shifts upward from \( O_C \) to \( O_C' \). The new allocation of factors between the industries given by point B corresponds to greater amounts of labor and capital dedicated to the capital-intensive computer industry and a reduction in the endowments devoted to the labor-intensive shoe industry. As predicted by the Rybczynski theorem, the output in shoes falls and computer production enlarges, as shown in panel (b) of Figure 5-13. Moreover, with no change in the capital/labor ratios across the two industries, the wage and the rental on capital remain unchanged. Similar to the inflow of labor, the results of the long-run model show that an increase in capital does not impact the price of either factor.

**APPLICATION**

**The Effect of FDI on Rentals and Wages in Singapore**

Many countries have policies to attract foreign investments. One such country is Singapore, which for many years encouraged foreign firms to invest in its electronics industry through the establishment of subsidiaries within its borders. Table 5-2 presents the estimated effect of the inflow of FDI on the real rental and wages in Singapore for 1970 to 1990. Over this period, the overall capital/labor ratio grew about 5% per year. With the increase in capital relative to labor, the real rental on capital fell by 3.4% each year as shown in part A. On the flip side, the boost in capital available to each worker increased the marginal product of labor such that the real wage grew by 1.6% per year. More specifically, these estimates are consistent with the short-run specific-factors model, which predicts that the increase in capital due to FDI would lead to a fall in the rental on the specific factors (capital) and an increase in the wage paid to the mobile factor (labor).

Alternatively, the rental on capital can be measured as the price, \( P_K \), of the capital equipment multiplied by the interest rate, \( i \), earned had the capital been invested in other forms of asset plus its rate of depreciation, \( d \). Namely the rental on the capital equipment calculated as \( P_K \cdot (i + d) \) is equivalent to the return on a financial asset from renting out the equipment. Part B gives the estimates on the growth rate in the real rental using three different interest rates. The real rental is given by the following formula:

\[
\frac{R}{P} = \frac{P_K}{P} (i + d)
\]
where $P$ is the overall price index. Using the bank lending rate for $i$, the real rental is estimated to grow by 1.6% per year as shown in the first row. With the return on equity as the interest rate, the second row shows that the real rental to fall by 0.2% each year between 1971 and 1990. The third row shows the real rental to decline by 0.5% each year when the earnings–price ratio is used as the interest rate.

Altogether the alternative calculations for the rental on capital contradict the results of part A, suggesting a lack of evidence that the rental on capital fell as predicted by the short-run specific-factors model. However, these results do not clearly verify the long-run specific-factors model. In particular, part B also shows the real wage in Singapore over the same period. Contrary to the predictions of the long-run specific-factors model, instead of remaining constant, real wages grew between 2.7% and 3.6% per year, varying by the interest rate used. The growth of the real wages coupled with the relatively stable real rental on capital may indicate that productivity growth occurred in Singapore, which increased the marginal product of labor.

**HEADLINES**

**“The Myth of Asia” Miracle**

The article gives the reader the impression that the United States and Europe are concerned about rising competition from Asia due to the amount of capital accumulation in the region. In addition, it alludes to a pledge made—possibly by Bill Clinton—to meet the new challenge. However, it turns out that the Eastern economy is the Soviet Union and the technology challenge resulting from the launch of Sputnik. Moreover, the president in reference is John Kennedy. From this, Krugman drives the point that the competition facing the Western economies resulting from the economic growth of the Asian countries is not new.

**3 Gains from Labor and Capital Flows**

Most countries have restrictions on foreign investment and immigration, particularly the latter. These limitations include a quota on the number of individuals allowed from each country, such as the Quota Law of 1921 in the United States. The restrictions are supported by groups opposed to public spending on services available to immigrants (e.g., school, medical care, and welfare) as well as individuals in fear of job competition. However, as the specific-factors model shows, in the Host country, certain groups benefit from the inflow of workers, which lowers wages, particularly owners of the intensively used factor. Moreover, the movement of capital and labor provide potential gains to the Foreign country.

**Gains from Immigration**

**Wages at Home and Abroad** The specific-factors model for the world is illustrated in Figure 5-14, in which the horizontal axis measures the number of workers at Home, $L$, from left to right, and the number of workers in Foreign, $L^*$, is measured from right to left, giving the total amount of workers in the world, $L + L^*$. The labor demand curve for Home is downward sloping, with
OL workers employed prior to immigration at the equilibrium wage of \( W \) given by point \( A \). With additional workers entering from the Foreign country, Home increased employment to \( OL' \), which reduces the Home wage to \( W' \), at point \( B \). For Foreign, the labor demand curve is upward sloping because its endowment is measured from right to left. Before the movement of labor, the number of workers employed in Foreign is equal to \( O'L \), where the equilibrium wage, \( W' \), at point \( A' \) is lower than that at Home. The higher Home wage entices some workers to leave Foreign, which reduces the number of labor to \( O'L' \), driving up the Foreign wage to \( W'' \), at point \( B \). Note that wages are equalized across the two countries at point \( B \) or the equilibrium with full migration.

**Gains for the Home Country** We are now ready to determine whether there are overall gains to Home from immigration. Recall that wage is equal to the marginal product of labor in the respective industry multiplied by the price of its good. Therefore, the marginal product of the first Foreign worker to migrate equals the Home wage, \( W \). As each additional Foreign worker enters the Home workforce, the marginal product of labor at Home falls given the law of diminishing returns and our assumption of fixed land and capital in the short run. The decrease in marginal product due to the inflow of immigrants causes the Home wage to decrease from \( W \) to \( W'' \) along the Home wage curve from points \( A \) to \( B \).

After migration all workers are paid the Home wage of \( W'' \), which equals the marginal product of the last worker multiplied by the goods price in each industry. However, the marginal product of labor of all the Foreign workers with the exception of the last to migrate is higher than the wage paid. Therefore, the contribution of each Foreign worker to Home production is equal to the individual’s marginal product minus the wage received. Namely, Home benefits \( W - W'' \) from the first Foreign migrant, and so on. Summing up the benefits from each Foreign worker, the overall gains to the Home economy from immigration is denoted by the triangle \( ABC \).

**Gains for the Foreign Country** In the Foreign country, the wage absence of emigration is \( W'' \) at point \( A' \). As each worker leaves, the Foreign marginal product of labor improves, causing the wage to rise from \( W'' \) to \( W''' \). In addition to workers in the Foreign country receiving the higher wage, emigrated Foreign workers are also paid \( W'' \) in the Home country under full migration. However, because the wage earned, \( W''' \), at Home is higher than the Foreign marginal product of labor (i.e., between \( W'' \) and \( W''' \)), the Foreign country benefits from the earnings sent back by migrated workers. Adding up the differences between the wage earned by the migrants and their Foreign marginal products gives the overall Foreign gains represented by triangle \( A'B'C \).

**Sidebar**

**Immigrants and their Remittances**

For some countries, remittances or earnings sent back to Home by immigrants are an important source of income. The estimated remittances in 2008 were $336 billion, up from $289 billion in 2007. World remittances then declined to $316 billion in 2009 due in part to the global recession. Table 5-3 shows the remittances versus net foreign aid received by some developing countries in 2007. For these countries, remittances accounted for a larger source of income than official aid.
**World Gains from Migration**

The sum of triangles $ABC$ and $A'B'BC$ representing Home and Foreign gains, respectively, gives the larger triangle $A'AB$, which denotes the increase in the world gross domestic product (GDP) due to immigration. For example, when the first migrant leaves Foreign for Home, the GDP in the former country falls by $W'$ whereas that in the latter increases by $W$. The gain in world welfare due to the movement of the first migrant is equal to the difference between the Home and Foreign wages.

**APPLICATION**

**Gains from Migration**

It is estimated that the net gain due to immigration is about 0.1% of GDP where the migrants are assumed to make up approximately 10% of the U.S. workforce and compete for domestic jobs. The 0.1% net GDP gain translates into an estimate of 2% gains for capital and 1.9% loss for domestic labor. The relatively small size in GDP gain compared with the transfer of income from labor to capital helps to explain the focus on potential harm to labor instead of overall increases in welfare in debates over immigration policies.

The first row of part A in Table 5-4 shows that the gains are higher (0.4% of GDP) if we assume the low-skilled work provided by the immigrants complements those of the higher-skilled U.S. population. The gains are even higher using estimates from household workers as shown in the second row. More specifically, the net GDP gain would be about 1.2% to 1.4% if low-skilled foreign labors substitute high-skilled domestic individuals by performing household work.

The estimated worldwide gains due to immigration are shown in part B. The result in the first row indicates that a 3% flow of workers from developing to developed countries increases world GDP by 0.6%. The remaining findings in part B consider the enlargement of the European Union (EU), taking into account differences in technology across countries and allowing for full mobility. The estimates suggest that the original 15 EU countries double in productivity with the addition of the new members. Over time, the benefits to the EU countries continue to rise due to the movement of capital and labor from Eastern Europe.

**Gains from Foreign Direct Investment**

To determine the overall gains from FDI we present in Figure 5-15 the total world capital on the horizontal axis and the rental earned in each country on the vertical axis. The amount of capital used at Home, measured from left to right, is denoted by $OK$. Prior to FDI, the Home rental is $R$ at point $A$. The units of capital employed in Foreign, measured from right to left, equals $O'K$, with the Foreign rental $R'$ determined at point $A'$. With capital mobility, FDI flows from Home to Foreign because the rental is higher in the latter. The increase in available capital decreases the marginal product of capital in Foreign, which drives down the Foreign rental although raising the Home rental due to the rise in the marginal product of capital at Home. The rental on capital is equalized across the two countries at point $B$ at which capital ceased to
move from Home to Foreign. Due to reasoning similar to that of the move-
ment of labor, the benefits to Home (Foreign) from the capital outflow (in-
flow) can be illustrated by the triangle $ABC (A'B'C)$. The sum of Home and
Foreign gains gives the world welfare improvement due to foreign direct in-
vestment, denoted by triangle $A'B'A$.

5 Conclusion
This chapter examines the impact of labor and capital mobility on the Home
and Foreign country in the short and long run using the specific-factors
model. In the short run, the inflow of foreign workers reduces the marginal
product of labor, which in turn decreases wage in the host country. However,
due to the decrease in the payment to labor, the rentals on capital and land
rise. These results explain the opposition to immigration by labor groups, al-
though policy toward fewer labor restrictions are supported by landowners
and capital owners. In the long run, when labor as well as capital is mobile
between the industries, the wage does not necessary fall in contrast to the
short-run case. The reason is that there is an expansion in the output of the
industry that uses the labor intensively and a contraction in the other indus-
try leading to full employment without a change in the labor/capital ratio.

The cross-border movement of capital, also known as foreign direct invest-
ment (FDI), leads to an analogous effects on the Home and host countries as
immigration. Namely, the increased supply of capital from abroad lowers the
rental on capital in the short run. At the same time, the rental on land de-
creases and the surge in capital raises the marginal product of labor, which
causes wage to rise. However, as in the case with immigration, capital mobil-
ity does not lead to changes in wage and the rental on capital in the long run.

There are gains to the host country from the movement of labor and cap-
ital across borders. The gains to the home country result from paying the fac-
tors of production less than its full contribution to GDP. The source country
also benefits from the remittances or earnings received by the factors in the
host country. The overall gains in the world are the sum of the welfare in-
creases across the countries.

TEACHING TIPS

Tip 1: Differences in the Short- and Long-Run Model
This chapter deals with the affects of factor movements on factor returns in
both the short- and long-run models. This is important because it demon-
strates the differences between these two models. In teaching this chapter, it
is important to stress the differences in factor returns and their link to factor
mobility. In-Class Problems 9 and 10 demonstrate this difference. Ask stu-
dents to complete these problems and comment on the difference in output
and factor prices in these two problems.

Tip 2: Discussion and Debate Migration
Ask students to use information from this chapter (we suggest students read
SIDEBAR: Immigrants and their Remittances and APPLICATION:
Gains from Migration, as well as independent research, to prepare to discuss the consequences of migration for both countries involved. Given that the short-run model predicts that both countries gain from migration only in the presence of remittances, have students investigate recent developments in remittance flows. Here are some potential data sources to get students started:

**Data on world migration:**
UN International Migrant Stock: http://esa.un.org/migration/

**Data source for remittance flows:**

Most recent data and projections: Search for “World Bank migration and remittances” to find the World Bank’s Prospects for Migration and Remittances, which provides the most recent data on remittance flows.

**Tip 3: FDI Data Exercise**
To familiarize students with data sources, ask students to look up the most recent U.S. direct investment data, as seen in In-Class Problems 1–3. Instruct students to go to http://www.bea.gov, and then proceed to the section labeled “International Economic Accounts.” Scroll down to “Operations of Multinational Companies” and click on the “Selected Tables” link for U.S. direct investment abroad and foreign direct investment in the United States. Here students will find country-by-industry tables on historical cost basis for FDI in the United States and the U.S. direct investment position abroad (as is reported in the in-class problems).

Ask students to investigate the latest available industry level data and discuss whether it remains consistent with previous data or if there have been any major changes. Additionally, you may want to ask students to investigate the data by source and destination country (as in Problems 1 and 2). Which countries does the United States invest in most heavily, and in which industries? Which countries invest most heavily in the United States, and in what U.S. industries? Ask students to compile this information and discuss.
1. Obtain information pertaining to the U.S. Direct Investment Position Abroad on a Historical-Cost Basis from the Bureau of Economic Analysis (http://www.bea.gov/). Name the top ten countries receiving FDI from the United States. Comment on your list. Are the countries the same over the years?

**Answer:** The top ten countries receiving FDI from the United States from 1990 to 2005 are given in the table below. For the most part, the top ten countries are the same over the years. All the countries on the list, with the exception of Bermuda, are industrialized countries. The investment in Mexico is considered vertical FDI, in which U.S. multinationals move production within the borders of its southern neighbor to cut costs by using lower Mexican wages. By contrast, Bermuda receives FDI from the United States because of its tax policies.

| U.S. Direct Investment Abroad on a Historical-Cost Basis |
|----------------|----------------|
| **Country** | **2009** |
| World       | 3,508,142 |
| Netherlands | 471,567   |
| United Kingdom | 471,384 |
| Canada      | 259,792   |
| Bermuda     | 245,671   |
| Luxembourg  | 174,092   |
| Ireland     | 165,924   |
| Switzerland | 148,239   |
| United Kingdom Islands, Caribbean | 141,527 |
| Germany     | 116,832   |
| Australia   | 106,370   |

2. Name the top nine countries investing in the United States using data from the Historical-Cost Basis. Is your list of countries the same as that of problem 1? What may account for the differences?

**Answer:** The top nine countries investing in the United States from 1990 to 2005 are given in the table below. Most countries receiving FDI from the United States as listed in problem 1 are also the top ten countries investing in the United States. As mentioned in this chapter, this type of investment is called horizontal FDI. Note that Bermuda and Mexico are replaced by Sweden and France.

| FDI into the U.S. by Country on a Historical-Cost Basis |
|-------------|----------------|
| **Country** | **2009** |
| World       | 2,319,585 |
| Japan       | 271,883   |
| Germany     | 259,612   |
| Canada      | 251,162   |
| France      | 212,614   |
| Netherlands | 118,984   |
| Bermuda     | 92,588    |
| Switzerland | 88,448    |
| Australia   | 48,353    |
| Spain       | 47,480    |
3. In which industries is the U.S. investment abroad the largest? In what industries are foreign investments in the U.S. most concentrated?

**Answer:** U.S. investment is largest in manufacturing as well as services such as “holding companies (nonbank)” and “finance and insurance.” Foreign investment in the United States is most concentrated in the manufacturing sector.

<table>
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<tr>
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<tbody>
<tr>
<td><strong>2005</strong></td>
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<tr>
<td>All Industries</td>
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<tr>
<td>Mining</td>
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<td>Manufacturing</td>
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<td>Food</td>
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<tr>
<td>Chemicals</td>
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<tr>
<td>Primary and Fabricated metals</td>
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<tr>
<td>Machinery</td>
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<tr>
<td>Computers and electric products</td>
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<tr>
<td>Electrical equipment, appliances, and components</td>
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<tr>
<td>Transportation equipment</td>
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<tr>
<td>Wholesale trade</td>
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<td>Information</td>
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<tr>
<td>Finance and insurance</td>
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<tr>
<td>Professional, scientific, and technical services</td>
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<tr>
<td>Holding companies (nonbank)</td>
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*Source: Bureau of Economic Analysis*

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<td><strong>2005</strong></td>
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<td>Wholesale trade</td>
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<td>Retail trade</td>
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<tr>
<td>Information</td>
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<tr>
<td>Depository Institutions (banking)</td>
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<tr>
<td>Finance and insurance</td>
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<tr>
<td>Real estate, rental, and leasing</td>
</tr>
<tr>
<td>Professional, scientific, and technical services</td>
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</tbody>
</table>

4. Why might a labor group support limitations on the outflow of FDI?

**Answer:** In the short run, an outflow of FDI decreases the amount of capital available per worker. This lowers the marginal product of labor resulting in a fall in the equilibrium wage.
5. According to Table 5-3, for some countries remittances account for a larger source of income than foreign aid. Should these countries have policies to encourage emigration? Explain.

**Answer:** In the short run, emigration would decrease the available labor leading to a higher marginal product of labor and higher wages in the foreign country. In addition, if remittances are a significant source of income for the foreign country, then it is likely that emigration policies would be encouraged.

6. Assume that Mexico receives an inflow of FDI. Suppose two factors (labor and capital) are used in the production in two industries (food and televisions). Further assume that televisions are capital-intensive as compared with food. Use the long-run specific-factors model to answer the following questions.

a. Show the impact of the inflow of FDI on Mexico in an illustration similar to Figure 5.13 with output of food (televisions) on the vertical (horizontal) axis. What happens to the output of each good?

**Answer:** Due to the inflow of FDI, more labor and more capital are in televisions so that the output of that industry goes up. By contrast, less labor and less capital are devoted to the production of food, leading to a fall in the output in this industry. As predicted by the Rybczynski theorem, the additional capital increased the output of the capital-intensive industry (televisions) and decreased the output of the labor-intensive industry (food).

b. How has wage changed in terms of food and televisions?

**Answer:** Because the capital-intensive industry (televisions) absorbed the additional capital along with the shift of labor from the labor-intensive industry, the capital/labor ratios remained constant. With the capital/labor ratios unchanged across the two industries, the wage is also unchanged. With constant factor prices, wage does not change in terms of either food or televisions.

7. Only developing countries compete for FDI. Comment.

**Answer:** Competition for FDI takes place among developing as well as developed countries. An example is the generous incentive package offered by Kentucky to Toyota Motor Corporation in 1985.
8. The following table shows the flow of FDI for select countries between 1985 and 2008. Over this period, the inflow of FDI to China increased substantially. What is the impact of this flow of capital on wages in China according to the short-run specific-factors model?

<table>
<thead>
<tr>
<th>FDI Flow by Country, millions of U.S. dollars, 1985 to 2008</th>
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<tbody>
<tr>
<td>World Inflows</td>
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<td>World Outflows</td>
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<td>Developed Countries Inflows</td>
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<td>Developed Countries Outflows</td>
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<td>United Kingdom Inflows</td>
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<td>United Kingdom Outflows</td>
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<td>Japan Inflows</td>
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<td>United States Inflows</td>
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<td>United States Outflows</td>
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<td>Developing Countries Inflows</td>
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<td>Developing Countries Outflows</td>
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<td>India Inflows</td>
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<td>India Outflows</td>
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<tr>
<td>China Inflows</td>
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<td>China Outflows</td>
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<tr>
<td>Mexico Inflows</td>
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<tr>
<td>Mexico Outflows</td>
</tr>
</tbody>
</table>

Source: UNCTAD, Interactive Database

**Answer:** In the short run, the inflow of capital raises the marginal product of labor in the capital-specific industry. With prices held constant, the equilibrium wages in China increase initially in the capital-specific industry and eventually across both sectors as wages become equalized.

9. Consider a long-run model for a country producing two products (digital cameras and baskets) using two factors (capital and labor).

a. Which good would you expect to be capital-intensive? Which good would you expect to be labor-intensive? Why?

**Answer:** We define a capital-intensive good (in contrast to a labor-intensive good) as the one having a higher capital/labor ratio. One would expect digital cameras to be capital-intensive due to the relatively high proportion of machinery, knowledge, and technology that combine to produce the final good. Conversely, baskets typically require more manual skill; hence, we would expect them to be labor-intensive relative to digital cameras.

b. Suppose that foreign owners of domestic capital decide to decrease their investment. Illustrate the effects of this change in a box diagram. Does output in each industry increase, decrease, or stay the same? Do wages increase, decrease, or stay the same in each industry?

**Answer:** The effect of decreasing FDI is equivalent to a decrease in capital in this model of two products and two factors. To ascertain changes in industry output, recall the Rybczynski theorem: A decrease in a factor will decrease the output of the industry for which that factor is intensive and increase the output of the other industry. In this case, the decrease in FDI decreases the output of capital-intensive digital cameras and increases the output of labor-intensive baskets. Because wage is determined in each industry by the ratio of marginal products of labor (which are unchanged because the capital/labor ratio does not change), there is no change in wages due to the decrease in capital in this model.
10. Suppose a country has two specific factors, land and capital. Land is an input in the production of corn. Capital is used only in the production of rockets. A third factor, labor, is mobile between the two sectors. Holding all else constant, what is the effect of an increase in the amount of available capital?

a. on the real return on capital?

**Answer:** The increase in capital leads to a decrease in its real return in the short run because there is more capital available per unit of labor, which lowers the marginal product of capital.

b. on the real return of the mobile factor of production?

**Answer:** Wages increase because the additional capital raises the marginal product of labor.

c. on the output of corn and rockets?

**Answer:** According to the Rybczynski theorem, an increase in the amount of capital will raise the output of the industry using that factor (rockets) and decrease the output corn, which is land specific.
Increasing Returns to Scale and Imperfect Competition

Notes to Instructor

Chapter Summary
In this chapter, we examine a model in which countries benefit from trade when there is increasing returns to scale in production. Producers gain by moving down their average cost curve and consumers are able to enjoy more product varieties. We show how well the monopolistic competition model holds in empirical applications. One application deals with the impact of the North America Free-Trade Agreement, from the viewpoint of Canada, Mexico, and the United States. We also use the gravity equation to determine the importance of economic size and distance in the amount of trade between two countries.

Comments
By now the students have a good understanding of the concept of comparative advantage as the basis for trade. To get them thinking about the monopolistic competition model and product differentiation, find out how many students prefer Coca Cola versus Pepsi Cola. Then name products that are traded between developed countries. For example, the United States exports and imports wine and beer. With the exception of increasing returns to scale in production, the material in this chapter is likely to be new to many students, particularly topics such as the gravity equation. For classes in which calculus
is a prerequisite, the instructor may choose to present the numerical examples differently from that in the textbook.

Lecture Notes

Introduction
Due to proximity, resources, and comparative advantage, the United States imported snowboards from twenty different countries in 2009, although exporting very little in return. By contrast, the United States imported golf clubs valued at $284 million from twenty-five countries and exported $226 million of the product to about eighty-three countries in 2009. Panel (a) of Table 6-1 shows that China is the top-selling country of golf clubs to the United States, with $254 million sold with an average price of $18 each. Thailand comes in at a distant second at $14 million; however, its average price is considerably higher at $102 each. The variation in wholesale price among the top twelve selling countries captures the differences in the quality of the clubs with Thailand as the leader. Although Canada takes the number eleven spot on the list of top U.S.-importing countries, it ranks number one among the countries in which the United States exports golf clubs. Aside from Canada, seven other countries on the top importing list (Japan, United Kingdom, South Korea, Australia, Hong Kong, Malaysia, and Taiwan) are also among the top twelve buyers of American golf clubs. The quality of golf clubs exported from the United States, although higher than most of the clubs imported, also varies; the average price per club ranges from $75 to $104.

To explain why the United States is both an importer and exporter of golf clubs, we introduce a market structure called monopolistic competition whereby countries trade goods that are similar but not identical to each other. In other words, a firm is able to maintain some monopoly power by differentiating its products from those of its competitor. An empirical application of the amount of trade involving imports and exports of different product varieties, also known as intra-industry trade, is also discussed. A second empirical application, the gravity equation, explains the high volume of trade that takes place between large countries. Last, we examine how increasing returns of scale allow countries to trade with one another despite nearly identical technologies and factor endowment.

1 Basics of Imperfect Competition

Monopoly Equilibrium
Recall from your principles course that as the sole producer in a market, the demand curve faced by the monopolist is the industry demand curve. As shown in Figure 6-1, the industry demand curve, \( D \), is downward sloping, which means that the monopolist must lower its price to sell an additional unit of output. With the fall in price, the extra revenue received from the additional unit is less than the price so that the marginal revenue curve, \( MR \), lies below the demand curve. Similar to perfectly competitive firms, the monop-
olist maximizes profits by setting marginal revenue equal to marginal cost, \( MC \). With the constant marginal cost depicted in Figure 6-1, the monopoly equilibrium level of output is \( Q^* \) with a price of \( P^* \) given by point \( A \) on the demand curve.

Demand with Duopoly

By adding one additional firm to the industry, we have a duopoly, where the industry demand curve, \( D \) (illustrated in Figure 6-2) is shared between the two competitors. If they charge identical prices, each firm faces one half of the industry demand, \( D/2 \). Namely, at the price of \( P_1 \), the industry demand is at point \( A \) so that each firm sells the quantity \( Q_2 \), which is half of the total market demand \( Q_1 \). If the product is homogeneous, one of the firms will be able to capture the entire market simply by decreasing its price while the other firm holds the price constant at \( P_1 \). Suppose the second firm charges \( P_2 < P_1 \); it will satisfy total market demand with the quantity \( Q_3 \) if the products are identical. However, if the products are similar but not perfect substitutes, namely, differentiated, then lowering the price to \( P_2 \) will increase the second firm’s market share but it will not be able to capture the entire market. Figure 6-2 shows that the demand curve, \( d \), for the second firm with a differentiated product is flatter than the demand curve \( D/2 \) for the homogeneous goods. Following along the firm’s demand curve \( d \), we see that the second firm is able to increase the quantity it sells to \( Q_4 \) when it lowers the price to \( P_2 \) if the first firm maintains its price at \( P_1 \).
2 Trade under Monopolistic Competition

We will now turn to the monopolistic competition model beginning with assumption 1.

**Assumption 1:** Each firm produces a good that is similar to but differentiated from the goods that other firms in the industry produce.

Because each product cannot be perfectly substituted by another, the monopolistically competitive firm has some degree of market power (i.e., the firm faces a downward-sloping demand curve and chooses its optimal quantity and price to sell).

**Assumption 2:** There are many firms in the industry.

With many firms in the industry, if they all charge the same price, the share of demand faced by each firm is now \( D/N \), where \( N \) is the number of firms.

As with the duopoly case, if a firm lowers its price, it faces a flatter demand curve, \( d \).

**Assumption 3:** Firms produce using a technology with increasing returns to scale.

Increasing returns to scale technology means that the average cost of production decreases as output increases, as illustrated by Figure 6-3. The average cost, \( AC \), falls as quantity increases because the marginal cost, \( MC \), of each additional unit is lower than the average cost of production, therefore pulling the \( AC \) downward.
**Numerical Example** For simplicity, let’s look at a numerical example with a firm that has constant marginal costs similar to those depicted in Figure 6-3. Suppose the firm has the following costs of production:

\[
\begin{align*}
\text{Fixed Costs} &= $150 \\
\text{Marginal Costs} &= $25/\text{unit}
\end{align*}
\]

From the following table, we see that average cost for the first five units of output is $55 each. Notice that marginal cost is lower at $25 per unit. Because \( MC \) is less than \( AC \), the firm would be able to lower its average costs by increasing the quantity produced. With the next additional 10 units produced, the firm’s \( AC \) decreases to $35 per unit.

<table>
<thead>
<tr>
<th>Quantity, ( Q )</th>
<th>Variable costs = ( Q \cdot MC )</th>
<th>Total Costs = Variable Costs + Fixed Costs</th>
<th>Average Costs = Total Costs / Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>125</td>
<td>275</td>
<td>55</td>
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<tr>
<td>15</td>
<td>375</td>
<td>525</td>
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<td>30</td>
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<tr>
<td>50</td>
<td>1,250</td>
<td>1,400</td>
<td>28</td>
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<tr>
<td>75</td>
<td>1,875</td>
<td>2,025</td>
<td>27</td>
</tr>
</tbody>
</table>

**Assumption 4:** Firms can enter and exit the industry freely, so monopoly profits are zero in the long run.

Similar to perfect competition, free entry and exit drives monopoly profits to zero in the long run.

**Equilibrium without Trade**

**Short-Run Equilibrium** As shown in Figure 6-4, a firm in a monopolistic competition faces a downward-sloping demand curve, \( d_0 \). This is because consumers view its product to be different from that of other firms in the industry. In the short run, a monopolistically competitive firm maximizes profits by producing output \( Q_0 \) and charging a price of \( P_0 \), given by the intersection of the marginal revenue curve, \( mr_0 \), and the marginal costs curve. With price above average costs at \( Q_0 \), the firm earns monopoly profits.

**Long-Run Equilibrium** Attracted by the monopoly profits and given the assumption of free entry into the industry, new firms will provide similar, albeit not identical, products to existing consumers. With the availability of new product varieties some consumers will switch their purchases to the new firms, causing the demand curve, \( d_0 \), for the established firm to shift to the left. In addition to losing some consumers who opt to try the new varieties, the firm faces a more elastic demand curve as consumers become more price-sensitive given the increasing number of close substitutes.

Entry by new firms continues until all positive monopoly profits are exhausted. At this point, the industry is in a long-run equilibrium, where firms neither want to enter nor exit. Illustrated by Figure 6-5, the demand curve, \( d_1 \), in the long run is flatter and to the left of the short-run demand curve, \( d_0 \). The
long-run equilibrium is given at point $A$, at which the demand curve is tangent to the $AC$ curve, corresponding to the intersection of the marginal revenue and the marginal cost curves. At the profit-maximizing level of output, $Q_1$, and price, $P^A$, the firm is making zero profits because price equals average costs.

We now introduce another demand curve, $D/N^A$, to Figure 6-5 before examining trade under monopolistic competition. This demand curve, derived
from dividing the total market demand, \(D\), by the number of firms in autarky, \(N^A\), reflects the quantity demanded faced by each firm when all competitors charge the same price. The \(D/N^A\) curve is steeper (less elastic) than the individual demand curve, \(d_i\). This means that a drop in price by one firm will lead to a greater increase in quantity demanded than when all firms equally lower their prices. The reason is that when one firm decreases its price, it is able to attract more consumers away from competitive firms than when all firms drop their prices equally.

**Equilibrium with Free Trade**

Suppose firms in both Home and Foreign are monopolistically competitive. For simplicity, further assume that the two countries are identical in terms of size, number of consumers and firms, and technology and cost curves. Note that without the assumption of increasing returns to scale, the two countries would not engage in trade given their symmetry (Heckscher-Ohlin model), particularly in technologies (Ricardian model); their autarky relative prices would be the same. By contrast, we will see that under monopolistic competition, the two countries can still benefit from trading with each other despite their similarities.

**Short-Run Equilibrium with Trade**

We begin with the no-trade equilibrium given by point \(A\) in Figure 6-5, which is reproduced in Figure 6-6. As the two countries engage in trade, the number of consumers each firm can serve doubles. Likewise, there are twice as many firms available to consumers in each country so that the demand curve, \(D/N^A\), remains the same (i.e., \(2D/N^A = D/N^A\)). However, with the doubling of the number of firms, the variety of products available also doubles. In the short run with trade, the demand curve faced by each firm becomes even more elastic because there are more products competing for consumers in both countries. Given the new demand curve, \(d_2\), and new marginal revenue curve, \(mr_2\), the firm maximizes profit by setting price at \(P_2\), which is greater than its average costs. Namely, by decreasing its price from \(P_A\) to \(P_2\) the firm anticipates an increase in the quantity demanded to \(Q_2\), which would allow it to make monopoly profits.

However, motivated by the same incentive to attract consumers from other firms by lowering prices, every firm in the industry will make the same decision. This collective move means that the quantity demanded for any one firm does not increase along the curve \(d_2\) but rather downward on the demand curve \(D/N^A\). The short-run equilibrium due to all firms lowering price to \(P_2\) is the quantity \(Q_2\) at point \(B\). Because the short-run equilibrium price, \(P_2\), is less than the average costs of production, the firms are making a loss.

**Long-Run Equilibrium with Trade**

The losses will cause some firms to leave the industry, reducing the product varieties available to consumers and increasing demand for surviving firms. The number of firms remaining in each country after trade, \(N^T\), is less than pretrade, \(N^A\), such that the demand share facing each firm increases, \(D/N^T > D/N^A\), as illustrated in Figure 6-7, where demand \(D/N^T\) is to the right of demand \(D/N^A\) in Figure 6-6. Although there are fewer firms than before trade, the number of products available to consumers in each country has increased, that is, \(2N^T > N^A\). Given the availability of greater product variety with trade, the demand curve, \(d_3\), facing each firm is more elastic than with absence of trade. The intersection of the marginal rev-
The revenue curve, $mr_1$, with the marginal cost curve gives the long-run equilibrium with trade at point $C$, where all firms earn zero monopoly profits (i.e., price is equal to average costs). With international trade, remaining firms are able to take advantage of increasing returns to scale by decreasing their average costs because they each face a higher demand share. At the same time, the rise in the number of products increases competition, which causes the firms to reduce prices. More specifically, in the long run with trade, $P^w < P^*$ whereas $Q_1 > Q_2$. 

**Figure 6-6**

**Short-Run Equilibrium with Trade**

**Figure 6-7**

**Long-Run Equilibrium with Trade**
Gains from Trade  In general, consumers gain as a result of trade under monopolistic competition. In particular, consumers benefit because of the reduction in the price. Furthermore, assuming the variety is valued, they are better off by being able to choose from products produced both at Home and in Foreign. Surviving firms improve their productivity by taking advantage of increasing returns to scale to reduce their average costs.

Adjustment Costs from Trade  Nevertheless, to fully examine the overall effect of trade when firms compete under imperfect competition, we need to also analyze the short-run adjustment costs faced by exiting firms.

3 The North American Free Trade Agreement

Although the notion that trade could lead to an increase in product varieties was discussed earlier by David Ricardo, the introduction of the monopolistic competition model to capture this concept is credited to the work of Professors Elhanan Helpman, Paul Krugman, and the late Kelvin Lancaster in the 1980s.

Gains and Adjustment Costs for Canada under NAFTA

The gains and losses for Canada from joining the Canada–U.S. Free Trade Agreement (CUSFTA) are examined by economist, Daniel Trefler. Using data from 1989 to 1996, Trefler found that the short-run adjustment costs of the regional agreement amounts to a 5% loss of employment in manufacturing, or about 100,000 jobs. These losses, however, were compensated by employment created in other parts of the industry over time. Trefler also estimates that industries most affected by the tariff cuts experienced an increase in productivity equaling 1.9% per year, or 15% over the study period. Moreover, real earnings in Canada rose by 3% over 8 years due to the overall 6% productivity growth in manufacturing. Furthermore, in a comparison of trade creation versus trade diversion following the tariff reduction, Trefler found a positive difference between the amount of trade created weighted by the shares of U.S. imports and the amount of trade diverted weighted by the shares of imports from the rest of the world. This result implies that Canada is better off under the free-trade agreement with the United States.

HEADLINES

What Happened When Two Countries Liberalized Trade?
Pain, Then Gain.

Using detailed data on Canadian industries and individual companies, Trefler examined the impact of trade liberalization between two rich countries. Namely, he analyzed the effect of the removal or reduction in tariffs on Canada with the formation of CUSFTA. Trefler found that industries highly protected by tariffs experienced the most harm following the reduction of trade barriers, with employment falling by 12%. The lost employment from less-productive firms going under was offset by the hiring of new workers by more productive manufacturers that improved their operations as well as expanded in the United States. Through competition with U.S. firms, formerly sheltered industries increased labor productivity by 15%. Trefler further noted that at least half of the productivity increase was due to
the closing of inefficient plants. More significantly, the long-run rise in productivity can also be attributed to the adoption of superior operating practices.

Gains and Adjustment Costs for Mexico under NAFTA
As part of its economic reforms, Mexico joined the NAFTA with the United States and Canada in 1994. Under NAFTA, Mexican tariffs on U.S. goods declined from 14% in 1990 to 1% in 2001.

Productivity in Mexico We can examine the growth in labor productivity in Mexico, as shown in panel (a) of Figure 6-8 for maquiladora plants—those near the U.S. border, producing mostly for export to the United States—and for all other nonmaquiladora manufacturing plants. From 1994 to 2003, the labor productivity increased by 45% and 25% in maquiladora and non-maquiladora plants, respectively. We can estimate the impact of NAFTA on the maquiladora above that which occurred in the rest of Mexico by taking a difference between the compound growth rate per year for these export-oriented plants (4.1%) and the nonmaquiladora (2.5%).

Real Wages and Incomes Panel (b) of Figure 6-8 shows the real wages in the maquiladora and nonmaquiladora plants. Between 1994 and 1997, the real wages for Mexican workers fell by over 20% in both nonmaquiladora and maquiladora plants. In the same year that it joined NAFTA, Mexico experienced a devaluation of the peso, which increased the consumer price index, thereby lowering real wages. More susceptible to the fluctuations of the exchange rate, the maquiladora plants did not experience a large productivity gain over the 3-year period. By 2003 the productivity at both plant types rose over 20% relative to the level in 1994. In both sectors, real wages increased by 2003 to levels obtained in 1994.

As an alternative to examining real wages, we could instead study the real monthly income, which would more accurately reflect the earnings of higher-income individuals who receive salaries. Panel (b) of Figure 6-8 shows a near-identical movement between real wages and real monthly income for the nonmaquiladora sector. By contrast, real monthly incomes are higher for workers in maquiladora plants in 2003 as compared with those in 1994. In general, the results imply modest gains for Mexico from joining NAFTA, with higher-income workers in the maquiladora sector benefiting the most.

HEADLINES

NAFTA Turns 15, Bravo!
This article celebrates the fifteenth anniversary of NAFTA, and all that this agreement has done to promote trade between the United States and Mexico. Bilateral trade between the United States and Mexico increased from $81.5 billion in 1993 to $347 billion in 2007, which the author attributes in large part to NAFTA. The benefits cited by this article mirror those discussed in this chapter: both lower prices due to increasing returns to scale and greater product variety benefitting U.S. and Mexican consumers alike.

Adjustment Costs in Mexico
Before NAFTA, it was expected that Mexico’s agricultural sector, particularly corn growers, would face severe short-run adjustment costs due to intense im-
port competition from the United States. Post-NAFTA, there is no evidence that Mexican corn growers suffered great harm. The reason may be attributable to the finding that the poorest farmers benefited from consuming the lower priced corns from the United States rather than competing as sellers. Another is that some corn farmers received subsidies from the Mexican government that offset the reduction in their income.

In the maquiladora sector, employment grew post-NAFTA from 584,000 workers in 1994 to a height of 1.29 million workers in 2000. However, as a result of several factors, including the recession in the United States, overvaluation of the peso, and competition from China, employment dropped to 1.1 million workers by 2003.

**Gains and Adjustment Costs for the United States under NAFTA**

To examine the gains and losses in the United States from the entry of its southern neighbor into the free-trade agreement, we begin by noting that consumers, as well as some U.S. firms, receive benefits from the expansion of product varieties from Mexico. Next, we compare the long-run gains in consumer surplus due to the increase in import varieties with the short-run adjustment costs faced by competing firms.

**Expansion of Variety to the United States**  Due to reduction in trade barriers, the variety of products imported from Mexico substantially increased. Table 6-3 shows that between 1990 and 2001, Mexico’s export variety to the United States grew, on average, at an annual rate of 2.2%. In the wood and paper industry the rate was 2.6% per year and in petroleum and plastics the annual rate of growth was 2.5%. Electronics grew more rapidly at 4.6%.

In addition to Mexico, the raise in product varieties from all countries between 1972 and 2001 resulted in an increase in consumer surplus that is equivalent to a reduction in import prices by 1.2% per year. The benefits to consumers from the growth of import varieties over the first 9 years of NAFTA are estimated to be $49.5 billion.

**Adjustment Costs in the United States**  Short-run adjustment costs consist of the exiting of domestic firms due to foreign competition. As firms leave the manufacturing industry, workers become temporarily unemployed. Under U.S. trade laws, these displaced workers are entitled to temporary support by claiming for **Trade Adjustment Assistance (TAA)**. From 1994 to 2002, approximately 525,000 workers lost their jobs due to import competition from Canada or Mexico under NAFTA. In comparison with the annual number of manufacturing workers displaced between January 1999 and December 2001, the NAFTA layoff of 58,000 workers per year amounts to 13% of the total displacement in U.S. manufacturing.

Alternatively, we can evaluate the short-run adjustment costs by comparing the lost wages of displaced workers with the long-run gains in consumer surplus. We simplify the calculations by assuming that all workers require 3 years to obtain a new job. Multiplying the average yearly earning in manufacturing in 2000 ($31,000) by three we get that the wage lost due to displacement is $93,000 per worker. It follows that the annual adjustment costs equal $5.4 billion (58,000 workers annually displaced multiplied by $93,000 per worker). Although the private NAFTA costs of $5.8 billion is nearly equal to the consumer gains of $5.5 billion, overall, U.S. consumers are better off due
to the annual expansion of import varieties from Mexico. Moreover, because the unemployment is temporary, whereas the growth in import varieties occurs annually, the benefits of increased trade far exceed the short-run costs.

**Summary of NAFTA** The long-run gains to the United States come from the expansion of product varieties from Mexico as well as the drop in consumer prices. For Mexico and Canada, improvements in exporter productivity relative to the rest of the manufacturing sector provide evidence of long-run gains. In terms of the United States and Canada, the long-run gains are greater than the short-run costs such that these two neighboring countries benefited from the formation of NAFTA. By contrast, the beneficiaries of NAFTA mainly consist of higher-income workers in the maquiladora sector since they experienced a rise in their real earnings.

**N E T W O R K**

**Group Eligibility Requirements: TAA**

- Workers’ company produces a product.
- A required minimum of the workforce has been laid off in the 12 months preceding the date of the petition or is threatened with layoffs (three workers in groups of fewer than 50, or 5% of the workforce in groups of 50 or more)
- One of the following:
  - Increased imports contributed importantly to an actual decline in sales or production and to a layoff or threat of a layoff; or
  - There has been a shift in production to certain countries outside the United States; or
  - There has been a shift in production outside the United States and there has been or is likely to be an increase in the import of like or similar articles; or
  - Loss of business as a supplier of component parts, a final assembler, or a finisher for a TAA-certified firm contributed importantly to an actual decline in sales or production, and to a layoff or threat of a layoff.

Under Section 113 of the Trade Adjustment Assistance Reform Act of 2002 (PL 107-210), workers may be eligible to apply for TAA services if they were laid off as a result of increased imports or if their companies shifted production out of the United States to certain foreign countries. In 2009, President Obama revised the TAA as part of the American Recovery and Reinvention Act of 2009 (the stimulus bill). The TAA benefits were increased and all service sector employees are now eligible for assistance.

**Intra-Industry Trade and the Gravity Equation**

In the Ricardian and Heckscher-Ohlin models, countries traded homogeneous goods either by exporting or importing the products but not both. By contrast, countries engage in **intra-industry trade** by sending different varieties of differentiated goods back and forth to one another in the monopolistic competition model.

**Index of Intra-Industry Trade** To determine what proportion of a good traded involves both imports and exports we calculate the index of intra-industry trade given by the following equation:

\[
\text{Index of Intra-industry Trade} = \frac{\text{Minimum of Imports and Exports}}{\frac{1}{2}(\text{Imports} + \text{Exports})}
\]
As an example, we use the information that the value of import for yachts in 2009 is $8.020 billion and export is $1.436 billion. The minimum of imports and exports is $8.020 billion with an average of \(\frac{1}{2} \times (8.020 + 1.436) = 1.119\) billion. Thus, \(\frac{8.020}{1.119} = 72\%\) of the U.S. trade in yachts involves imports and exports. Table 6-4 shows other examples of intra-industry trade in the United States.

**The Gravity Equation**

**The Gravity Equation in Trade** The gravity equation is used to explain the value of trade that takes place between two countries. Given by the following equation, the amount of trade between two countries is equal to the product of their respective gross domestic products (GDPs; \(GDP_1\) and \(GDP_2\)) and a constant, \(B\), divided by the distance, \(dist\), between them:

\[
\text{Trade} = B \cdot \frac{GDP_1 \cdot GDP_2}{dist^n}
\]

In particular, the amount of trade between the two countries will be greater the larger the two countries are or the closer they are to each other. The reason is that a large country such as the United States will produce more product varieties for consumers at Home and in Foreign although importing more to meet demand for differentiated goods. The proximity of the two countries leads to lower transportation costs, which results in more imports and exports.

**Deriving the Gravity Equation** To derive the gravity equation, we assume each country produces a differentiated product, where the import demand for goods produced by Country 1 depends on (1) the relative size of the importing country and (2) the distance between the two countries. The relative size of the importing country (Country 2) is measured by its GDP as compared with the rest of the world (\(\text{Share}_2 = \frac{GDP_2}{GDP_W}\)). The distance between the two countries provides a measure for the transportation costs associated with exporting the good from one country to another. Raising to the distance between Country 1 and Country 2 a power, or \(dist^n\), we have that the exports from the former to the latter are equal to the following equation:

\[
\text{Trade} = \frac{GDP_1 \cdot \text{Share}_2}{dist^n} = \left(\frac{1}{GDP_W}\right) \frac{GDP_1 \cdot GDP_2}{dist^n}
\]

By denoting the term \(\left(\frac{1}{GDP_W}\right)\) as a constant term, \(B\), we have the gravity equation.

**APPLICATION**

The Gravity Equation for Canada and the United States

Panel (a) of Figure 6-9 shows the trade between U.S. states and Canadian provinces in 1993 with the gravity term \(\left(\frac{GDP_1 \cdot \text{Share}_2}{dist^n}\right)\) as a logarithmic scale on the horizontal axis and the value of export also in logarithmic scale (in millions of U.S. dollars) from a Canadian province to a U.S. state (or vice versa) on the vertical axis. With data from 30 states and 10 provinces, the points in panel (a), which represent the trade flow and gravity term between a particular state and province, show that trading partners with a higher gravity term have more trade with one another. By including a line
of “best fit” to the set of points, we get that the constant term $B = 93$. In other words, the predicted amount of trade between a U.S. state and a Canadian province is $93$ million when the gravity term equals one.

**Trade within Canada**

The gravity equation can also predict intranational trade, or trade within a country. Panel (b) of Figure 6-9 shows the value of exports between pairs of Canadian provinces and their gravity term. Similar to panel (a), we see a strong, positive relationship between the gravity term for the two provinces and the amount of their trade. From drawing a “best fit” straight line through the set of points, we can determine that the constant term $B = 1,300$. This means that when the gravity term equals 1, the amount of trade predicted within Canada is $1300 / 93 = 14$ times greater than that between the Canadian provinces and U.S. states. In 1988, a year prior to the formation of the Canada–U.S. Free-Trade Agreement, intranational trade between Canadian provinces was 22 times higher than international trade across the border. Although the trade agreement increased trade between Canada and the United States by eliminating some barriers to trade such as tariffs and quotas, there are other border effects, which include customs and regulations, that influence the amount of trade between countries.

**5 Conclusions**

In contrast to classical trade models such as the Ricardian model and the Heckscher-Ohlin model, we find that two seemingly identical countries can benefit from trading with one another when we remove the assumption of perfect competition. Under monopolistic competition, the doubling of the market size with free trade motivates firms to attract consumers away from their competitors by lowering their prices. However, the collective movement to lower prices by all firms leads to negative profits for everyone and causes some to exit the industry. With an increase in the market share relative to free trade, the surviving firms raise the quantity supplied, which allows them to take advantage of increasing returns to scale and lower their average costs. Due to the reduction in their average costs, firms lower their prices, which increases consumer surplus in the importing country. Moreover, the increase in the number of firms resulting from trade implies that there is an expansion in the variety of products available to consumers.

Despite potential for long-term gains to consumers in the form of lower prices and increased variety and to remaining producers from greater efficiency, a comparison of the short-run adjustment costs to workers displaced due to the exiting of some firms is necessary to fully examine the effect of tariff reductions following the formation of regional trade agreements. In general, the long-run gains are likely to exceed the short-run adjustment costs if the diversion of imports from an outside member to an inside member is less than the creation of trade between countries in the newly formed regional agreements.

This chapter also shows that when a firm has market power, possibly due to a tariff or high transport costs, it can behave as a discriminating monopoly by charging consumers at Home a different price than those in the Foreign
market for identical products. Charging different prices across markets or dumping also occurs in both directions, also known as reciprocal dumping.

**TEACHING TIPS**

**Tip 1: Understanding Increasing Returns to Scale and Monopolistic Competition**

Chapter 6 introduces a very important, but difficult, model of trade. For students to understand the complexity of this model, it is imperative that they fully grasp the concepts of monopolistic competition, market power, and love of variety. One way to help students internalize this logic is by finding examples in their own lives. Have the class brainstorm examples of industries where firms sell differentiated goods, firms have market power, and consumers benefit from increased variety.

**Tip 2: Adjustment Costs and Trade Adjustment Assistance**

In the model of Chapter 6, trade creates a firm exit, which results in short-term costs to trade. Ask students to independently research the changes made to the TAA by President Obama in 2009. Ask students to detail the changes and relate them to what we have learned about international trade, especially the new model developed in Chapter 6, where trade, though beneficial, can create short-run adjustment costs. A good source for a summary of changes can be found at the United States Department of Labor web page (http://www.doleta.gov/tradeact/).

**Tip 3: Data Analysis of Intra-Industry Trade**

We continue our effort to familiarize students with economic data by asking students to investigate the level of intra-industry trade for goods of their own choosing. Ask students to look up the Harmonized Tariff code for four goods, two of which they believe will have low intra-industry trade and two of which they believe will have high intra-industry trade (HTCs can be found at http://tse.export.gov/TSE/TSEhome.aspx). Then have students follow the instruction in Problem 9 of Chapter 6 to find the intra-industry trade for each good. Ask students to justify their choices appealing to the theory learned in Chapter 6.
IN-CLASS PROBLEMS

1. How does increasing returns to scale lead to gains from trade under monopolistic competition?
   **Answer:** Through trade, firms are able to expand their outputs by selling in the Foreign market. With the rise in the number of product varieties available, competition increases in the importing country, which drives prices to fall. Although some firms exit the market because of the losses resulting from the lower prices, the remaining firms are able to reduce their average costs through increasing returns to scale by expanding their output. Consumers in the importing country gain from the lower prices charged by firms as a result of the decrease in average costs. Consumers also benefit from the increase in the product varieties.

2. Portland and Aleland are two identical countries. Beer manufacturers in each country compete under monopolistic competition.
   a. Suppose the two countries engage in trade. Determine the impact of free trade on consumers in Portland.
      **Answer:** Consumers in Portland will gain from an increase in the varieties of beer available through importing. Additionally, prices will fall due to the increased competition.
   b. How does trade affect the welfare of domestic producers in Portland?
      **Answer:** By selling abroad, the producers in Portland will be able to lower their average costs through increasing returns to scale. However, they will face greater competition in their local market due to new varieties available from the import of beer from Aleland. As a result of the competition from Aleland, consumer demand for their variety decreases, thus driving their prices down.

3. What had Canada expected to gain from forming the CUSFTA with the United States?
   **Answer:** Relative to the United States, the Canadian market is small. By forming CUSFTA with its larger southern neighbor, Canada expected to be able to expand production by serving the bigger market, which in turn would allow the firms to lower their costs through increasing returns to scale.

4. Refer to the gravity equation.
   a. Why is trade greater between two large trading partners?
      **Answer:** Large economies produce more product varieties. Thus, when two countries trade differentiated product as is the case in the monopolistic competition model, the larger countries will have more to export. Moreover, larger economies will also have a higher import demand for the number of product varieties. Thus, trade is greater between two large countries.
   b. How does distance between trading partners influence the amount of trade?
      **Answer:** Distance influences the amount of trade because the closer are the trading partners in proximity, the lower transportation costs, which results in more imports and exports.

5. In the monopolistic competition model, would you expect prices to be higher or lower as the number of firms increases? Briefly explain why.
   **Answer:** As the number of firms increases, there will be more product varieties available to the consumers. Due to the increase in competition, the demand curve for the existing firms become more elastic and the demand for each variety decreases, leading to a fall in prices.

6. Assume a firm has the following costs:
   - Fixed costs: $100
   - Marginal costs: $50/unit
   a. Fill in the missing information on the following chart:

<table>
<thead>
<tr>
<th>Quantity, Q</th>
<th>Variable costs = Q \cdot MC</th>
<th>Total Costs = Variable Costs + Fixed Costs</th>
<th>Average Costs = Total Cost/Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<tr>
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<tr>
<td>270</td>
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</tr>
</tbody>
</table>
b. At what level of output does the firm experience increasing returns to scale?

Answer: The firm experiences increasing returns to scale over the range of 5 to 270 units of output.

7. How does an increase in the number of product varieties benefit an importing country?

Answer: Assuming that consumers prefer more varieties to less, an increase in the number of available product varieties would be a benefit. In addition, as the number of varieties increases, the demand for any one variety decreases such that its price falls.
Chapter Summary
The topic of offshoring is discussed in this chapter through a model and various case studies. The chapter examines whether offshoring or the shift toward skill-biased technological equipment explains the increase in the demand for high-skilled labor in the United States. There is a discussion of the potential loss of U.S. comparative advantage to countries such as China and India. Winners and losers of offshoring are also identified.

Comments
Offshoring is a deeply debated topic. Therefore, it is likely that your students have some ideas about the impact of offshoring on their futures or someone they know. After reminding them of what they have learned thus far about the potential gains from international trade, ask your students whether they support policies to limit offshoring. To motivate the topic, the video "Outsourcing: White Collar Exodus" provides an in-depth look at the growing use of service outsourcing, particularly focusing on call centers in India.

This chapter uses the concept of production possibilities frontiers (PPFs) in examining the model of outsourcing. The students should be reminded that the PPF now refers to the production possibilities for a firm rather than an economy. In addition, isoquants are presented. Briefly discuss the similarity
between a consumer’s indifference curve and an isoquant to help the students to understand that along the curve, the output remains constant although the combination of inputs changes.

Lecture Notes

Introduction

Offshoring materials, parts, components, and services necessary to produce the simplest to the most sophisticated products is common. Technically, offshoring is defined as “the provision of a service or the production of various parts of a good in different countries that are then used or assembled into a final good in another location.” Offshoring differs from traditional models of international trade (Ricardian and Heckscher-Ohlin) in that it involves trade of intermediate inputs rather than final goods. Unlike final goods, intermediate inputs may cross numerous borders before being integrated into a product that is sold either to the domestic or foreign market. The popularity of offshoring is largely due to the cost reduction of international services, such as transportation and communications. One of the newest forms of offshoring is the outsourcing of business services such as accounting, auditing, human resources, order processing, telemarketing, and after-sales service to foreign countries.

SIDEBAR

Foreign Outsourcing versus Offshoring

Offshoring is defined as Foreign production of goods in plants owned by the Home firm. As an example, Intel produces microchips in subsidiaries in China and Costa Rica. By contrast, outsourcing occurs when a Home firm subcontracts the production of its product to Foreign vendors. Examples include Mattel and Nike, where the final products are made to the firms’ specifications and carry the firms’ brand names but the production takes place in plants owned by Foreign firms. Although it should be noted that some firms use a combination of offshoring and outsourcing, such as Dell, this chapter uses both terms interchangeably.

1 A Model of Offshoring

We begin the formal model of offshoring by ranking skill intensity of activities involved in producing a good. Panel (a) of Figure 7-2 presents the production process in chronologic order, namely, from research and development to marketing and after-sales service. By contrast, panel (b) gives the rank of the activities based on the ratio of high-skilled to low-skilled labor required in the process with assembly as the least skilled-intensive part of the production to research and development the most skilled intensive.

Value Chain of Activities

Figure 7-1 illustrates the value chain for the product because each subsequent activity adds more value to the previous to produce the final good. We
will use the value chain to determine which activities a firm is most likely to outsource to maintain competition.

**Relative Wage of High-Skilled Workers** Letting $W_L$ ($W_H$) denote the wage of low-skilled (high-skilled) labor at Home, whereas $W_L^*$ ($W_H^*$) represents those in Foreign, we make the assumption that compared with Home, wages in Foreign are less ($W_L^* < W_L$ and $W_H^* < W_H$) and the relative wage of low-skilled labor is lower ($W_L^*/W_L < W_L^*/W_H$).

For example, consider Home as the United States, where the average wage of production workers was 37% less than nonproduction workers in 1988. Foreign can be viewed as Mexico, where production workers earned 55% less in average wage than nonproduction workers in the same period.

**Costs of Capital and Trade** In deciding whether to outsource certain activities in its production process, a firm must weigh the savings in labor cost achieved by shifting to the lower-wage Foreign country against the additional costs associated with doing business abroad. These “trade costs” include physical capital of a foreign plant or factory, transportation and communication, and Foreign-imposed tariffs. To simplify the firm’s decision process to base only on the savings in labor costs, we assume that regardless of the source, all trade costs apply uniformly across all activities in the value chain.

**Slicing the Value Chain** Given our assumptions, the firm will maintain the more labor-intensive activities at Home and shift the most labor-intensive activities abroad. Referring to panel (b) of Figure 7-1, the firm is slicing the value chain by shifting all activities to the left of the vertical line A to Foreign.

**Relative Demand for Skilled Labor** Adding the demand for high-skilled and low-skilled labor in the activities to the right of line A, we obtain Home’s relative demand for high-skilled labor as illustrated in Figure 7-2, where the horizontal axis is the relative demand for skilled labor, $H/L$, and the vertical axis gives the relative wage of high-skilled labor, $W_H/W_L$. The downward-sloping relative demand curve reflects the inverse relationship between higher relative wage for high-skilled labor and the Home firms’ quantity demand for high-skilled labor as compared with low-skilled labor. Namely, the Home firms are likely to substitute less-skilled labor in some activities for skilled labor in response to an increase in the relative wage of the latter. To derive the relative demand for high-skilled labor in Foreign, we similarly add up the demand for high-skilled, $H^*$, and low-skilled, $L^*$, labor for all activities to the left of line A. The relative demand for skilled labor in Foreign, $H^*/L^*$, against the relative wage, $W_H^*/W_L^*$, is presented in panel (b). By adding a relative supply curve to each respective diagram, we are able to determine the equilibrium relative wage given by points A and $A^*$ at Home and Foreign, respectively.

**Changing the Costs of Trade** With our assumptions thus far, we see that Home will send abroad to Foreign its least-skilled-intensive activities, namely, those to the left of line A. Suppose further that the cost of offshoring decreases either due to a fall in the costs of capital or trade in Foreign. An example of this includes the implementation of North American Free Trade Agreement (NAFTA), which lowered tariffs between Mexico and the United States.
Change in Home Labor Demand and Relative Wage  Due to the decline in trade costs, the Home firm will be motivated to shift more activities in the value-chain to Foreign. In other words, Home will move the next-least-skilled-intensive production processes abroad as illustrated by the area between lines \(A\) and \(B\) in Figure 7-3. These activities, although more skilled-intensive than those sent to Foreign before the fall in trade costs, are still less skilled intensive than those kept at Home. Therefore, the average range of activities performed at Home becomes even more skilled intensive. Consequently, the ratio of high-skilled to low-skilled labor increases at Home as shown by the rightward shift of the relative demand curve in panel (a) of Figure 7-4. The intersection of the relative supply curve with the new relative demand curve gives the new equilibrium point \(B\), where the relative wage of high-skilled labor has increased due to additional offshoring.

Change in Foreign Labor Demand and Relative Wage  Similarly, the average range of activities in Foreign is now more skilled-labor intensive due to the additional offshoring done by the Home firm. Although the newly outsourced activities (between lines \(A\) and \(B\)) are less skilled intensive as compared with those maintained at Home (to the right of line \(B\)), these production processes are more skilled intensive than the activities originally outsourced to Foreign (those to the left of line \(A\)). As a result, the relative demand for high-skilled labor in Foreign also increases as illustrated by panel (b) of Figure 7-4. The increase in the Foreign high-skilled to low-skilled labor ratio raises the relative wage of skilled labor given by the new equilibrium at point \(B'\).

APPLICATION

Change in Relative Wages across Countries

The wage differential between high-skilled and low-skilled workers in developed countries such as the United States, Japan, the United Kingdom, and Sweden, as well as less-developed countries such as Mexico and Chile, has increased since the early 1980s. This change in wages is consistent with the prediction of the offshoring model.

Change in Relative Wages in the United States  A comparison of the wage movements in the manufacturing industries allows us to more accurately attribute each factor toward explaining the widening wage differential experienced in the United States. We consider production workers to be “blue collar” workers and nonproduction workers to be “white collar” workers.

Relative Wage of Nonproduction Workers  From Figure 7-5, we see that the average annual earnings of nonproduction workers relative to production workers in U.S. manufacturing did not follow any particular trend between 1958 and 1967. The average annual earnings ratio exhibited a downward trend from 1968 to 1983. This decline is attributed to an increase in the supply of college graduates in nonproduction jobs. However, starting from 1983, nonproduction wage increased relative to production wage.

Relative Employment of Nonproduction Workers  Figure 7-6 shows the relative employment of nonproduction to production workers in U.S. manufacturing from 1958 to 2001. Until the early 1990s, there was a rise in the nonproduction employment ratio. Then the trend reversed itself until
the late 1990s. The increase in relative supply of college-educated workers in nonproduction prior to 1983 coincides with both the decline in the relative wage (Figure 7-5) and expansion in relative employment (Figure 7-6) of nonproduction workers. Notice that contrary to conventional thinking, the increase in the relative wage of nonproduction concurs with an increase in nonproduction employment as compared with production rather than a shift away from nonproduction workers. Consistent with both movements during that time is an increase in the demand for high-skilled workers as shown in Figure 7-7.

**Explanations** The increase in the relative demand for high-skilled workers due to offshoring is one possible explanation for the rising wage gap between high-skilled and low-skilled workers in the United States and other countries. The increase in the relative demand for high-skilled workers, however, can also partly be explained by the shift toward computers and other high-tech equipment, or skill-biased technologic change.

Part A of Table 7-1 shows the share of total wage payments going to nonproduction or high-skilled labor in U.S. manufacturing industries from 1979 to 1990, whereas part B gives the relative wage of nonproduction labor for the same period. Offshoring is measured as the import of intermediate inputs by each industry. For high-technology equipment, two measures are provided. One is the fraction of the total capital equipment installed in each industry (i.e., fraction of the capital stock) and the other is the fraction of new capital investment devoted to computers and other high-tech devices (i.e., fraction of the annual flow new investment). The top row of part A, using the first measure of high-tech equipment, shows that about 20% to 23% of the increase in the share of nonproduction wage payments can be explained by offshoring, whereas high-tech capital explains about 8% to 12%. However, the bottom row of part A, using the second measure of high-tech equipment, indicates that high-tech investment attributes more to the increase in the nonproduction share of wages with 37% as compared with offshoring at 13%.

Using the same definitions, part B of Table 7-1 attributes the results of an increase in the relative wage of nonproduction workers to offshoring and high-tech equipment. With high-tech equipment given by the fraction of capital stock, the top row of part B shows that about 21% to 27% of the increase in the relative nonproduction wage is explained by offshoring whereas 29% to 32% of the increase is attributed to the increasing use of high-tech capital. The bottom row of part B, using the fraction of new investment, gives questionable results because almost all (99%) of the increase in relative wage for nonproduction workers can be explained by high-tech equipment.

**Change in Relative Wage in Mexico** As predicted by the offshoring model described in the preceding section, the relative wage of nonproduction workers in Mexico increased during 1985 to 1994, as shown in Figure 7-9. However, after 1994, the relative wage of nonproduction workers fell. Recall that NAFTA was implemented in 1994. One study notes that because NAFTA favors U.S. exports of skill-intensive goods to Mexico, the prices of those goods fell, leading to the fall in the relative nonproduction wage in the non-maquiladora plants. ■
2 The Gains from Offshoring

From the previous section, we know that offshoring leads to an increase in the relative demand for high-skilled labor, which in turn raises their wage compared with low-skilled labor. Consequently, high-skilled labor benefits from offshoring whereas low-skilled labor suffers a loss. However, in addition to high-skilled labor, consumers also gain through the lower cost of final goods passed on to them by the offshoring firm. The question we examine in this section is whether the gains enjoyed by the winners outweigh the losses faced by the losers.

Nobel laureate Paul Samuelson noted that although there are gains from trade through offshoring, it is not necessarily the case that the winnings from those who benefit exceed the losses of those who lose.

Simplified Offshoring Model

To examine the gains and losses of offshoring and the validity of the comment made by Samuelson, we will simplify the offshoring model to consist of just two processes: components production and research and development (R&D). Although both activities require high-skilled and low-skilled labor, components production is low-skilled-labor intensive whereas R&D is high-skilled-labor intensive. Although we are focusing only on high-skilled and low-skilled labor, we maintain the earlier assumption that the costs of capital are equal in the two activities. A firm “endowed” with a certain amount of high-skilled \((H)\) and low-skilled \((L)\) labor can choose to allocate its resources between components production and R&D, as illustrated by the production possibility frontier (PPF) in Figure 7-9, where components production is on the horizontal axis and R&D is on the vertical axis.

Production in the Absence of Offshoring

Let’s begin by assuming that the firm initially partakes in both components production and R&D at Home (i.e., the firm does not outsource these activities). With the two production processes used to produce the final good, the firm chooses a point on its PPF that enables it to reach its highest isoquants. Given its production possibilities, the firm produces the final goods combination \(Y_0\) using \(Q_C\) quantity of components and \(Q_R\) quantity of R&D, denoted by point \(A\). Drawing a line tangent to the slope of the isoquant at point \(A\) gives the relative price of components, \((P_C / P_R)^A\), without offshoring or the no-trade equilibrium.

Equilibrium with Offshoring

Now we will ease our previous assumption by allowing the Home firm to engage in offshoring. By opening up to trade, the Home firm finds that it can import the components more cheaply than it could produce on its own because it faces a lower relative price of components, \((P_C / P_R)^W < (P_C / P_R)^A\). The lower world-relative price is represented in Figure 7-10 by a line that is flatter than the no-trade relative price line at Home. Because producing components at Home has become relatively more expensive, the Home firm shifts its resources toward R&D and away from components production by offshoring the latter to Foreign. Doing so, the Home firm moves from point \(A\) to point \(B\) on its PPF, which enables it to obtain a higher level of final-goods combination, given by point \(C\) on the isoquant \(Y_I\).
Gains from Offshoring within the Firm The gain the Home firm experiences through offshoring is measured by the increase in the amount of final good it produces, namely, the difference between \( Y_0 \) and \( Y_1 \). More specifically, the firm has become more productive because it is capable of producing more final goods using the same total “endowment” of high-skilled and low-skilled labor as in the absence of offshoring. The firm achieves this higher productivity by focusing on R&D and offshoring components assembly to Foreign, where the low-skilled-intensive activity is cheaper. This cost savings, reflected by the lower price in the final product, gives one of the general conclusions that there are gains from offshoring when Home faces a different relative price compared with the no-trade case.

Terms of Trade
To further understand Paul Samuelson’s comment, we need to reintroduce the concept of terms of trade. Recall that the terms of trade is given by a country’s export price divide by the price of its imports. For any country, a rise in its terms of trade means that it is either receiving a higher price for its exports or is able to purchase its imports at a lower price.

Fall in the Price of Components Suppose Foreign improves its productivity in components production, leading to a fall in the world-relative price. As an importer of components, Home experiences a rise in its terms of trade due to the fall in the relative price of components. With an even flatter world-relative price, \((P_C / P_K)^{W2}\) as shown in Figure 7-11, the Home firm dedicates more resources to R&D by moving to point \( B' \) along its PPF and producing a greater amount of final goods given by point \( C' \) on \( Y_2 \). Thus, due to the fall in the price of components production, the Home firm enjoys additional benefits through offshoring.

Fall in the Price of R&D Let’s examine the case in which the world-relative price of R&D falls instead of components production. Illustrated in Figure 7-12, the fall in world-relative price of R&D means that Home faces a steeper price line, \((P_C / P_K)^{W3}\), compared with the situation before the decline in the price of R&D. With the decline in the world-relative price, the Home firm shifts some of its resources from R&D to components production, moving from point \( B \) to point \( B'' \). It follows that the firm’s final output falls from point \( C \) on isoquant \( Y_1 \) to point \( C'' \) on isoquant \( Y_3 \). The fall in the price of R&D leads to losses for the Home firm because the terms of trade at Home worsened compared with the initial offshoring equilibrium. Notice that because \( Y_3 \) is still higher than \( Y_0 \) (final output absence of trade) Home still gains from offshoring as compared with the no-trade equilibrium at point \( A \). Thus, although Home is worse off when its terms of trade fall, it is still better off than in the absence of offshoring. However, as noted by Paul Samuelson, unlike traditional trade in final goods, a fall in the terms of trade with offshoring could have a negative impact on the Home country in that the gains of the winners may not be large enough to compensate the losses of the losers. This issue becomes particularly pertinent as countries such as China and India gain comparative advantage in activities once dominated by the United States.
APPLICATION

U.S. Terms of Trade and Service Exports

*Merchandise Prices* Figure 7-13 shows the U.S. terms of trade for merchandise goods, excluding petroleum. Between 1987 and 1994, the terms of trade worsened for the United States. From 1994 through 2008, the United States has benefitted from imports of intermediate inputs and final goods due to the rise in the terms of trade, but there has been a slight dip since 2009.

*Service Prices* We can examine a similar study in U.S. terms of trade for services using international prices on air travel, available from 1995. The air-travel terms of trade, equal to the price foreigners pay traveling on U.S. airlines divided by the price Americans pay on Foreign airlines, does not exhibit any systematic patterns before 2002. From 2002 to 2005, the data indicate increasing gains from trade for the United States in air travel. Since then U.S. terms of trade in air-travel has been generally falling, though somewhat erratically.

*Service Trade* Because prices are not available for services other than air travel, we will use the amount of service traded to examine whether there is any evidence to support Paul Samuelson’s comment. Table 7-2 shows that the United States enjoyed a surplus in service trade in 2008 worth about $160 billion. In particular, it can be noted that the United States has a comparative advantage in traded services given that exports exceed imports in most categories listed in Table 7-2. Figure 7-14 presents the combined trade surpluses in computer and information services, other business services, and financial services for the United States, the United Kingdom, and India since 1982. The U.S. surplus steadily grew in lock step with the surplus of the United Kingdom until about 1995. Since that time, the U.K. surplus has grown faster than that of the United States. Over the past decade, India has quickly become a world competitor with nearly all of their surplus coming from exports of computer and information services.

SIDEBAR

Offshoring Microsoft Windows

The type of offshoring in the 1980s and 1990s was largely manufacturing activities, however, today offshoring has shifted towards business services. This sidebar describes one such example, the offshoring of routine software maintenance by Microsoft to Wipro, an Indian high-tech firm. Throughout the night, the computers of Seattle-based Microsoft are managed remotely by Wipro. Wipro employees perform tasks from troubleshooting viruses to installing upgrades to Microsoft’s own Windows software.

3 The Political Future of Offshoring

Offshoring is often a hotly debated issue in the United States, largely because it is associated with the loss of American jobs. The Democratic primary election of 2007 provided a prime example of the political issues associated with offshoring. Both President Obama and Hillary Clinton promised to close loopholes, which they claimed gave tax breaks to firms who shipped jobs overseas.
Currently, corporate profits are taxed at 35 percent in the United States, however, profits made by subsidiaries overseas are untaxed by the United States so long as those profits stay overseas. The current legal environment may give firms incentive to invest profits earned abroad; it is not clear that it leads to offshoring jobs in the first place. When these profits are moved to the United States, they are taxed at 35 percent, as are all corporate profits. Though it appears that President Obama will follow through with his pledge to change the corporate tax code, this action has little support from economists.

The affect of offshoring on employment is often unclear. Even though some jobs might be moved overseas, the reduction in costs that occur could possibly increase rather than shrink domestic employment, as is discussed in the following Headlines. In addition to the ambiguous employment consequence, there is evidence that between 11 to 13 percent of the total increase in productivity within U.S. manufacturing from 1992 to 2000 can be attributed to offshoring.

**HEADLINES**

**How to Destroy American Jobs**
This article argues against President Obama’s proposed reform of the U.S. international tax system, which would increase taxes paid by multinational corporations on profits made overseas. It is argued that instead of promoting U.S. job creation, as is intended, this tax increase would destroy U.S. jobs. The author argues that multinational employment overseas is often a complement rather than a substitute for U.S. employment, an argument which is born out in the data. Over the past two decades, employment by foreign affiliates of multinational corporations has increased by only slightly more than domestic employment by parent corporations. Additionally, U.S. multinationals are responsible for large amount of U.S. private sector R&D and productivity gains.

**HEADLINES**

**Caterpillar Joins “Onshoring” Trend**
Following an extended period of globalization, many firms are beginning to see disadvantages to offshoring, such as transportation costs, complications in supply chains, and issues of quality. One such company, Caterpillar, is considering bringing some of its manufacturing back to the United States in a move being called “onshoring.” Weakness of the U.S. dollar has made it difficult for companies like Caterpillar to import products from overseas to be sold in the United States. While other firms like General Electric are moving operations back to the United States by negotiating more favorable labor agreements.

**NETWORK**

**The Harsh Truth About Offshoring**
Paul Craig Roberts, former Assistant Treasury Secretary under President Reagan, cast doubts on whether there are any gains from offshoring. He stated that the traditional theory of comparative advantage does not apply to offshoring because modern-day trade in goods and services is based on acquired knowledge rather than differences in technology and capital. More specifically, Roberts claimed that because offshoring is driven by absolute advantage, countries such as India and China will ultimately gain whereas the First World will lose. He
reasoned that the Asian countries have an excess supply of skilled and educated labor that, coupled with capital, technology, and business know-how from the First World, will give them the competitive edge over higher cost labor in the latter countries. Therefore, the First World will lose out not only in terms of ability to compete in labor costs but also inability to replace lost industries and jobs.

The Future of U.S. Comparative Advantage

It has been noted by many Americans that as China and India continue to become more developed, there will be few if any goods or services that cannot be outsourced to these countries. This naturally leads to the question of what lies in the future for the United States in terms of its comparative advantage. Examples of eroding comparative advantage include relatively high-skilled-intensive services such as radiology. An article published in the *New York Times* in 2003 suggested that American radiologists are losing jobs to India, where the pay is a fraction of that in the United States. Although there is a growing demand for “nighthawks” services, which allows smaller hospitals to obtain readings during the nighttime hours, these are often preliminary reads that are reviewed by a staff radiologist the following day. Because radiology is a profession involving decisions that cannot be codified in written rules and procedures, with the exception of specific tasks such as the reading of mammograms for breast cancer, there will continue to be a demand for highly trained radiologists with years of experience. Similarly, there will always be service activities that cannot be easily outsourced due to the lack of clearly defined written rules and procedures. These jobs, some of which are listed in Table 7-2, will allow the United States to maintain its comparative advantage.

4 Conclusion

This chapter provides a trade theory that helps explain the increasing use of outsourcing in the manufacturing and service industries. Offshoring differs from the traditional trade models in that it involves the movement of intermediate input across borders rather than final goods. In particular, various stages of the production process are ranked according to the requirement of low-skilled relative to high-skilled labor. With the assumption that the relative wage of low-skilled labor and general wages are lower in Foreign, the firm will outsource the less-skilled-intensive activities abroad and continue to focus on the more-skilled-intensive activities at Home. Due to a decline in the cost of capital or trade in Foreign, the Home firm will outsource the next least-skilled-intensive activities on the value chain. These additional activities outsourced will raise the ratio of high-skilled to low-skilled labor in Foreign and at Home.

The model also examines the impact of a change in the terms of trade for Home relative to the initial offshoring equilibrium. An improvement in the terms of trade will lead the Home firm to outsource even more of the low-skilled-intensive activities, leading to an increase in the relative wage of high-skilled labor and higher output of the final products. By contrast, a worsening of the terms of trade will trigger the firm to cut back on the
skilled-intensive activity, resulting in a lower output of the final goods as compared with the initial outsourcing equilibrium. In either case, Home achieves a greater level of production relative to the no-trade equilibrium.

Last, the chapter explores the impact of the increasing popularity of service offshoring on the future of U.S. comparative advantage. The data presented seem to support the notion that although some activities, particularly routine tasks with written rules and procedures, will continue to be outsourced to India where there are many college-educated workers who are paid considerably lower wages relative to their U.S. counterparts, there will always be activities that are not economical to outsource. The existence of these highly skilled services, requiring years of training or intrinsic abilities, means the United States will continue to have comparative advantage, despite competition from rapidly growing countries such as India and China.

**TEACHING TIPS**

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**Tip 1: Pros and Cons of Offshoring**

Offshoring is a hotly debated topic in the world today. As discussed in the comments portion of this instructor’s manual, most of your students will know someone who has been affected by offshoring. Before teaching this chapter, ask students to discuss their own opinions of offshoring. Then after completing the chapter, have a second class discussion, asking students to weigh the costs of offshoring against its benefits as detailed in Chapter 7.

**Tip 2: Relative Demand for Skilled Labor**

Students often have trouble understanding how the relative demand for skilled labor can increase in both countries as a result of trade in intermediate inputs. This concept is essential to understanding the model of offshoring presented in Chapter 7. It may be helpful to have a brief discussion with your students discussing the mechanism that generates this result.

**Tip 3: Data Analysis and Recent Trends in Service Trade**

The growth in services trade discussed in this chapter has helped make professional services a major component of U.S. GDP. In 2007, the professional services industry accounted for 17 percent of GDP, and employment in this industry study at 25 million is increasing by 3 percent since 2002. Table 7-2 displays the U.S. trade in services for 2008. Have students find the most recent U.S. services trade data, available through the Bureau of Economic Analysis (http://www.bea.gov/international/). Ask students to comment on any trends they may have observed.

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1. What are the main differences between the offshoring phenomena in manufacturing versus services?  

Answer: Manufacturing involves low-skilled-intensive labor such as the assembly of goods. Therefore, offshoring in manufacturing entails the movement of low-skilled-intensive activities overseas and occurs in countries with low-wage low-skilled labor. By contrast, services offshoring, particularly of business services such as accounting, auditing, human resources, order processing, telemarketing, and after-sales service for computer purchases uses high-skilled-intensive labor. Although offshoring in services also take place in low-wage countries, these activities are performed by high-skilled labor. As such, India is a favored destination for service offshoring because the wages of educated workers are lower relative to those in the United States. Moreover, manufacturing offshoring of intermediate inputs may be traded across borders several times. Due to the slicing of production process, each country involved must have reliable infrastructures, such as efficient road and transport networks.

2. In a graph similar to Figure 7-10, illustrate the no-trade equilibrium, $A^*$, for the Foreign firm.

a. Supposing Foreign engages in international trade, add the world-relative price of components to your graph. Indicate the Foreign firm’s resource allocation and production of the final goods when it faces the new price line.

Answer: See the following figure, where the new equilibrium is $B^*$ and $C^*$.
b. Illustrate the gains or losses faced by the firm relative to the initial offshoring equilibrium, assuming a fall in the price of components.  

**Answer:** See the following figure, where the new equilibrium is $B''$ and $C''$.

3. Reproduce part (a) of problem 2. Then, illustrate the gains or losses faced by the firm relative to the initial offshoring equilibrium, assuming a fall in the price of R&D.  

**Answer:** See the following figure, where the new equilibrium is $B''$ and $C''$. 

4. Use the simplified offshoring model with two activities and the information below to answer the following questions.

Two countries: Techland and Prodland
Two activities: Assembly, which is low-skilled-labor intensive, and product development, which is high-skilled-labor intensive

Final good: JPod

Prodland: \( W^L_P = 1,000, W^S_P = 5,000 \)

Techland: \( W^L_T = 30,000, W^S_T = 90,000 \)

The costs of capital and trade are uniform across production activities.

a. Which country has the higher relative wage of low-skilled labor?

**Answer:** The relative wage for low-skilled workers is \( W^L_P / W^S_P = 1,000 / 5,000 = 1/5 \) in Prodland and \( W^L_T / W^S_T = 30,000 / 90,000 = 1/3 \) in Techland. Because \( W^L_T / W^S_T < W^L_P / W^S_P \), the relative wage of low-skilled labor is higher in Techland.

b. Suppose the two countries engage in trade. Which activity will Techland outsource? Explain.

**Answer:** With a higher relative wage for low-skilled labor, Techland will outsource assembly, which is the most low-skilled-labor intensive, and keep the high-skilled-labor intensive activity of product development at home.

c. Draw relative labor supply and demand diagrams for Prodland and Techland on separate graphs.

**Answer:** See the figures below.

d. Suppose the cost of capital in Prodland decreases. What do you expect will happen to the relative wage in each country?

**Answer:** When the cost of capital declines in Prodland, it becomes more profitable for Techland to outsource additional assembly activities abroad. The activity that remains in Techland is now greater in high-skilled-labor intensity, on average, relative to the set of activities newly outsourced to Prodland, leading to an increase in the relative demand for high-skilled labor. The relative wage of high-skilled labor increases with the new equilibrium relative labor supply and demand.

In Prodland, the relative wage of high-skilled labor also rises because the activity newly outsourced from Techland is more high-skilled-labor intensive, on average, than the assembly work previously performed in the country. Therefore, the relative demand for skilled labor likewise increases in Prodland.
5. In 2005 there were 127 legislations proposed by 40 states to restrict offshoring. The following table defining the proposed legislations is from the National Foundation for American Policy.

<table>
<thead>
<tr>
<th>Proposed Legislation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCB: State Contract Ban</td>
<td>Prohibit work on state contracts to be performed overseas or by individuals not authorized to work in the United States</td>
</tr>
<tr>
<td>CCR: Call Center Restrictions</td>
<td>Require operators to identify their location in some manner</td>
</tr>
<tr>
<td>HDR: Health Care and/or Data Transfer Restrictions</td>
<td>Ban or require an “opt-in” for data to be processed outside of the United States</td>
</tr>
<tr>
<td>TAR: Trade Agreement Restriction</td>
<td>State not be party to international trade agreements on procurement</td>
</tr>
<tr>
<td>ISP: In-State Preference</td>
<td>In-state preference for state contracts</td>
</tr>
<tr>
<td>SAR: Development Assistance Restrictions</td>
<td>Development assistance restriction for outsourcing companies</td>
</tr>
<tr>
<td>9DN: 90-Day Notice</td>
<td>90-day notice for transferring 25% of workforce</td>
</tr>
<tr>
<td>LSW: Location of State Work</td>
<td>Report on location of state work</td>
</tr>
<tr>
<td>NO: Notification of Outsourcing</td>
<td>Notification to worker of outsourcing</td>
</tr>
<tr>
<td>OCF: Outsourcing Compensation Fund</td>
<td>Outsourcing compensation fund for employees</td>
</tr>
</tbody>
</table>

Given the list of proposed legislation by states below, identify the potential winners and losers of the offshoring restrictions:

<table>
<thead>
<tr>
<th>State</th>
<th>Proposed Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama</td>
<td>HDR</td>
</tr>
<tr>
<td>California</td>
<td>CCR, ISP</td>
</tr>
<tr>
<td>Connecticut</td>
<td>SCB, CCR, HDR, HDR, DAR, ISP, 9DN</td>
</tr>
<tr>
<td>Georgia</td>
<td>CCR</td>
</tr>
<tr>
<td>Idaho</td>
<td>SCB</td>
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<tr>
<td>Indiana</td>
<td>SCB</td>
</tr>
<tr>
<td>Kansas</td>
<td>CCR</td>
</tr>
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<td>Maryland</td>
<td>SCB, TAR</td>
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<tr>
<td>Michigan</td>
<td>ISP</td>
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<tr>
<td>Mississippi</td>
<td>SCB, CCR</td>
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<tr>
<td>Montana</td>
<td>SCB</td>
</tr>
<tr>
<td>Nevada</td>
<td>HDR</td>
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<tr>
<td>New Jersey</td>
<td>SCB, CCR</td>
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<tr>
<td>New York</td>
<td>SCB, DAR, NO</td>
</tr>
<tr>
<td>North Dakota</td>
<td>SCB, ISP</td>
</tr>
<tr>
<td>Oklahoma</td>
<td>SCB</td>
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<tr>
<td>Pennsylvania</td>
<td>SCB</td>
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<tr>
<td>South Carolina</td>
<td>ISP</td>
</tr>
<tr>
<td>Utah</td>
<td>ISP</td>
</tr>
<tr>
<td>Washington</td>
<td>SCB</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>SCB</td>
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</table>

<table>
<thead>
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<th>State</th>
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<td>West Virginia</td>
<td>CCR, SCB, DAR</td>
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Answer: Potential winners would be those whose jobs are banned from being outsourced. The losers would be firms that are unable to reduce costs by shedding their less skilled-intensive activities. Consumers would also lose from having to pay a higher price for the final product because the firms are restricted from lowering their costs through offshoring.

6. What impacts will the offshoring restrictions in problem 5 have on industry competitiveness in the proposed states?

Answer: The competitiveness of the industry facing the offshoring restrictions in the proposed states would be challenged. According to the offshoring model presented in this chapter, the firms faced with the ban would not be able to attain the
higher isoquants by subcontracting their less skilled-intensive activities to outside sources. Their production would occur at the no-trade equilibrium on their PPF.

7. Referring to problem 5, would the proposed legislation be as restrictive if the services were outsourced to another state (domestic offshoring) rather than across international borders (foreign offshoring)? Comment on the welfare of the states involved.

Answer: Offshoring to another state is likely to elicit a significantly less-restrictive response because the endangered jobs would be maintained within the United States borders. Assuming that the home state has a higher relative wage of low-skilled labor, the increased demand for high-skilled-intensive labor from offshoring the less skilled-intensive activities will drive the relative wage of high-skilled labor higher at Home. Likewise, the relative wage of skilled labor will rise in the host state as long as the outsourced activities are more skilled-labor intensive relative to those currently performed.

8. How does trade today differ from the past?

Answer: There is more trade today than in the past. In addition, between 1925 and 1950, two categories, (1) foods, feeds, and beverages and (2) industrial supplies and materials, accounted for 90% of imports and 80% of exports in the United States. By 2005, the shares of these two categories decreased to 35% for imports and exports. With the recent increased use of offshoring, the share of automotive and capital and consumer goods in U.S. imports and exports increased from 10% and 15%, respectively, in 1925 to 65% in 2005. Moreover, trade today involves not only final goods but also intermediate goods that often cross several borders before reaching their final destination.
Import Tariffs and Quotas under Perfect Competition

Notes to Instructor

Chapter Summary
This chapter examines the impact of import tariffs on the welfare of the importing country, exporting country, and world. The welfare implications are different depending on whether the importing country is small or large. Reasons for the popularity of tariffs are discussed as well as the role of the General Agreement on Tariffs and Trade (GATT)/World Trade Organization (WTO). In addition to tariffs, there is also a discussion of the use of an import quota as a barrier to trade.

Comments
To help students understand the impact of import tariffs on Home welfare under the small- and large-importing country cases, it would be useful to briefly review how consumer and producer surplus changes when a tax is imposed with a perfectly elastic supply curve and an upward-sloping supply curve.

Lecture Notes

Introduction
In 2009, President Obama imposed a “safeguard” tariff on imports of tires from China. This tariff was requested by the United Steelworkers of America
and is an example of using trade policy to protect the American tire workers. A few years earlier, President Bush imposed a similar “safeguard” tariff on imports of steel.

As a member of the WTO, the United States is governed by policies to promote free trade between nations by lowering tariffs and other barriers to trade. In this chapter, we examine why countries apply import tariffs or import quotas (limits on imports), and the welfare implications of these tariffs on the importing country, exporting country, and the world under the assumption of perfect competition. In addition, we compare the effect of an import quota with that of a tariff.

1 A Brief History of the World Trade Organization

The GATT was formed in 1947 to promote free trade among nations by reducing trade barriers. The goal was to foster cooperation, integration, and mutual gains from trade. Through periodic negotiations called rounds, member countries would agree to lower trade restrictions. On January 1, 1995, the GATT was christened the World Trade Organization and became a formal global institution. The WTO gained authority to govern international trade through binding agreements.

1. One of the main agreements governing trade states that a nation must apply the same tariffs to all members of the WTO. Article I of the GATT, also known as the “most favored nation” clause, helps to eliminate discrimination by requiring that all WTO countries be treated equally.

2. Although the rules of the WTO require members to maintain low tariffs, under certain provisions, a member country may temporarily charge a higher tariff. One such case is the exception under Article VI of the GATT, which allows an importing country to respond with a tariff when an exporting country is found dumping, namely selling products below fair-market value.

3. Under Article XI, countries agree to promote free trade by not maintaining quotas or limits on imports.

4. By Article XVI, the members will refrain from distorting trade through the use of export subsidies. If export subsidies are provided, the extent of the subsidies should be declared to all affected parties (i.e., particular firms, sectors, or industries).

5. Another exemption from the rules is given in Article XIX, also referred to as the “safeguard” provision or the “escape clause.” Under Article XIX, a country experiencing or in threat of serious injury from foreign competition may temporarily raise its import tariffs against the exporting country.

6. In addition, provided that tariffs on outside members remain unchanged, two or more WTO countries may form regional trade agreements, such as free-trade areas and customs unions, under Article XXIV of the GATT.
There are 149 members as of December 11, 2005.

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2 The Gains from Trade

In what follows, we use the concept of consumer surplus and producer surplus to examine the gains a country receives from engaging in international trade, beginning with a review using supply and demand curves.

Consumer and Producer Surplus

Recall that the height of the demand curve reflects the consumer’s willingness to pay for a product. With the demand curve, \( D \), illustrated in panel (a) of Figure 8-1, the consumer is willing to buy \( D_1 \) units of the good at the price of \( P_1 \). For the last unit purchased, the demand curve intersects the price paid. This means that the consumer is paying the amount exactly equal to the individual’s value of the product. However, for every unit prior to the last one, the demand curve is above the price paid. Namely, the consumer is willing to pay a price higher than \( P_1 \) for the product. The vertical difference between the demand curve and the price, \( P_1 \), is the additional surplus the consumer receives from purchasing the product. Consumer surplus (CS) is obtained by summing the additional benefit from each unit purchased at price \( P_1 \) up to demand, \( D_1 \).
To determine producer surplus refer to the supply curve, $S$, shown in panel (b) of Figure 8-1. The supply curve indicates the marginal cost of producing each additional unit of output. Given a price of $P_1$, a firm will supply $S_1$ quantity of the product. In supplying the last unit, the marginal cost incurred by the firm from production is precisely offset by the price received. For each quantity produced by the firm prior to $S_1$, the marginal cost of that unit is lower than the price paid by consumers. For example, in providing the $S_0$ unit, the marginal cost to the firm is $P_0$. However, since the firm is able to receive the price of $P_1$ for that unit it obtains an additional surplus equal to the vertical distance between the price received and the supply curve. Adding up the surplus for units up to $S_1$ gives the producer surplus (PS) at the price of $P_1$. It is important to note that the producer surplus is not a measure of monopoly profit, because we assume perfect competition throughout this chapter.

**Home Welfare**

Using the concept of consumer and producer surplus, we will return to our simple world of two countries to examine how trade affects the total welfare at Home.

**No-Trade** Panel (a) of Figure 8–2 shows that in the absence of trade, the intersection of supply and demand gives the equilibrium quantity, $Q_0$, and equilibrium price, $P^e$. CS is the region beneath the demand curve and above $P^e$ in panel (a) or area $a$ in panel (b). PS is represented by the section above the supply curve and below $P^e$ in panel (a) or area $(b + \delta)$ in panel (b). The Home welfare is the sum of consumer and producer surplus, which equals CS + PS in panel (a) or area $(a + b + \delta)$ in panel (b). Home is better off the greater the amount of consumer and producer surplus.

**Free Trade for a Small Country** We will now allow Home to engage in international trade. Suppose that Home is an importer much too small to impact the world price by the amount it purchases. Given the fixed world price, $P^w$,.

---

*Figure 8-1: Consumer and Producer Surplus*

- **Consumer surplus (CS)** is the region beneath the demand curve and above the price line in panel (a).
- **Producer surplus (PS)** is the region above the supply curve and below the price line in panel (a).

![Diagram of Consumer and Producer Surplus](image-url)
which is lower than its autarky price of $P_A$, consumers at Home will increase the quantity demanded to $D_1$, whereas producers will decrease the quantity supplied to $S_1$. The excess demand, given by the difference between $D_1$ and $S_1$, is satisfied via imports, $M_1$.

**Gains from Trade** Let’s turn to panel (b) to determine the gains from trade. Under free trade, consumers are better off because they pay a lower price, $P_W$, relative to autarky, $P_A$. Due to the decrease in price and increase in quantity demanded, consumer surplus enlarges by the amount $(b + d)$. By contrast, producers at Home are worse off because the price they received decreased from $P_A$ in the absence of trade to $P_W$ under free trade. Due to the reduction in price received, the quantity supplied decreases.

The drop in price results in a loss of area $b$ for producers. By summing up the gains of the consumers, $(b + d)$, with the losses of producers, area $b$, we can calculate the net effect of trade on Home welfare as follows:

\[
\begin{align*}
\text{Rise in consumer surplus:} & \quad +(b + d) \\
\text{Fall in producer surplus:} & \quad -b \\
\text{Net effect on Home welfare:} & \quad d
\end{align*}
\]

Because the rise in consumer surplus is greater than the fall in producer surplus (i.e., $(b + d) > b$) the overall impact of trade on Home welfare is positive.

The triangle $d$ denotes the gains from trade Home receives by importing under free trade.
Home Import Demand Curve

We will briefly review the concept of import demand curves and export supply curves first introduced in Chapter 2 before we begin our analysis of import tariffs. Panel (a) of Figure 8-3 shows the familiar supply and demand diagram for Home. The domestic market equilibrium, absence of trade, is given by point $A$ with equilibrium quantity and price denoted by $Q_0$ and $P_A$, respectively. Because the quantity supplied equals the quantity demanded at point $A$, Home import is zero as shown by point $A$ in panel (b). Suppose when Home opens to trade, it faces a lower world price, given by $P_W$. From panel (a), we see that at $P_W$, the quantity demanded, $D_1$, exceeds the quantity supplied, $S_1$. The difference between what consumers at Home are willing to purchase at $P_W$ and what producers are willing to supply is the amount imported, $M_1$, or point $B$ in panel (b). The line labeled $M$ in panel (b) connecting points $A'$ and $B$ represents the import demand curve for Home.

3 Import Tariffs for a Small Country

We are now ready to examine the effect of an import tariff on Home’s welfare. We begin by assuming that Home is a small country taking the world price as fixed.

Free Trade for a Small Country

Figure 8-4 shows the Home market in panel (a) and the import market in panel (b). Given that the world price, $P_W$, is below the no-trade equilibrium price, Home will import $M_t$ to meet the excess demand $(D_1 - S_1)$. Because Home is a small country, its demand in the world market does not influence price as represented by the horizontal export supply curve, labeled $X^*$ in panel (b).

Effect of the Tariff

In what follows, we will impose an import tariff, also known as a duty, in the amount of $t$ on each good that enters Home. Similar to other forms of taxes,
the import tariff will have an effect on the price paid by the consumer as well as the prices received by the local and foreign producers. We assume that the product is homogenous, whether produced at Home or exported from Foreign.

Due to the import tariff in the amount of \( t \) per unit, the price of the import increases from \( P^W \) to \( P^W + t \) in panel (a), which corresponds to an upward shift of the export supply curve by size of the tariff to \( X^* + t \) in panel (b). At the higher price, quantity demanded falls from \( D_1 \) to \( D_2 \) as shown in panel (a). By contrast, the quantity supplied increases from \( S_1 \) to \( S_2 \) because additional producers now find it profitable to supply in the market. Namely, at \( P^W \), producers with marginal costs greater than the free-trade price would not be able to compete. However, with the higher price induced by the tariff, producers whose marginal costs exceed \( P^W \) but are less than or equal to \( P^W + t \) can now domestically supply their product. With the decrease in the quantity demanded and the increase in the quantity supplied, it follows that the amount imported, \( M_2 \), has fallen, as shown in panel (b).

**Effect of the Tariff on Consumer Surplus**
Recalling that consumer surplus is the difference between what the consumers are willing to pay, represented by the demand curve, minus what they actually pay, we will determine the effect of the import tariff on the welfare of the consumers at Home. Because the tariff raised the price paid by consumers from \( P^W \) to \( P^W + t \), consumer surplus is no longer the area under the demand curve and above \( P^W \) but instead is the smaller area under the demand curve and above \( P^W + t \). The resulting loss in consumer surplus is denoted by area \((a + b + c + d)\) in Figure 8–5.

**Effect of the Tariff on Producer Surplus**
Contrary to the situation for consumers, producer surplus increases as a result of the import tariff. To see this, recall that producer surplus is the area between the price received and the marginal cost of production, given by the supply curve. In particular, the tariff raises the price the sellers receive from \( P^W \) to \( P^W + t \) so they gain the additional area labeled \( a \) in Figure 8–5.
Effect of the Tariff on Government Revenue

To accurately determine the impact of the import tariff on Home welfare, we also need to consider the tariff revenue received by the government. With the amount of the tariff per unit given by $t$ and the quantity imported equal to $M_2$ or $D_2 - S_2$, the revenue collected by the government is the area $c$ from multiplying $t$ with $M_2$.

Overall Effect of the Tariff on Welfare

To analyze the effects of the import tariff on Home welfare, we sum up the loss of the consumers with the gains of the producers and government as follows:

- **Fall in consumer surplus:** $-(a + b + c + d)$
- **Rise in producer surplus:** $+a$
- **Rise in government revenue:** $+c$

\[
\text{Net effect on Home welfare} = -(b + d)
\]

The net effect on Home welfare is negative, as denoted by the areas $b$ and $d$ in panel (a) of Figure 8-5. More specifically, the areas $a$ and $c$ once belonging to consumers before the tariff are transferred to producers and the government, respectively. However there are additional losses to consumers that are not claimed by any group in the economy after the imposition of the tariff. This net loss—also referred to as a deadweight loss—is represented by area $(b + d)$ in panel (b).

**Production Loss**

The deadweight loss can be further identified. The triangle $b$ is called the production loss or efficiency loss because, although the product can imported more cheaply at the world price, production is shifted to local producers with higher marginal costs when the price received by producers at Home raises from $P^W$ to $P^W + t$ due to the tariff.
Consumption Loss With the tariff, the price faced by consumers \( (P_W + t) \) is now higher than some individual's willingness to pay for units \( D_1 \) to \( D_2 \). The resulting consumption loss is given by the triangle labeled \( d \) in panel (a).

Why and How Are Tariffs Applied?
This section shows that a small importing country loses when it imposes a tariff on foreign export. Yet tariffs are widely used despite the potential net loss for the importing country. One explanation is that tariffs provide necessary government revenues for a developing country. Another reason is that the benefits of the tariff to producers and workers in the protected industry are more concentrated relative to the costs borne by consumers. With a more defined constituent, the promise of or imposition of tariffs could potentially lead to political gains. Examples include President Obama's use of tariffs on tires from China to gain support for healthcare and President Bush's promise to impose an import tariff to protect the steel industry during his re-election campaign.

SIDE BAR

Safeguard Tariffs
The U.S. Trade Act of 1974 describes conditions under which tariffs can be applied in the United States. Two sections that deal with "safeguard" tariffs are Section 201 and Section 421.

Section 201 states that a tariff can be imposed if the U.S. International Trade Commission determines that rising imports have been "a substantial cause of serious injury, or threat therefore, to the U.S. industry..." Section 201 defines "substantial cause" to mean that rising imports are the most important cause of injury to the U.S. industry.

Section 421 applies only to China and was added by the United States upon China's entry into the WTO in 2001. Under Section 421, tariffs can be imposed against China if the U.S. International Trade Commission determines that rising imports from China cause "market disruption," which are "a significant cause of material injury or threat of material injury..." Section 421 defines "significant cause" such that a tariff can be applied even when rising imports from China are not the most important cause of injury.

APPLICATION

U.S. Tariffs on Steel and Tires
U.S. steel and tire tariffs are examples of politically motivated "safeguard" tariffs, applied despite their deadweight loss. We now formalize this notion of deadweight loss with the example of the U.S. steel tariff, and then compare it to the recent tire tariff.

The 2002 tariff on steel was imposed under Section 201 of the U.S. Trade Act, which has a "safeguard" provision similar to the "escape clause" in Article XIX of the GATT for importers facing "serious injury, or threat thereof" from foreign competition.

As part of his re-election campaign to the steel-producing states of Pennsylvania, West Virginia, and Ohio, President George W. Bush made promises to protect the steel industry. Upon his victory, President Bush requested the U.S. International Trade Commission (ITC) to initiate a Section 201 investigation for the steel industry. The ITC in turn recommended to the President that the tariffs be imposed. In March 2002, the President placed tariffs on steel, ranging from 8% to 30%, but exempted countries that have free-trade
agreements with the United States (i.e., Canada, Mexico, Jordan, and Israel) as well as 100 small developing countries that export lesser amounts of steel to the United States. The tariffs were to be imposed for 3 years, declining with each subsequent year.

**NETWORK**

According to the guidelines of Section 201 of the U.S. Trade Act of 1974, the ITC has 120 days from the time a complaint is filed to make its injury finding. For more complicated cases, the ITC is allowed 150 days. Any recommendations, along with the report, must be submitted to the president within 180 days after receipt of the petition.

**Recent Cases Section 421**

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<td>October 2005</td>
<td>China</td>
<td>Circular welded nonalloy steel pipe from China</td>
<td>Allied Tube and Conduit Corp.; IPSCO Tubulars, Inc.; Maruichi American Corp.; Maverick Tube Corp.; Sharon Tube Co.; Western Tube Conduit Corp.; Wheatland Tube Co.; and the United Steelworkers of America, AFL-CIO</td>
</tr>
<tr>
<td>TA-421-5</td>
<td>March 2004</td>
<td>China</td>
<td>Uncovered innerspring units from China</td>
<td>American Innerspring Manufacturers (AIM)</td>
</tr>
</tbody>
</table>


**Deadweight Loss due to the Steel Tariff** To calculate the deadweight loss due the tariff on steel, we will define the corresponding triangle $b + d$ in panel (b) of Figure 8-5 as

$$DWL = \frac{1}{2} \cdot DP \cdot \Delta M$$

where $\Delta M$ is the change in import (base of triangle) and $DP$ is the increase in the domestic price (height of the triangle) following the import tax (i.e., $DP = t$). To measure the deadweight loss relative to the value of imports $PW \cdot M$, we multiply the right-hand side by the percentage tariff, $t / PW$. Re-arranging gives:

$$\frac{DWL}{PW \cdot M} = \frac{1}{2} \cdot \frac{t \cdot \Delta M}{PW \cdot M} = \frac{1}{2} \cdot \left( \frac{t}{PW} \right) \cdot \% \Delta M.$$

Next we substitute in the percentage increase in price with the average tariffs of 30% (i.e., $t / PW = 0.3$) and the 30% decrease in the quantity of steel imported during the first year of the tariff (i.e., $\% \Delta M = 0.3$) and get,
\[
\frac{DWL}{P \cdot M} = \frac{1}{2}(0.3 \cdot 0.3) = 0.045, \text{ or 4.5\% of the import value.}
\]

Averaging the value of steel imports before ($4.7 \text{ billion}$) and after ($3.5 \text{ billion}$) tariff placement gives a 2-year average of $4.1 \text{ billion}$. Multiplying the calculated deadweight loss of 4.5\% to the average import value of $4.1 \text{ billion}$, we get that the net annual loss to the United States due to the tariffs on steel was $185 \text{ million}$.

**Response of the European Countries** As expected, those in the steel-producing industry gained from the tariff, whereas consumers of steel opposed the higher price. However, it was the threat of tariff retaliation by exporting countries, which included 25 members of the European Union along with Japan, South Korea, China, Norway, Switzerland, New Zealand, and Brazil, that led President Bush to suspend the steel tariff on December 5, 2003. The potential **tariff war** ended the steel tariff 19 months after it was imposed rather than 3 years originally planned. Through the **dispute settlement procedure**, the exporting countries received permission from the WTO to impose tariffs against U.S. exports. The WTO ruled that because the United States failed to prove serious injury to its steel industry due to a sudden increase in import competition, it was ineligible for Article XIX protection.

**Tariff on Tires** The tariff on tires imported from China was announced on September 11, 2009. The tariff is to last three years and follow a declining schedule of 35 percent in the first year, then 30 percent, and then 25 percent in the third year.

One key difference between this tariff and that imposed on steel by President Bush is that the tire tariff applied only to imports from China. This is because the tariff was applied under Section 421 of U.S. trade law. Section 421 was added to U.S. trade law when China joined the WTO in 2001. The tariff on tires marks the first time Section 421 was ever used.

Another key difference is who supported the tariff. As mentioned previously, U.S. steel producers supported the tariff on steel, whereas no tire producers operating in the United States joined the petition against Chinese tires. This is because, of the ten producers of tires in the United States, seven of them also produce tires in China.

### 4 Import Tariffs for a Large Country

Aside from potential government revenues and political gains, some countries use tariffs to increase their gains from trade. In particular, unlike the small-country case we studied in the previous section, a large importing country may be able to improve its welfare by imposing a tariff. Namely, a large country has the power to affect the exporter’s price with a tariff due to its purchasing capacity.

**Foreign Export Supply**

Contrary to the situation for the small country, the Foreign export supply will no longer be horizontal when we examine a large Home country because the importer can influence free-trade price by the amount it imports in the world.
market. To derive the Foreign export supply curve, we will refer to panel (a) of Figure 8-6, which shows the Foreign demand and supply curves, denoted by $D^*$ and $S^*$, respectively. Without trade, the Foreign equilibrium price, $P^A^*$, is at point $A^*$ in panel (a) or correspondingly represented by point $A''$ in panel (b) where exports are zero. As Foreign opens up to trade, it will export the amount $X^*_1 = S^*_1 - D^*_1$ because the world price, $P^W$, is higher than its autarky price of $P^A^*$. The upward-sloping Foreign export supply curve is obtained by connecting points $A''$ and $B^*$, where the latter is given by the amount exported at the world price of $P^W$. Combining the Foreign export supply curve, $X^*$, and Home import demand curve, $M$, we get the free-trade price, $P^W$, as shown in panel (b).

**Effect of the Tariff**

We assume that Home imposes a tariff in the amount of $t$ dollars on Foreign imports. Due to the tariff, the export supply curve shifts up by the amount $t$ as illustrated in panel (b) of Figure 8-7. The intersection of the new export-supply curve, $X^* + t$, with the import-demand curve, $M$, at point $C$ gives the new equilibrium price, $P^* + t$, faced by Home consumers. At the higher price, the quantity demanded at Home falls to $D_2$, whereas the quantity supplied increases to $S_2$ so that the amount imported decreases to $M_2$.

Note that in panel (a) the increase in the price due to the tariff (vertical distance between $P^* + t$ and $P^W$) is less than the amount of the tariff. This implies that the burden of the tariff is incurred not only by consumers at Home but also by Foreign exporters. The price received by the Foreign exporters, $P^*$, is obtained by subtracting the tariff from the new Home price. Because $P^*$ is less than $P^W$, the price Foreign exporters receive has fallen due to the tariff.
Recall that a country’s terms of trade is defined as the ratio of its export price to its import price. With the fall in the import price relative to the initial world price, $P^W$, Home experiences a gain in its terms of trade.

**Home Welfare** To examine whether the gain in the terms of trade leads to an increase in welfare at Home, we will analyze the impact of the tariff on the consumers, the producers, and the government. From panel (a) of Figure 8-7, we see that the loss in consumer surplus due to the higher Home price is given by the areas $(a + b + c + d)$. The benefit to producers arising from the price increase is the gain in producer surplus denoted by area $a$. Lastly, the benefit to the government is equal to the amount of the tariff $t$ multiplied by the amount of Home imports, $M_2$. The tariff revenue, $t \cdot M_2$, is represented by the areas $(c + e)$. Summing up the loss of the consumers with the gains of the producers and government gives the overall impact of the tariff as follows:

- **Fall in consumer surplus**: $-(a + b + c + d)$
- **Rise in producer surplus**: $+a$
- **Rise in government revenue**: $+(c + e)$

**Net effect on Home welfare**

As in the small-country case, the triangle $(b + d)$ indicates the deadweight loss due to the tariff. However, contrary to the small country, the large country gains area $e$ because it is able to shift part of the burden of the tariff to the Foreign exporters. Area $e$ gives a measure of the terms-of-trade gain due to the
tariff. It follows that Home would be better off with the tariff if \( e \) is greater than \( (b + d) \) and worse off if \( e \) is smaller than \( (b + d) \).

**Foreign and World Welfare** By contrast to Home, exporters in Foreign suffer a loss given by \( (e + f) \) in panel (b). Although the terms-of-trade gain for Home is offset by the terms-of-trade loss by Foreign (i.e., area \( e \)), areas \( (b + d + f) \) remain undistributed. Therefore, areas \( (b + d + f) \) represent the net loss in world welfare or world deadweight loss. Moreover, because the gain of Home due to the tariff is at the expense of Foreign, the imposition of the tariff is also referred to as a “beggar thy neighbor” policy.

**Optimal Tariff for a Large Importing Country** We have found that a large importer might gain by imposing an import tariff, but have not yet determined what level of tariff a country should apply in order to maximize welfare.

**Optimal Tariff** To clearly calculate the effect of the tariff on U.S. welfare, we will need to incorporate the concept of the optimal tariff, the duty which maximizes the increase in welfare for the importing country. To begin with, our theory tells us that a large importing country can increase its welfare by imposing a tariff. Starting from the left of Figure 8-8, relative to free trade denoted by point \( B \), we see that Home can increase its welfare by applying a tariff on foreign exports. The welfare continues to increase until it reaches the highest point corresponding to the optimal tariff. After point \( C \), any additional increases in the amount of the tariff results in a decline in Home welfare. A tariff is called a “prohibitive tariff” if it is so large that trade is prevented (see point \( A \)).

**Optimal Tariff Formula** The formula for the optimal tariff is:

\[
\text{Optimal tariff} = \frac{1}{E^*_X}
\]

where \( E^*_X \) is the elasticity of export supply, which measures the percentage change in the quantity exported due to a percentage change in the world price.
of export. Thus, according to the formula, a country will obtain a greater terms-of-trade gain through a large tariff if the elasticity of export supply is small (i.e., a more inelastic or steeper Foreign export supply curve). This is because the Foreign exporter will absorb a larger fraction of the tariff when the export-supply elasticity is low. If the elasticity of export supply is high the situation is reversed. Namely, for a small country facing a horizontal Foreign export supply, Home welfare will be highest if the optimal tariff is zero.

**APPLICATION**

**U.S. Tariffs on Steel Once Again**

We will re-examine the effect of the steel tariff on U.S. welfare assuming that it is a large country. Namely, the United States has an impact on the Foreign export price because it is a large importer of steel. It is important to note, however, that all welfare gains in the United States come at the expense of exporting countries. If all countries impose such tariffs all terms-of-trade gains would be eliminated and only deadweight loss would remain. Avoiding such an outcome is one of the main goals of the WTO.

**Optimal Tariffs for Steel** With the established formula, we can now determine the impact of the tariffs on the steel industry using the export supply elasticities presented in Table 8-2.

For the steel products classified under iron and nonalloy steel flat-rolled products and iron and steel tubes, pipes, and fittings, the export supply elasticities are large. Taking the inverse of the export supply elasticity for each of these product categories, we can calculate the optimal tariffs and compare them with the actual tariffs. For iron and nonalloy steel flat-rolled products, the optimal tariff is \(\frac{1}{750} \approx 0\%\), which is the nearly the same as the actual tariff. The optimal tariff for iron and steel tubes, pipes, and fittings is \(\frac{1}{90} = 1\%\). Because the actual tariff was between 13% and 15%, the deadweight loss from the tariff was greater than the terms-of-trade gain so that the United States experienced an overall loss in welfare from the duty imposed on this product. In other words, the high elasticity of export supply suggests that the United States is a small country when it comes to the imports of iron and steel tubes, pipes, and fittings. As such, welfare in the United States would have been highest under free trade.

The first three items have small elasticities of export supply. Therefore, the United States is a large country relative to other countries in importing these products such that the optimal tariffs, given by the third column, are very high. As an example, U.S. welfare would be maximized if the government levied a tariff of \(\frac{1}{0.27} = 370\%\) on alloy steel flat-rolled products. For these three products, the improvement in terms of trade exceeded the deadweight loss from applying the tariff. As a result, the United States increased its welfare relative to free trade by imposing the import duty. However, the gains would have been greater had the actual tariff been much higher.

5 Import Quotas

After more than three decades from its inception in 1974, the system of import quotas known as the Multifibre Arrangement (MFA) came to an end.
on January 1, 2005. In an effort to protect their domestic industries, the arrangement allowed Canada, the United States, and Europe to restrict the amount of textiles and apparel products that were imported from garment-producing countries. However, the threat of import competition from China with the abolishment of the MFA has led to the establishment of new import quotas by the United States and Europe. Other examples of import quotas include those imposed on sugar by the United States and ones previously placed on bananas by Europe to protect exporters in its former colonies in Africa from producers in Latin America which ended in 2009.

HEADLINES

Banana Wars
The banana wars, which started back in 1993, have come to an end. The banana wars began when the European Union set quotas favoring banana imports from the Ivory Coast, the Windward Islands, and other former colonies. These preferential policies—whose aims were to assist the development of former colonies—were challenged by American banana companies and the Latin American countries where bananas were grown. The suit, which several times over the intervening sixteen year threatened to cause a full-blown trade war, finally ended in late 2009. In December 2009, the EU agreed to reduce the tariff on Latin American bananas by 35 percent over the next seven years.

HEADLINES

Sweet Opportunity
In an effort to protect American farmers from import competition, the United States imposes import quotas on foreign sugar. As a result of the restriction, the domestic sugar price has been two to three times higher than the world price for the past 25 years. Moreover, the government guarantees the farmers a break-even price by allowing them to sell their excess to the U.S. Department of Agriculture (USDA). However, the sugar program may need to change given that the world price of sugar has now risen to the U.S. level and a shortage exists in the United States. Under the current condition, the U.S. government could potentially remove the import quota, which would improve domestic welfare without inflicting huge costs to the USDA. Not surprisingly, the U.S. sugar producers have a strong incentive to maintain the status quo by lobbying for limits on trade expansion.

Import Quota in a Small Country
The effect of an import quota on a small country is similar to that of a tariff, as we will now examine.

Free-Trade Equilibrium We begin the analysis of an import quota in a small country with the Home demand and supply curves shown in panel (a) of Figure 8-9. The quantity demanded at Home given the free trade world price of \( P^W \) is \( D_t \), and the quantity supplied is \( S_t \). Thus, the amount imported is \( M_t = D_t - S_t \). The equilibrium of the import demand curve, \( M_t \), and the horizontal export supply curve, \( X^* \), is given by point \( B \) in panel (b).
**Effect of the Quota**  If Home imposes an import quota of \( M_2 < M_1 \), then the exports may not exceed this amount. We can represent the limitation with a vertical export supply curve, \( X \), as shown in panel (b). Given the Home import demand curve and the new restricted export supply curve, the new equilibrium price is higher at \( P_2 \). Due to the higher price, domestic producers increase the quantity supplied to \( S_2 \) and consumers reduce the quantity demanded to \( D_2 \). Note that the change in quantity and price would be identical if the government replaced the quota with an import tariff of \( t = P_2 - P^w \). Namely, import quotas have equivalent import tariffs, which would lead to the same higher price and lower quantity of imports.

**Effect on Welfare**  The welfare effect of an import quota on producers and consumers is similar to that of a tariff. More specifically, in Figure 8-9 the loss in consumer surplus due to the quota is area \((a + b + c + d)\), whereas the gain in producer surplus is the area \(a\). However, the similarity ends with the consideration of area \(c\). Although it is the revenue collected by the government under a tariff, area \(c\) represents “rents” under a quota. Depending on the allocation of the **quota rents**, the net loss due to an import quota may be greater than that of a tariff.

1. **Giving the Quota to Home Firms**  The first possibility is for the quota licenses to be given directly to the Home firms. Namely, the Home firms are given the right to import the amount \( M_2 \) at the world price of \( P^w \) and to sell it in the domestic market at the price of \( P_2 \). Therefore, the rents earned by the Home firms are \( M_2 \cdot (P_2 - P^w) \). Summing up the losses and gains due to the quota gives:

- **Fall in consumer surplus:** \(- (a + b + c + d)\)
- **Rise in producer surplus:** \(+ a\)
- **Quota rents earned at Home:** \(+ c\)

**Net effect on Home welfare:** \(- (b + d)\)

With the Home firms holding the quota licenses, the net effect of the quota on welfare is the same deadweight loss as a tariff. The only difference is that area \(c\) is collected by the Home firms instead of the government.

2. **Rent Seeking**  The second possibility also involves the quota licenses to be given to the Home firms but not directly. As a result, firms engage in rent-seeking behaviors. Namely, they employ inefficient activities to obtain the rights to the import the product at the world price of \( P^w \). For example, a firm may overproduce if the license distribution is based on production in the previous year. If the resources dedicated to rent seeking equal the value of the rents, then area \(c\) is essentially wasted. As such, the welfare effect of the quota is the sum of the loss in consumer surplus and the gain in producer surplus:

- **Fall in consumer surplus:** \( a + b + c + d \)
- **Rise in producer surplus:** \(a\)

**Net effect on welfare:** \(- (b + c + d)\)
Due to the rent-seeking activities, the net welfare loss is greater with the quota than a tariff.

3. Auctioning the Quota  The third possibility is for the Home government to auction off the quota licenses. Assuming that the value the government accrued from the auction is equal to area $c$, then the net effect of the quota is the same as that of a tariff as given by the following:

- Fall in consumer surplus: $a + b + c + d$
- Rise in producer surplus: $a$
- Auction revenue earned at Home: $c$

Net effect on welfare: $-(b + d)$

4. “Voluntary” Export Restraint  The fourth possibility is the case in which the Foreign country initiates the quota. Namely, Foreign voluntarily puts limits on the amount it exports to Home. These self-imposed restrictions are referred to as “voluntary” export restraint (VER) or “voluntary” restraint agreement (VRA). Because the quota rents are collected by foreign producers, the loss in Home welfare is greater than a tariff as the summation of the losses and gains below shows:

- Fall in consumer surplus: $-(a + b + c + d)$
- Rise in producer surplus: $+a$

Net effect on Home welfare: $-(b + c + d)$

Although a VER clearly results in a greater negative net effect on Home welfare relative to an import tax, by transferring the quota rents to the Foreign exporter, a tariff or quota war may be prevented by imposing the “voluntary” trade restriction.

Costs of Import Quotas in the United States

Estimates of U.S. deadweight loss and quota rents due to import quotas on five industries are presented in Table 8-3 for 1985. The sum of the deadweight loss for these industries ranged from $8 to $12 billion annually, with textiles and apparel contributing about $5 to $6 billion of the total. The net welfare loss is even larger since the rents were transferred to Foreign exporters in all the industries, except for dairy. Foreign earned about $7 to $17 billion in quota rents each year during the mid 1980s. Because some of the quotas expired or ceased to be binding (MFA and automobiles, respectively), whereas others were replaced by tariffs (steel and agricultural products), most of the costs associated with the import quotas no longer exist today.

APPLICATION

China and the Multifibre Arrangement

The long standing MFA came to an end on January 1, 2005. The system of import quotas protected the apparel industry in the industrialized countries by specifying the amount of each product the developing countries could export. The end of the MFA meant that exporters no longer needed to hold
back their production capabilities. This represented a huge potential for China, the largest supplier, which became a cause for concern not only among other developing countries but also industrialized countries. The common worries were that rising exports from China would compete with their textiles and apparel industry, causing job losses.

**Growth in Exports from China** Figure 8-10 compares the changes in clothing and textiles exports with the United States following the elimination of the MFA. Panel (a) shows that in 2005, China’s textile and apparel exports to the United States increased by more than 40% relative to the previous year, whereas those from higher-cost exporters like South Korea, Hong Kong, and Taiwan declined by 10% to 20%. Furthermore, Chinese exports of tights and pantyhose to Europe increased by as much as 2000% during the first 2 months of 2005 as compared with the year before.

According to the theory, the removal of the MFA should lead to a reduction in the price that was raised by the import quotas. Panel (b) shows that prices of “constrained goods” indeed decreased for many countries exporting to the United States, with the largest drop from China by 38% between 2004 and 2005.

**Welfare Cost of MFA** The drop in prices in 2005 with the removal of the MFA translates to a return of the quota rents from the foreign exporters to U.S. consumers. More specifically, with an estimated price reduction ranging between $6.5 and $16.2 billion from 2004 to 2005, the cost of the MFA equates to about $100 per household when we divide the loss of $11.4 billion by 111 million U.S. households.

**Import Quality** The removal of the MFA resulted in a “quality downgrading” of Chinese exports. The reduction in prices was larger in percentage terms for lower-priced products such as t-shirts ($1) relative to more expensive items such as a blouse ($10). The reason is that without the import quota, the incentive to sell a limited quantity at higher values becomes moot.

**Reaction of the United States and Europe** To restrict the growth of its exports and subdue the growing concerns, China offered to self-impose a system of export taxes. However, the United States and Europe successfully negotiated a new system of quotas with China, which restricted the amount the developing country can sell in a variety of products. The system of quotas imposed by the United States ended on December 31, 2008. Due in large part to the worldwide recession, Chinese exports in this industry were much lower in 2009 than in earlier years.

6 **Conclusion**

This chapter examines the effect of trade barriers such as tariffs on the welfare of the importing country, exporting country, and world. Reasons why importing countries impose the barriers to trade include politics, raising government revenue, and increasing welfare for the large-country case. The analysis shows that although a small country always loses with a tariff, a large country may improve its terms of trade by shifting some of the burden of the duty to foreign exporters. Similar to a tariff, an import quota raises the do-
Domestic price, which increases producer surplus while making consumers worse off. However, unlike a tariff, in which the importing government collects revenue, “rents” from the quota may go to either the licensed importer, the foreign exporter when the export restraints are “voluntary,” or the government if the rights to quota licenses are auctioned.

TEACHING TIPS

**Tip 1: Trade Policy and Welfare**
Chapter 8 marks the beginning of a four-chapter treatment of trade policy. Throughout the next four chapters, the concept of welfare is crucial to our analysis. As such, welfare, consumer surplus, and producer surplus warrant a brief review.

**Tip 2: Current Events in Trade Policy**
Have students find recent news articles regarding trade disputes involving the United States. Ask students to interpret these disputes with the theories presented in this chapter. Do any of these trade disputes seem to be retaliatory or part of a trade war as discussed in Chapter 8?

**Tip 3: Current Events in Trade Investigations**
Students can look up all recent trade investigations through the United States International Trade Commission Web site (http://www.usitc.gov/). Have students look up the most recent safeguard investigations by the ITC, noting both the products and countries being investigated, and then discuss their findings. Ask students to comment on which countries are most frequently the subject of investigation and why.
IN-CLASS PROBLEMS

1. LobbyInc is a firm that specializes in lobbying the government on behalf of special interest groups. Suppose the sugar producers recently hired LobbyInc to help them obtain the rights to the sugar quota licenses.

a. What is the maximum the domestic sugar producers are willing to pay LobbyInc for their services? Explain.

Answer: The sugar producers are willing to pay up to the amount of the quota rent, or area $c$, in Figure 8-9. Any amount greater would result in a smaller producer surplus than the benefits of the quota licenses.

b. What is the net effect of their activities on the welfare of the domestic sugar market?

Answer: The net effect of their rent-seek ing activities would be a fall in domestic welfare by the amount represented by areas $b + c + d$ in Figure 8-9.

2. Suppose Home is a large country whose supply and demand curves are given by the left of the following figure.

a. Assume the world price is $P_W = $5. Determine the consumer and producer surplus under free trade.

Answer:

Consumer surplus under free trade:

$CS = \frac{1}{2} \cdot 12 \cdot (16 - 5)$

$CS = 66$

Producer surplus under free trade:

$PS = \frac{1}{2} \cdot 4 \cdot (5 - 1)$

$PS = 8$

Total surplus: $66 + 8 = 74$

b. Suppose the government at Home government imposes a tariff in the amount of $4$ (i.e., $t = $4). What is the new Home price? What is the price received by the foreign exporters?

Answer: Because Home is a large country, it does not face a horizontal export supply curve. Rather, Home is able to have an impact on the world price. With a tariff of $4$, the new Home price is $7$ whereas the price received by the Foreign exporters is $2$.

c. Determine the terms of trade for Home with the tariff.

Answer: Home’s terms-of-trade gain is denoted by area $e$ in the figure. Namely it is equal to $4[= (8 - 6)(5 - 3)]$.

d. Does Home welfare increase or decrease due to the tariff? Explain.

Answer: To determine whether Home welfare increases or decreases, we need to compare the terms-of-trade gain with the dead-weight loss that results from the tariff (i.e., Home is better off if area $e$ is greater than areas $b + d$).

Areas $b + d$:

$b + d = \frac{1}{2} \cdot (6 - 4) \cdot (7 - 5) + \frac{1}{2} \cdot (12 - 8) \cdot (7 - 5)$

$b + d = 2 + 4$

$b + d = 6$

Because area $e$ equals 4 in part (c), whereas areas $b + d$ equal 6, then Home is worse off with a tariff of $4$. 

3. Refer to problem 2. At what amount would the tariff be considered prohibitive? Explain.

**Answer:** A tariff in the amount of $6 would be prohibitive because it would raise the price paid by consumers to the no-trade equilibrium level. As a result, imports would be zero.

4. Aoslia is a small country that takes the world price of corn as given. Its domestic supply and demand for corn is given by the following:

\[
D = 45 - 3P \\
S = 3P - 9
\]

a. Assume initially that Aoslia does not open to trade. What is the autarky equilibrium price and quantity?

**Answer:** Setting \( S = D \) gives \( P = 9 \) and \( Q = 18 \).

b. Suppose Aoslia decides to engage in trade. Determine the quantity demanded, quantity supplied, and import given the world price of $6 per bushel of corn.

**Answer:** Given \( P_W = 6 \), we have that \( D = 45 - 3(6) = 27 \) and \( S = 3(6) - 9 = 9 \), so \( M = D - S = 27 - 9 = 18 \).

c. If the Aoslia government imposes a tariff in the amount of $1 (i.e., \( t = 1 \)), what is the new domestic price? What is the amount imported?

**Answer:** The new domestic price is \( P_W + t = 7 \) so \( D_2 = 45 - 3(7) = 24 \) and \( S_2 = 3(7) - 9 = 12 \) so \( M_2 = D_2 - S_2 = 24 - 12 = 12 \).

d. Determine the effect of the tariff on the Aoslian consumers, producers, and government.

**Answer:**

<table>
<thead>
<tr>
<th>Consumer surplus</th>
<th>Consumer surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>without tariff:</td>
<td>with tariff:</td>
</tr>
<tr>
<td>( CS = \frac{1}{2} \cdot 27 \cdot (15 - 6) )</td>
<td>( CS = \frac{1}{2} \cdot 24 \cdot (15 - 7) )</td>
</tr>
<tr>
<td>( CS = 121.5 )</td>
<td>( CS = 96 )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Producer surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>without tariff:</td>
</tr>
<tr>
<td>( PS = \frac{1}{2} \cdot 9 \cdot (6 - 3) )</td>
</tr>
<tr>
<td>( PS = 13.5 )</td>
</tr>
</tbody>
</table>

g. Calculate the terms-of-trade gain. What is the net effect of the tariff on Aoslia’s welfare? Explain.

**Answer:** Aoslia does not have a terms-of-trade gain because it faces a perfectly elastic (i.e., horizontal) export supply curve. This means that the entire burden of the tariff falls on its consumers.

<table>
<thead>
<tr>
<th>Net effect on Home welfare:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall in consumer surplus:</td>
</tr>
<tr>
<td>Rise in producer surplus:</td>
</tr>
<tr>
<td>Rise in government revenue:</td>
</tr>
</tbody>
</table>

5. Refer to problem 4. Suppose the Aoslian government applies an import quota that limits imports to 12 bushels.

a. Determine the quantity demanded, quantity supplied, and new domestic price with the quota.

**Answer:** Setting \( S = D \) gives \( P = 9 \) and \( Q = 18 \).
Answer:

\[ 45 - 3P - 3P + 9 = 12 \]
\[ D = 45 - 3P \]
\[ S = 3P - 9 \]
\[ 54 - 6P = 12 \]
\[ = 45 - 3(7) \]
\[ = 3(7) - 9 \]
\[ 6P = 42 \]
\[ = 45 - 21 \]
\[ = 21 - 9 \]
\[ P_2 = 7 \]
\[ D_2 = 24 \]
\[ S_2 = 12 \]

b. Calculate the quota rent.

Answer:

\[ \text{Quota Rent} = M_2 \cdot (P_2 - P_{1w}) \]
\[ \text{Quota Rent} = 12 \cdot (7 - 6) \]
\[ \text{Quota Rent} = 12 \]

c. Assuming that the quota licenses are allocated to domestic producers, what is the net effect of the quota on Aoslia’s welfare?

Answer:

Fall in consumer surplus: \(-25.5\)
Rise in producer surplus: \(+10.5\)
Quota rents earned at Home: \(+12\)

Net effect on Home welfare: \(-15\)

6. Why do many countries, including the United States, continue to use tariffs to limit imports when the theory shows that such restrictions have a potential to impose net loss on the domestic country?

Answer: For small-importing countries, tariff is a source of government revenue that is “easy to collect” compared with income or value-added taxes because the latter requires individuals and firms to honestly report earnings. For large importing countries such as the United States, a tariff has the potential to increase domestic welfare if the terms-of-trade gain is larger than the resulting deadweight loss created by the import tax. Moreover, an imposition of a tariff could lead to potential political gains by promising to protect the concerned industries or groups from import competition.

7. Suppose the United States is a large importer of Mexican tortilla. Following the implementation of NAFTA, U.S. tariff on tortillas decreased from 25% to 0.

a. Will the price of tortillas in the United States fall by the exact amount of the tariff? Explain.

Answer: Because the United States is a large country, a portion of the tariff was absorbed by Mexico. As such, consumers in the United States did not experience the entire hike in the import price due to the tariff. With the removal of the tariff, the price of tortillas will fall, but by less than 25%.

b. What is the impact of the NAFTA on U.S. tortilla producers, Mexican tortilla producers, and U.S. tortilla consumers?

Answer: U.S. tortilla producers received a higher price under the tariff, so they are worse
off with the removal of the tariff. Mexican tortilla producers receive a higher price under NAFTA whereas U.S. tortilla consumers are able to purchase the good at a lower price, so both of these groups benefit from the elimination of the tariff.

c. Removal of the tortilla tariff under NAFTA has increased welfare for the United States.

**Comment.**

**Answer:** The statement is true only if the gain in terms-of-trade (area $e$) under the tariff was smaller than the deadweight loss $(b + d)$ so that the tariff removal corrects the negative impact of the trade barrier on U.S. welfare.

8. What is the role of the “most-favored nation” clause in helping to eliminate discriminatory treatment in international commerce?

**Answer:** Article I of the key provisions of the GATT states that nations must apply the same tariff to all members of the WTO. This “most-favored nation” clause helps to eliminate discriminatory practices by requiring that all WTO countries be treated equally. Namely, a country must extend the same tariff to all members of the WTO as it would to its most-favored trading partner.

9. The government is more concerned about producer surplus than consumer surplus if it levies an import tariff that raises the domestic price. Comment.

**Answer:** This comment is true if the country is a small importer because the loss in consumer surplus outweighs the gain in producer surplus from the import tax even if the government were to re-distribute the tariff revenue to the consumers. Moreover, the comment is also true if the country is a large importer that has the potential to impact the world price. If the terms-of-trade gain is larger than the deadweight loss and the government re-distributes the tariff revenue to the consumers, consumers and would still lose relative to free trade because some of the consumer surplus is transferred to the producers as a result of the higher price induced by the tariff.

10. What is an efficiency loss? Does it only occur when small country imposes a tariff?

**Answer:** The efficiency loss or production loss results from the Home producer increasing the quantity supplied following the raise in the domestic price with the tariff. From Figure 8-5, we see that the additional units, $S_2 - S_1$, are supplied by the Home producers with higher marginal costs than foreign exporters producing at the world price. The loss results regardless of the size of the importing country.

11. Why is tariff revenue less important as a source of income for the U.S. governments relative to some developing countries?

**Answer:** Unlike some developing countries, the high- and middle-income countries are able to obtain a net increase in tax revenue by switching to hard-to-collect taxes such as income and value-added taxes. The reason maybe that the penalty for individuals and firms failing to accurately report their earnings is sufficient to obtain the necessary information in countries such as the United States compared with the developing countries. By contrast, because all imports are subject to customs inspection upon arrival to a country's port, import tariffs are easy to collect for a developing country.

12. What causes the Foreign-export supply curve to slope upward?

**Answer:** The Foreign-export supply gives the amount exporters in Foreign are willing and able to supply internationally at each world price. When the world price, $P^W$, is higher than Foreign’s no-trade price, the quantity supplied by producers in Foreign, $S^*_F$, exceeds the quantity demanded by consumers in Foreign, $D^*_F$, as illustrated by Figure 8-6. This excess supply or surplus $(X^*_F = S^*_F - D^*_F)$ is the amount available for the international market. As the world price rises, the quantity demanded by Foreign consumers decreases even further, whereas the quantity supplied by Foreign producers increases, resulting in a greater quantity of export supply. The direct relationship between the world price and the quantity of export supply gives the curve its upward slope.

13. Graphically show the effect of a United States-imposed tariff on world welfare, assuming that the United States is a small country. How does your result differ if the United States is a large country?

**Answer:** In addition to the deadweight loss equal to area $b + d$, there is an additional amount equal to area $f$ if the United States is a large country.
14. If the Foreign export supply is perfectly elastic, what is the optimal tariff Home should apply to increase welfare? Explain.

**Answer:** A perfectly elastic Foreign export supply curve implies that the importing country is small. Therefore, the optimal tariff for Home is to set the tariff to zero (i.e., not impose an import tax) because it does not have a terms-of-trade gain but suffers a deadweight loss.
Import Tariffs and Quotas under Imperfect Competition

Notes to Instructor

Chapter Summary
This chapter examines the impact of import tariffs and quotas under imperfect competition (i.e., either home monopoly or foreign monopoly). It first contrasts the effects of a tariff and quota on the economic welfare of the home country when there is a home monopoly. One application of that case is “infant industry” protection, which is discussed in theory and through several country studies. Then the effects of a tariff are examined when the exporting firm in the foreign country is a monopolist. The chapter also discusses the effect of dumping and antidumping duties on the home country.

Comments
This chapter offers a number of interesting applications that link theory and real-world events. In addition, the questions at the end of the chapter refer students to the International Trade Association (ITA) and World Trade Organization (WTO) Web sites to examine dumping petitions. The timely and interesting examples as well as the references to data sources will help the students have a clearer understanding of the material. In the section on infant industry, encourage students to express their views on the benefits of the protection prior to presenting the net effects on Home welfare.
Lecture Notes

Introduction

Though most economists agree that tariffs and quotas usually reduce general economic welfare, there is a long history of countries using tariffs and quotas. The United States has had high tariffs for large periods of its history, reaching as high as 50 percent in the 1800s. More recently, China had tariffs of 80 to 100 percent on passenger cars, which greatly limited the imports of automobiles, leading to joint ventures between foreign firms and local partners producing outdated models at very high prices. To understand why China or any other country may choose to apply tariffs and quotas despite the resulting loss in consumer surplus, we will assume that firms operate under imperfect competition where they have some market power, beginning with the case in which the home firm is a monopolist.

We then examine the effect of a tariff applied by a small importing country on its welfare when the foreign exporting firm is a monopolist. Contrary to the situation in which the home firm is a monopoly, the importing country may experience a terms-of-trade gain similar to the “large-country case” by imposing a tariff on the sole foreign producer.

A country may protect its domestic firms by imposing a tariff on a foreign competitor engaged in dumping. Under WTO rules, an importing country is permitted to respond with a tariff when a foreign firm sells a product more cheaply abroad than it does in its local market or at less than the cost of production. Charges of dumping have increased in popularity in recent years not only in developed but also in developing countries as alternatives to “safeguard” tariffs that are allowed in the guidelines of the WTO.

We then return to the Chinese government’s protection of its “infant industry,” namely, the automobile sector, by analyzing the impact of the tariffs and quotas on the domestic consumers and producers.

1 Tariffs and Quotas with Home Monopoly

We begin by assuming that the Home firm is the only producer selling a homogeneous good. We will see that tariffs and quotas are non-equivalent in imperfect competition. With a tariff, the Home monopoly’s market power is eliminated due to the foreign competition. By contrast, the Home monopoly is able to retain its market power under a quota.

No-Trade Equilibrium

The Home demand curve, $D$, and the monopolist’s marginal cost curve, $MC$, are illustrated in Figure 9-1. To maximize profit, the Home monopolist sets marginal revenue, $MR$, equal to $MC$, selling quantity, $Q^M$, at price, $P^M$.

Comparison with Perfect Competition

Suppose Home consisted of many firms selling the same product and that the industry marginal cost equals the monopoly marginal cost in Figure 9-1. Then market equilibrium yields the quantity $Q^C$ and price $P^C$, where the supply, given by the industry $MC$, equals demand. Therefore, without trade, consumers pay a higher price for fewer units of the product under a monopoly.
Free-Trade Equilibrium
Suppose that Home is a small country. Under free trade, the monopolist may not charge a price higher than \( P^w \) because consumers can meet their demand via imports at the given world price. With the constant price per unit, the monopolist’s marginal revenue curve is horizontal at the world price, which is also the Foreign export supply curve, \( X^* \). Equating marginal revenue, \( MR^* \), to marginal cost at point \( B \), the profit-maximizing quantity for the Home producer is \( S_1 \). Because there is excess demand at the world price, the amount \( M_1 = D_1 - S_1 \) is imported from abroad.

Free Trade Equilibrium with Home Monopoly
Comparison with Perfect Competition By continuing to assume that the competitive firms face the same cost conditions as a Home monopoly, we see that with free trade this small country will consume $D_1$ at the price of $P^W$, where the amount $S_1$ is produced locally and $M_1 = (D_1 - S_1)$ is imported. Namely, the equilibrium under perfect competition and with a monopoly is the same under free trade. The reason is that although the monopolist is the sole local supplier, free trade eliminates the Home producer’s market power because the domestic product and the imported good are identical.

Effect of a Home Tariff
Suppose Home imposes a tariff in the amount of $t$ on imports. The tariff raises the Home price to $P^W + t$, which becomes the highest price the monopolist can charge for the product. The higher price corresponds to an upward shift of the marginal revenue curve to $P^W + t$. The intersection of the new marginal revenue curve, $MR^*$, with the firm’s marginal cost curve is at point $C$, which means that the profit-maximizing level of output with the tariff is $S_2$. It follows that imports ($M_2 = D_2 - S_2$) decreased due to the higher Home price.

Comparison with Perfect Competition With the tariff, the monopolist continues to set equilibrium quantity and price equal to that of a perfectly competitive industry. The reason is that although the tariff raises the price charged by the monopolist, due to foreign competition, it is unable to set prices above $P^W + t$.

Home Loss Due to the Tariff The impact of the import tariff on Home welfare is the same with the monopoly and perfect competition as summarized by the following:

- Fall in consumer surplus: $-(a + b + c + d)$
- Rise in producer surplus: $+a$
- Rise in government revenue: $+c$

Net effect on Home welfare: $-(b + d)$

Figure 9-3

Tariff with Home Monopoly
Effect of a Home Quota

Now let’s replace the tariff with a quota that limits imports to the exact amount that would enter Home under the import tax (i.e., $M_2$), as illustrated in Figure 9-4. Because no more than $M_2$ can be imported from abroad, the effective demand faced by the monopolist, labeled $D - M_2$, is the difference between the Home demand curve, $D$, and the import quota, $M_2$. Because not all consumer demands can be met by the given import, the monopolist retains its market power with its ability to influence price. Corresponding to the downward-sloping effective demand curve is the downward-sloping marginal revenue curve, $MR$, which the monopolist equates to its marginal cost curve to find the profit-maximizing price of $P_3$ and supply of $S_3$. It is evident that although both the tariff and quota achieve the same level of imports, $M_2$, the effect on Home price and quantity is quite different. Namely, the price paid by consumers with the tariff, $P^w + t$, is lower than that with the quota, $P_3$. In addition, the quantity supplied by the monopolist is lower under the quota than the tariff, $S_3 < S_2$. The reason this result is possible is because the quota creates a “sheltered” market for the Home firm, which allows the monopolist to exercise its market power. Moreover, given that output with the quota, $S_3$, is less than the amount produced with a tariff, $S_2$, workers in the protected industry are worse off with the import restriction. It should be noted that this outcome is just one possibility.

Home Loss Due to the Quota

We see that under imperfectly competitive markets tariffs and quotas have different effects on Home prices. Namely, the price faced by Home consumers is higher with a quota because the import restriction allows the monopolist to maintain market power. In other words, tariffs and quotas are nonequivalent in imperfect competition. Due to the increase in price, the loss in Home welfare is greater with a quota as compared with a tariff.

Figure 9-4

Effect of Quota with Home Monopoly
APPLICATION

U.S. Imports of Japanese Automobiles

We previously mentioned that during the 1980s the government in Japan limited the quantity of Japanese automobiles exported to the United States. We now examine in detail the impact of this voluntary export restraint (VER) on U.S. welfare, beginning with the state of the economy during that period. In the early 1980s, the United States was in a deep recession, which led to fewer investments by firms and less spending on consumer durables like automobiles. Following the subsequent rise in unemployment, the United Automobile Workers applied for Section 201 protection with the U.S. International Trade Commission (ITC) in June 1980. Ford Motor Company followed suit two months later. The auto industry, however, did not receive protection because the U.S. ITC determined that the U.S. recession was a more important cause of injury than the increased imports.

Undeterred by the failure to obtain Section 201 protection, several congressmen from auto states introduced a bill to restrict import competition but particularly those from Japan. Shortly before the scheduled revision for the bill by the Senate Finance Committee, the Japanese government announced that it would “voluntarily” impose limits on the sales of automobiles in the U.S. market. The quota was initially set at 1.83 million autos beginning April 1981. Although the limit was later raised to an annual amount of 2.51 million vehicles, it ceased to be binding after 1987 when the Japanese automakers shifted their production to the United States.

Price and Quality of Imports

As shown in Figure 9-5, under the VER, the average price of imported Japanese cars increased by about $2,900 between 1980 and 1985. A third of the price increase ($1,100) was due to quota rents earned by Japanese producers. With the exception of about $150 reflecting inflation, the rest ($1,650) was the result of improvements in the quality of the imported Japanese cars (i.e., weight, horsepower, transmission, etc.).

Quota Rents

The rent earned by the Japanese producers is found by multiplying the quota rents of $1,100 per car by the imports of about 2 million cars. The total estimated rent of $2.2 billion is lower than the annual cost shown in Table 8-4, particularly if we account for the increase in the price of European cars.

Price of U.S. Cars

In addition to the price increase in Japanese cars due to the VER, the price of European cars sold in the U.S. market also rose as a result of lessened competition from Japanese automakers. Moreover, from Figure 9-6, it is clear that U.S. automobile producers likewise benefited from the export quota as the average price of American cars rose from $4,200 in 1979 to $6,000 in 1981. However, only a fraction of the price increase in U.S. automobiles can be attributed to quality upgrading. Most was due to the market power retained by the U.S. producers following the import restriction on Japanese automobiles.

The GATT and WTO

Contrary to an import quota, the restraint of Japanese automobile exports did not violate Article XI of the GATT because the VER was enforced by Japan rather than the United States. Consequently the use of VERs increased in popularity in the 1980s and early 1990s as GATT members sought ways to limit foreign competition without using import quotas. The es-
establishment of the WTO in 1994 closed the loophole created by the VERs by preventing all members from entering into such voluntary arrangements.

2 Tariffs with Foreign Monopoly

We will now move to the case in which the Foreign exporting firm is a monopoly and Home is a small country, taking the world price as given. Our examination will show that the imposition of a tariff with a Foreign monopoly could make Home better off, as in the “large-country” case.

Foreign Monopoly

We will extend the previous example by assuming that the Foreign firm is a monopolist in its local and export markets. In addition, we will assume that the Foreign firm has constant marginal costs. Focusing only on the Home market, the downward-sloping demand curve, \( D \), faced by the Foreign-exporting monopolist is shown in Figure 9-7.

Free-Trade Equilibrium

Without barriers to trade, the Foreign monopolist exports \( X_1 \), where the Home marginal revenue, \( MR \), equals marginal costs, \( MC^* \), at point \( A \).

Effect of a Tariff on Home Price

With the fixed tariff in the amount of \( t \) dollars, the marginal cost of exporting to the Home market increases to \( MC^* + t \) as shown in Figure 9-7. Given the higher marginal costs, the Foreign firm decreases exports to \( X_2 \). This corresponds to the intersection of the new marginal costs curve with the marginal revenue curve at point \( B \), leading to an increase in the import price to \( P_2 \).

In situations in which the marginal revenue curve is steeper than the Home country’s demand curve, the importing country may experience a terms-of-trade gain because the increase in the import price from \( P_1 \) to \( P_2 \) is less than the amount of the tariff, \( t \). To prevent the quantity exported from falling below \( X_n \), the Foreign firm absorbs part of the tariff and passes through only a portion of it to the Home price. Thus, the net-of-tariff price (i.e., \( P_3 = P_1 - t \)) received by the Foreign exporter is lower than the pretariff level. As in the “large-country” case analyzed in Chapter 8, the Home country benefits from the application of the duty; however, the reasoning for the terms-of-trade gain differs with a Foreign monopolist.

Effect of the Tariff on Home Welfare

To determine the effect of the tariff on Home welfare, note that the increase in the import price reduces consumer surplus by the area \((c + d)\), as illustrated in Figure 9-7. Home producer surplus is unaffected as there are no domestic firms by assumption. The revenue collected by the government equals the amount of the tariff multiplied by the units of Foreign exports, or area \((c + e)\). Summing up the effect of the tariff on consumers and the government gives:

<table>
<thead>
<tr>
<th>Effect</th>
<th>Change in Home welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall in Home consumer surplus</td>
<td>(-(c + d))</td>
</tr>
<tr>
<td>Rise in Home government revenue</td>
<td>((c + e))</td>
</tr>
<tr>
<td>Net change in Home welfare</td>
<td>((e - d))</td>
</tr>
</tbody>
</table>
where Home is better off with the tariff if the terms-of-trade gain denoted by area $e$ is greater than the deadweight loss represented by area $d$. Recall that the results are conditional on having a marginal revenue curve that is steeper than the demand curve.

**APPLICATION**

**Import Tariffs on Japanese Trucks**

Initially, compact trucks imported from Japan mainly consisted of cab/chassis, which were classified as “parts of trucks,” requiring some final assembly in the United States before selling to consumers. Under this system, the Japanese compact trucks were subject to a 4% tariff. On August 21, 1980, prompted by the U. S. Congress, the U. S. Customs Service reclassified the Japanese compact trucks as “complete or unfinished” trucks, subjecting the imported goods to a 25% tariff, which remains in effect today.

A study on the increased tariff on compact trucks provides evidence in support of the theory presented above. Namely, the results of the study suggest that the Japanese producers passed through 12% of the tariff to U. S. consumer prices. The remaining 9% were absorbed by the exporters. Due to the reclassification of the imported compact trucks from Japan, the United States experienced a terms-of-trade gain as predicted.

**HEADLINES**

**The Chickens Have Come Home to Roost**

This article argues that the current troubles of the big three U.S. automobile producers is linked to the 25-percent tariff on lightweight trucks, which was born out of an “accident of history.” With the recent rise in fuel prices, U.S. manufacturers have seen a drop in demand for SUVs and small trucks, which were once a major source of profits due to a 25-percent tariff on imported lightweight trucks. This tariff dates back to the chicken wars of the 1960s. When the U.S. chicken producers were denied access to European markets, the United States retaliated by imposing a 25-percent tariff aimed at German automaker Volkswagen. Since GATT rules required that all retaliatory tariffs be nondiscriminatory, the tariff was applied to all lightweight truck imports, and it still applies today.

**A Model of Product Dumping**

Given their market power, firms engage in dumping by taking advantage of their ability to charge different prices across countries to increase their profits. A firm is considered to be dumping if it sells a product at less than its average costs of production, or more cheaply abroad than it does in its local market (or a third market if the local price is unavailable). Although this activity is discouraged by the World Trade Organization (WTO), it is a common practice. Under WTO rules, countries are allowed to impose tariffs in response to dumping, called **antidumping duties**.

**Discriminating Monopoly** We examine how a firm may find it profitable to price below the market value or the average cost of production. We begin by assuming that the foreign firm is a monopolist in its local market but has competition in the home market. Moreover, possibly due to a tariff or high transport costs between the markets, arbitrage does not occur between consumers
in the low-price home market and those in the high-price foreign market. As a result, the foreign firm acts as a **discriminating monopoly** by charging different prices in the two markets. The downward-sloping demand curve, \(D^*\), faced by the foreign monopoly in its local market is given in Figure 9-8, along with the corresponding marginal revenue curve, \(MR^*\). Due to intense competition, the foreign monopolist’s demand curve in the home market is horizontal where \(P = MR\).

**Equilibrium Condition** To maximize profit, the foreign firm produces \(Q_1\) at point \(B\), where marginal costs equal the export marginal revenue, \(MR\). Of the amount produced, \(Q_2\) units are sold locally. Note that the local quantity, \(Q_2\), given by point \(C\), corresponds to the intersection of local and export marginal revenue curves, where the latter equals the foreign firm’s marginal cost of the last unit produced at point \(B\). Because the profit-maximizing price, \(P^*\), charged in the local market is higher than that in the export market, \(P\), the foreign firm is dumping by definition.

**The Profitability of Dumping** Furthermore, Figure 9-8 also shows that the foreign monopoly is dumping when defined by the export price set below the average cost of production. More specifically, the average cost of production for output, \(Q_1\), is \(AC_1\). We see that the foreign firm is dumping given that the local price, \(P^*_l\), is above the average cost whereas the export price, \(P\), is below.

**Numerical Example of Dumping**

To understand why it is profitable for the foreign firm to export the good at below-average cost, we use the following hypothetical information pertaining to its costs and demand.

- Fixed costs = $150
- Marginal costs = $15/unit
- Local price = $35
- Local quantity = 10
- Export price = $20
- Export quantity = 5

The firm’s total costs equal the sum of its fixed and variable costs:

\[
\text{Total Costs} = 15 \times 10 + 150 \times 300.
\]

<table>
<thead>
<tr>
<th>Variable Cost</th>
<th>Fixed Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>($35 \times 10)</td>
<td>($150 \times 300)</td>
</tr>
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</table>

It follows that its average costs are \((\$300 / 10) = \$30\), and profits from selling only in the local market are:

\[
\frac{\$35 \times 10 - \$300}{\text{Revenue}} = \frac{\$50}{\text{Total Costs}} = \frac{\$15}{\text{Profit}}.
\]

If the foreign firm exports 5 units, its profits become:

\[
(35 \times 10 + 20 \times 5) - (15 \times 15 - 150) = 75.
\]

<table>
<thead>
<tr>
<th>Revenue</th>
<th>Variable Costs</th>
<th>Fixed Costs</th>
<th>Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>($35 \times 10 + 20 \times 5)</td>
<td>($15 \times 15)</td>
<td>($150)</td>
<td>($75)</td>
</tr>
</tbody>
</table>
Therefore, the foreign firm receives an additional $25 in profit by selling the five units abroad even though the average costs of production for those quantities are higher than the exporting price. The extra profit is because, although the exporting price—$20—is lower than the average costs—$30—the price charged abroad is still higher than the marginal cost of $15.

4 Policy Response to Dumping

Antidumping Duty

A foreign monopolist is considered to be dumping when its export price is less than its average costs of production or it is selling more cheaply abroad than it does in its local market (or a third market if the local price is unavailable). When a foreign firm is found to be dumping, the rules of the WTO allow the importing country to counteract the unfair trade practice by levying a tariff called an antidumping duty.

Recall from the previous section that a Foreign firm may be found to be dumping even though the price it sets abroad is the same as competitors’ in the Home market. We will now examine the impact on Home welfare due to the antidumping duty levied by the importing country in response to the export dumping by the Foreign firm.

Strategic Trade Policy? By raising the price of the dumped product with a tariff equal to the difference between the exporter’s local price and the import price, the importing country is able to protect its domestic producers. Although the antidumping duty increases the price domestic consumers pay, causing a deadweight loss for the importing country, this is not taken into consideration in the application of the tariff. We might expect a terms-of-trade gain from the monopolist absorbing part of the tariff though lowering its own price, as we see in Figure 9-7, however, we find that this not the case.

HEADLINES

China Escalates Trade Fight over European Shoe Tariff

This article discusses the recent antidumping duties imposed against China by the European Union on footwear. While some have welcomed the duties, many have opposed them, including the European Footwear Alliance, which represents many global footwear producers. It is argued that these duties hurt consumers and businesses by pushing up prices. The alliance claims its members have paid around $1.2 billion in antidumping duties over the past three and a half years.

Comparison with Safeguard Tariff Contrary to the situation in which Japanese producers of compact trucks treat the 25% tariff as fixed, a Foreign firm often has the ability to influence the amount of the antidumping duty levied by changing the price of its exporting product.

Calculation of Antidumping Duty Because the duty is equal to the difference between the exporter’s local price and the dumped price, the Foreign firm can face a smaller tariff by increasing the price charged abroad. In particular, if it matches the exporting price to that of its local price, the duty would effectively
be nullified. However, doing so would decrease profits because the Foreign firm would be charging a price above the profit-maximizing level in the exporting market.

The net effect on Home welfare due to the increase in the import price resulting from the Foreign firm’s response to the antidumping duty is largely negative. More specifically, we see from Figure 9-11 that the rise in the import price from $P_1$ to $P_2$ leads to a loss in consumer surplus equaling the area $(a + b + c + d)$. The gain in producer surplus from the import protection is denoted by the area $a$. The tariff revenue is zero because the Foreign firm is no longer dumping, given that it has raised the export price to that of its local market price.

\[
\begin{align*}
\text{Fall in Home consumer surplus:} & \quad -(a + b + c + d) \\
\text{Rise in producer surplus:} & \quad a \\
\text{Net change in Home welfare:} & \quad -(b + c + d)
\end{align*}
\]

Thus, the overall effect of the exporting firm’s response to the antidumping duty is a net loss for the Home country represented by area $(b + c + d)$. Without any government revenue, the loss generated by the antidumping duty is greater than the deadweight loss of a fixed tariff, which would have been area $(b + d)$.

Despite the negative net effect of the antidumping duty on the importing country, charges of Foreign dumping have become increasingly popular. The reason is that the threat of an antidumping duty often leads Foreign competitors to raise their prices, which reduces competition for domestic firms in the same market.

**APPLICATION**

**Antidumping/Countervailing Duties versus Safeguard Tariffs**

The “safeguard” provision in Article XIX of the GATT and Section 201 of the U.S. trade law, discussed in Chapter 8, allows a domestic firm temporary relief from foreign competition when it is determined that rising imports are the “most important cause of serious injury, or threat thereof, to the domestic industry.” Due to the difficulty of obtaining a tariff recommendation on competing imports, only 19 cases were filed in the United States between 1980 and 1989, as shown in Table 9-1. Seven of the 19 cases were recommended to the president and only five were affirmed for tariff protection. From 1990–2009 only an additional 12 cases were filed.

In contrast to the infrequent use of safeguard or escape clauses, more than 400 antidumping cases were filed in the United States in the same period. The reason for their popularity is the procedure necessary for tariff protection is relatively easier. In an antidumping case the Department of Commerce (DOC) first determines whether the imported good is sold at “less than fair value” compared with the exporting firm’s own market price or the average cost of production. The duties are applied when the ITC determines that the import caused “material injury” to the domestic industry. This condition is less strict than the guideline necessary for the safeguard tariff, which requires that the rising import be a “substantial cause of serious injury.” Moreover, the
President does not need to approve the case before the antidumping duty can be applied. As a result, approximately 550 of the 1,200 antidumping cases received tariff protection.

Aside from those cases in which duties were applied, about 450 cases were rejected and the remaining cases, approximately 150, were withdrawn before the final ruling. By withdrawing the case, the domestic producer, via a DOC intermediary, can coordinate with the Foreign competitor on prices and market shares. Through their coordinated efforts, the market price in the importing country rises.

The incentive to file dumping claims becomes evident when we note their potential benefits to the domestic producer. Namely, there is a relatively high success rate of obtaining tariff protection. Furthermore, a domestic firm is given permission to coordinate prices and market shares with its Foreign competitor once the case is withdrawn. Import competition is also lessened when a case is unsuccessful. The reason is that imports often decrease during the DOC or ITC investigation.

5 Infant Industry Protection

Aside from politics and the large-country case, a country may impose an import tariff to allow its import-competing industry to become more competitive by lowering costs or raising the quality of the products. The idea is that by temporarily nurturing the infant industry through tariffs, it will have the time needed to learn and grow so that the industry will be able to compete in the future without the necessary protection.

A successful protection is one in which the infant industry is able to increase future output in an environment whereby it may not have the opportunity otherwise to survive without the tariff. Such an environment may be caused by imperfection in the capital market. Namely, a firm is unable to secure loans to cover losses in the current period even with the potential of profits in the future. Another justification for infant-industry protection is when there is a positive externality in the form of knowledge spillover from the firm protected by the tariff to others in the industry. With the tariff protection, the firm properly aligns its incentive by increasing current production, which allows other firms to learn, thereby reducing industry costs. Thus, the deadweight loss caused by the tariff today is offset by future gains. Although both of these cases provide examples for which the infant-industry protection may be useful in resolving existing market failures, in reality, it is likely that the government does not have the necessary information to successfully implement the policy.

Free-Trade Equilibrium

To more formally develop the case for infant industry protection, we will refer to Figure 9-10, where panel (a) shows the Home firm’s current average cost curve. By increasing its output today, the Home firm is able to cut its costs in the future. As illustrated in panel (b) of Figure 9-10 the Home firm’s future average cost curve is lower relative to the one in panel (a). Note that we assume the Home is a small-importing country.
Equilibrium Today  Today, the industry faces the world price of $P^w$ under free trade as shown in panel (a). Given $P^w$ and the average cost curve, labeled $AC$, the industry would suffer loss if it produces at $S_1$ because its cost per unit is greater than the price received. Therefore, the firm would choose not to produce.

Tariff Equilibrium  However, if the government imposes a tariff in the amount of $t$ to protect the infant industry, then the domestic price raises from $P^w$ to $P^w + t$, which equals the firm’s average total cost.

Equilibrium Today  At the higher price, the industry earns zero profit rather than a loss. Consequently, the industry produces $S_2$ and through learning by doing, it will be able to become more efficient.

Equilibrium in the Future  The resulting future efficiency is represented by the lower average cost curve labeled $AC''$ in panel (b). With the lower average costs, the industry no longer requires the tariff protection to compete in the future.

Effect of the Tariff on Welfare  To analyze the effect of the tariff on welfare, we need to compare the deadweight loss today due to the tariff, denoted by the triangles ($b + d$) in panel (a) of Figure 9-10 and the future gain in producer surplus represented by area $e$ in panel (b). The infant industry protection is successful if $e$ is greater than ($b + d$). The deadweight loss caused by the tariff protection imposed today is not justified if $e$ is less than ($b + d$).
APPLICATION

Examples of Infant Industry Protection

The three examples of infant industry protection we examine include two from developing countries (i.e., automobile industry in China and computer industry in Brazil) and another from the United States (i.e., protection for the Harley-Davidson motorcycles in the 1980s).

Protecting the Automobile Industry in China

Before its accession to the WTO on December 1, 2001, China protected many of its industries, including the automobile industry, with high tariffs and strict quotas. Tariffs in automobiles fell from 260% in the early 1980s to 25% by the middle of 2006 and in 2009 the tariff on automobile parts was reduced from 25% to 10%, due to the increase in demand. Also in 2009, China overtook the United States as the largest automobile market in the world. We will now examine whether China’s protection of this once “infant industry” attributed to the success of its automobile sector.

Production in China

The production of automobiles in China began with a joint venture between American Motors Corporation and a local Beijing firm in 1983. Subsequently, other partnerships between foreign firms, Germany’s Volkswagen and France’s Peugeot, and local Chinese partners followed in Shanghai and Guangzhou, respectively. As a result of the variation in regulations, incentives, and tariffs across provinces and cities, joint ventures such as Volkswagen’s Shanghai plant succeeded in producing 200,000 vehicles per year by the late 1990s. Peugeot ended the agreement in 1997. In the 1990s, China’s automobile industry grew with the addition of Volkswagen’s factory in Changchun and new joint ventures with Honda, Toyota, Daihatsu, and General Motors. General Motors is now the leading producer in China, and in early 2009 it opened two new plants in Shanghai.

HEADLINES

Shanghai Tie-Up Drives Profits for GM

This article discusses how the Chinese automobile market may play a key role in the future of General Motors. In 2009, while domestic sales fell by 30 percent, those in China grew by 66 percent. In addition to the role that Chinese consumers appear to be playing in deciding the fate of GM, so too do GM’s Chinese partners. In exchange for Chinese backing for their expansion in Asia, GM relinquished majority control of Shanghai General Motors to its partner, Shanghai Automotive Industry.

Cost to Consumers

The high tariffs imposed by the Chinese government approximately doubled the import prices, which severely restricted the amount of foreign cars sold in China. Automobile imports ranged from a high of 222,000 cars in 1993 to a low of 27,500 in 1998. However, although tariffs increased the import prices, the quotas also affected domestic production, particularly when the firm enjoyed market power, as in the case of Volkswagen in Shanghai. As shown in Figure 9-12, Shanghai Volkswagen had the highest markups at an average of 42% during 1995 to 2001, with Tianjin Auto at a distant second at 19%. In addition to the higher prices, Shanghai Volkswagen exercised its monopoly power by producing outdated models.
Gains to Producers Although China continues to impose tariffs on autos and auto parts, these rates are significantly lower than those applied in the earlier years. Moreover, plans to start exporting cars from China indicate that some producers are able to lower their cost of production such that government assistance is no longer necessary. However, the success of China’s infant industry strategy depends on whether the reduction in the average cost of production is the result of past protection. Given this measurement, it is unclear whether the imposition of the tariffs and quotas was successful because the firms that are intending to export are not those that benefited most from the earlier protection. For example, the Lifan Group, which plans to export midsize sedans abroad, is doing so by purchasing ready-made plants from Brazil.

HEADLINES

Thanks to Detroit, China Is Poised to Lead
In response to fierce competition, automakers are now shifting to produce their latest models in China rather than outdated versions as in the past. These models include the Honda Civic and Toyota Prius. Ford Motor recently built a technologically advanced production line next to its first one in western China. Similar to Ford Motor, other American, European, and Japanese automobile manufacturers are incorporating their best technology in their Chinese plants to compete with one another as well as local firms. Although some foreign firms are expanding in China mainly to serve the domestic market, others are exporting from the developing country. However, there are potential risks for the foreign firms from producing in China. One of the main concerns is the transfer of proprietary technology to local firms, particularly with the announcement by General Motors’ joint venture partner, Shanghai Automotive, that it would begin selling to the domestic market under its own brand name.

Computers in Brazil
Between 1977 and the early 1990s, the Brazilian military government protected its domestic computer industry through a ban on imports of personal computers (PCs) and computer parts. In addition, they prevented foreign firms from producing computers in Brazil. Brazilian firms reverse engineered IBM PCs and used locally supplied parts to produce the computers. Due to a combination of the time requirement to reverse engineer the product and the use of higher cost inputs from local suppliers, the cost of production was greater in Brazil than the United States.

Prices in Brazil Computer prices, adjusting for improvements in speed, storage, and so forth, are shown in Figure 9-11 for Brazil and the United States for 1982 to 1992. The effective price of computing power fell rapidly in the United States between 1982 and 1988. Brazil, however, did not achieve the same low prices as the United States during the same period. More specifically, by 1992, Brazil was able to achieve the effective prices of computers that the United States had already established in 1988. This large gap in prices between Brazil and the United States indicates that Brazil would not have been able to successfully produce computers without the tariff protection.

Consumer and Producer Surplus The effect of the tariff protection on Brazilian welfare is presented in Table 9-3. The calculations show that com-
puter prices in Brazil were nearly twice as high as those in the United States in 1984. In the same year, the $29 million gained in producer surplus by Brazilian computer producers did not outweigh the loss of $80 million in consumer surplus. The net loss of $51 million ($CS - PS$) accounted for 0.2% of the Brazilian gross domestic product (GDP) that year. The net loss peaked at 0.6% of GDP along with sales in 1986.

**Other Losses** The losses due to the protection of the Brazilian computer industry weigh heavily on both producers using computers for production and individual users. The increasing dissatisfaction prompted Fernando Collor de Mello to promise an end to the infant industry protection during his presidential campaign. The failure of the Brazilian computer industry to effectively compete without import tariffs illustrates the difficulties involved in nurturing an infant industry through temporary protection.

**U.S. Tariff on Heavyweight Motorcycles**


In its determination of the source of the injury to the industry, the ITC found that the glut of Japanese inventories contributed to the low prices set by those companies and caused the losses incurred by Harley-Davidson. Upon the recommendation of the ITC, President Ronald Reagan placed import tariffs on heavyweight motorcycles (over 700 cc). The tariffs, which became effective April 16, 1983, were initially high (45%) and were set to decline annually over the next 5 years (35%, 20%, 15%, and 10%). Although the tariffs were not scheduled to end until April of 1988, Harley-Davidson petitioned the ITC to end the tariff after the 15% rate expired in 1987 because it had successfully restored profit through new product lines and lower production costs.

**Calculation of Deadweight Loss** Although Harley-Davidson requested that the import tariff end earlier than scheduled, a comparison of the deadweight loss due to the tariff against the potential gain in producer surplus is needed to more accurately study the welfare implications of the heavyweight motorcycle protection. We will use the formula developed earlier, which measures the deadweight loss relative to the import value resulting from the tariff:

\[
\frac{DWL}{P \cdot M} = \frac{1}{2} \left( \frac{t}{P^w} \right) \cdot \%\Delta M
\]

Using the data on heavyweight motorcycles presented in Table 9-2, we can calculate that the average quantity imported between 1982 and 1983 is \((164 + 139) / 2 = 151\) thousand, which equates to a percentage drop of 17% \(((164 - 139) / 151 = 0.17\)). Substituting in the numbers into our formula, we get that the deadweight loss relative to the import value in 1983 is:

\[
\frac{DWL}{P \cdot M} = \frac{1}{2} \left( 0.45 \cdot 0.17 \right) = 0.038, \text{ or } 3.8\%.
\]

Summing up the annual net losses over the tariff of four years period gives a total loss of $112.5 million.
Future Gain in Producer Surplus Next we will calculate the future gain in producer surplus to compare the value to the deadweight loss of $113 million. More specifically, we will measure the future gains in producer surplus by examining Harley-Davidson’s stock market value during the removal of the tariff protection. Harley-Davidson’s initial public offering in July 1986 was 2 million shares at $11 per share. In June 1987, Harley-Davidson issued an additional 1.23 million shares at $16.50 per share. Adding the first public offering of $22 million to the second offering of $20.3 million and its debt of $70 million, we see that Harley-Davidson’s producer surplus in present discounted value is $112.3 million. These calculations show the deadweight loss is approximately equal to the future gain in producer surplus. However, after the second stock offering, Harley-Davidson’s stock price increased to $19 per share. With the higher stock price, the future gain in producer surplus is estimated to be $131 million, which clearly exceeds the loss in consumer surplus.

Was Protection Successful? Our calculations imply that the tariff protection increased welfare for the United States because the deadweight loss is less than the future gain in producer surplus. However, there are doubts as to whether the heavyweight motorcycle tariff was indeed successful. If Harley-Davidson had not been able to survive without the tariff, the protection was successful. This may have been the case because they were on the verge of bankruptcy a week before the tariff protection. However, Harley-Davidson’s chairman stated that the tariff did not offer much protection because Japanese producers downsized their motorcycles to 699 cc to evade the tariff.

6 Conclusions
We examine the effect of trade barriers, such as tariffs and quotas under imperfect competition, on the welfare of the importing country in this chapter. With a tariff, a Home monopolist benefits from the increase in price just as perfectly competitive firms. By contrast, the impact of an import quota on the Home prices and quantity is different from that of a tariff under imperfect competition with a domestic monopoly. In other words, the price paid by consumers is higher under an import quota than a tariff because the Home monopoly is “sheltered” from foreign competition, which allows the firm to exercise its market power. Additionally, the quantity supplied by the sole Home producer is lower with the quota than a tariff.

Moreover, we also found that a Foreign monopolist facing a fixed tariff will absorb a portion of the tariff to prevent a large decrease in the quantity exported. As a result, the full amount of the tariff does not pass through in the import price. Therefore, by imposing a tariff under conditions in which the marginal revenue curve is steeper than demand, the importing country experiences a terms-of-trade gain similar to that of a large country.

We also analyzed the response of the importing country when a foreign firm engages in dumping. Although import quotas are prohibited under WTO guidelines, an importing country is allowed to levy an antidumping duty against a foreign exporter when the exporting firm is found dumping. More specifically, the foreign firm is dumping if it charges a lower price in the export market than its own local market or prices below the average cost of
production. Dumping claims have increased in popularity due to their potential to lessen the degree of import competition for the domestic firm. The general result of an application for antidumping duty is an increase in prices, whether due to the foreign firm raising its price to avoid the tariff or collusion between the domestic and exporting firms following the withdrawal of a case or a decrease in the amount of import.

In the last section, we studied the use of tariffs and quotas to protect an infant industry. By raising the import price today, domestic firms may reduce their cost of production, such that they no longer require government assistance in the future to go against foreign competition. The three examples presented in the chapter show that the infant industry protection may have succeeded in saving Harley-Davidson, although it failed to help the Brazilian computer industry to achieve the level of efficiency experienced in the United States. The success of the protection received by China’s automobile industry has yet to be evaluated, because the Chinese government continues to maintain tariffs on imported autos. In addition, firms that benefited the most from the early protection are not the main participant in China’s exports of automobiles.

**TEACHING TIPS**

**Tip 1: Antidumping Data Project**

The World Bank has collected an extensive database of antidumping cases called the Global Antidumping Database (GAD). Ask students to go to the Temporary Trade Barriers Database (http://econ.worldbank.org/ttbd) and proceed to the Antidumping Database. Through the “Raw Data Files,” ask students to download the file GAD-USA.xls, which documents all antidumping investigations by the United States since 1980. One good way to have students utilize this data is to ask them to investigate trends in countries these cases are brought against over the years. Which country has the United States brought the most cases against in recent years and since 1980? Students should notice that in recent years there has been a large increase in cases filed against China.

**Tip 2: Debate on Infant Industry Protection**

Infant Industry Protection is a very important part of Chapter 9. The Chinese automobile industry is one case discussed. At the time this text was written, the success or failure of this protection was unclear. Have students break into groups, conduct independent research, and debate the success or failure of China’s protectionist policies using the most recent data and events possible. This will be a good way to simulate students’ interest in trade policy.

**Tip 3: Economic Performance and Protectionism**

Ask students to find and read articles regarding protectionism during the global recession, which began in late 2007, and discuss the findings. One good article is “Antidumping, safeguards, and protectionism during the crisis: Two new insights from 4th quarter 2009” (http://www.voxeu.org/index.php?q=node/4635). This article presents the same data provided in Problem 13 of Chapter 9.
IN-CLASS PROBLEMS

1. Explain why the removal of an import quota by a small country where there is only one producer leads to a greater gain for consumers than a similar country where firms operate under perfect competition.

Answer: Under imperfect competition, an import quota allows the monopoly to retain its market power. Therefore, prices are higher and the quantity supplied by the home firm is lower compared with the case of perfection competition with a quota. As a result, the removal of the import quota would lead to a larger welfare gain for consumers because they face a higher price under the monopoly than perfect competition.

2. What is the effect on welfare when a foreign exporter dumps a product in the U.S. market?

Answer: Due to the terms-of-trade gain from the lower import price, consumers are better off when the foreign exporter dumps a product in the U.S. market. The domestic producers are worse off because they decrease the quantity supplied as a result of the decrease in price. Overall, the net effect on welfare is positive because the gains by consumers (areas \( b + c + d \) in Figure 9-9) is likely to be larger than the loss in producer surplus (area \( a \)).

3. Suppose the commerce department in a small importing country recently found that an exporter is dumping potatoes in the economy. Given the following scenarios, rank each from best to worst in terms of the importing country’s welfare. Explain.
   i. Free trade
   ii. Foreign dumping
   iii. Foreign dumping with an antidumping duty
   iv. Coordination between the foreign and domestic producers after the antidumping petition is withdrawn

Answer: ii > iii > i > iv. Foreign dumping is the best in terms of the importing country’s welfare because it decreases the price consumers pay. Moreover, the gain in consumer surplus generally exceeds the loss in producer surplus so that the net effect is positive. Foreign dumping with an antidumping duty is better than free trade if the duty raises the import price to the free-trade level. The reason is that the small country would import the same amount as it would under free trade but it gains the antidumping duty. Coordination between the foreign and domestic producers is likely to be the worst in terms of welfare because the collusion would lessen competition.

4. The following figure shows the top ten countries cited in antidumping cases by the United States from 1980 to 2004. Is there a relationship between the frequency of being cited in an antidumping case and the volume of U.S. imports from a country?

Top 10 Countries Cited in Antidumping Cases, by Number of Cases, Fiscal Years 1980-2004, Cumulative

Source: U.S. ITC, “Import Injury Investigations Case Statistics (FY 1980-2004)”, Figure 11
Answer: With the exception of the United Kingdom and Malaysia, the top ten countries cited in antidumping cases by the United States from 1980 to 2004 are also the top ranked U.S. imports in 2004. Thus, it is likely that there is a relationship between the frequency of being cited in an antidumping case and the volume of U.S. imports from a country.

5. The following table provides data on antidumping investigations in the United States from 1980 to 2004. Does the information indicate that it is relatively easy to obtain import protection through an antidumping case? Explain. Why do petitioning firms withdraw their claims before a decision is made?

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Canada</td>
</tr>
<tr>
<td>2</td>
<td>China</td>
</tr>
<tr>
<td>3</td>
<td>Mexico</td>
</tr>
<tr>
<td>4</td>
<td>Japan</td>
</tr>
<tr>
<td>5</td>
<td>Germany</td>
</tr>
<tr>
<td>6</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>7</td>
<td>South Korea</td>
</tr>
<tr>
<td>8</td>
<td>Taiwan</td>
</tr>
<tr>
<td>9</td>
<td>France</td>
</tr>
<tr>
<td>10</td>
<td>Malaysia</td>
</tr>
</tbody>
</table>


Answer: The data indicate that from 1980 to 2008, 82% of the 1069 cases filed received an affirmative determination from the DOC. The percentage of cases voted in the affirmative by the ITC, although smaller than that for the DOC, is still over 50%. Therefore, the data would suggest that it is relatively easy to obtain import production through an antidumping case. As we learned in this chapter, a domestic firm may withdraw its claim before a ruling because the act of the petition often leads the foreign competitor to raise the import price. Moreover, the withdrawal of the case allows the foreign and domestic firms to coordinate their output decisions.

6. Refer to Application: U.S. Imports of Japanese Automobiles in answering the following questions:

a. Why did the United Automobile Workers (UAW) and Ford Motor Company fail to receive protection from foreign competition from the ITC?

Answer: To receive protection under Article XIX of GATT and Section 201 of U.S. trade laws, the UAW and Ford Motor Company must have suffered serious injury where import competition was the “substantial cause.” Namely, the serious injury due to competing imports was “not less than any other cause.” They failed to receive the protection because the ITC determined that the U.S. recession was a more important cause of injury to the auto industry than were increased imports.

b. What is the impact on American consumers due to the voluntary export restraint (VER) imposed by Japan’s Ministry of International Trade and Industry (MITI) to limit the number of Japanese cars exported to the United States? More specifically, how did the VER affect prices and quality of the foreign and domestic cars?

Answer: The VER limited foreign competition, which raised the price of domestic cars without much upgrading in terms if quality. Prices of Japanese cars also rose between 1980 and 1985. However, over 50% of the rise in the price of Japanese cars was due to quality improvements. The export limitation on quantity created an incentive for the Japanese producers to sell more expensive models to the United States.

7. Determine the net impact on Home’s welfare when it imposes a tariff of $2 on the Foreign monopolist using the following figure.
Answer: With a tariff of $2 per unit, the Foreign monopolist sets \( MR = MC' \) so that price equals $11 while the quantity supplied is 7.

\[
\begin{align*}
\text{area } c &= 7 \cdot (11 - 10) \\
\text{area } c &= 7 \\
\text{area } d &= \frac{1}{2} \cdot (11 - 10) \cdot (10 - 7) \\
\text{area } d &= 1.50
\end{align*}
\]

Fall in Home consumer surplus: \(-8.50\)
Rise in Home government revenue: \(+14\)

\begin{align*}
\text{Net change in Home welfare: } & +6.50
\end{align*}

Therefore, the net change in Home welfare is positive.

8. Name the U.S. government agencies and their roles in determining whether to apply antidumping or countervailing duties on foreign firms.

Answer: The International Trade Commission (ITC) and the U.S. Department of Commerce (DOC) are responsible for conducting antidumping and countervailing duty investigations. If the DOC finds that an imported product is dumped or subsidized and the ITC finds that a U.S. industry producing a like product is materially injured or threatened with material injury, an antidumping duty order or countervailing duty order will be imposed to offset the dumping or subsidies. When an antidumping or countervailing duty order is imposed, the DOC instructs the Bureau of Customs and Border Protection to assess antidumping or countervailing duties on imports of the product into the United States to offset the unfair trade practice.

9. How is the amount of the antidumping duty determined?

Answer: The amount of an antidumping duty is the difference between the Foreign firm’s local price and its export price.

10. Who may petition for relief from foreign dumping in the United States?

Answer: Under this law, U.S. industries may petition the ITC and DOC for relief from unfairly priced (dumped) and subsidized imports.

11. Name the countries that have filed antidumping claims against the United States. You can find this information by going to the Web site of the U.S. Department of Commerce International Trade Administration given by the following link (http://ia.ita.doc.gov/trcs/foreignadcvd/index .html) and clicking on “Case Archives.”
12. Refer to problem 11. Examine the Chinese import of Acipic Acidacrylates from the United States. What other countries did China claim were dumping Acipic Acidacrylates? When did China initiate the antidumping duty petition? What was the final decision? Was a duty applied? If so, how much? What is the current status of the antidumping duty?

Answer:

<table>
<thead>
<tr>
<th>Product</th>
<th>Initiation</th>
<th>Provisional Measures</th>
<th>Final Measures</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adipic Acid</td>
<td>November 10, 2008</td>
<td>June 26, 2009</td>
<td>November 1, 2009</td>
<td>Respondent nations: United States, EU, South Korea</td>
</tr>
<tr>
<td>(AD Measure)</td>
<td>(Investigation)</td>
<td>5.7%–35.4%</td>
<td>5%–35.4%</td>
<td></td>
</tr>
</tbody>
</table>

13. Refer to problem 11. Examine India’s import of Phenol from the United States. What other countries did India claim were dumping Phenol? When did India initiate the antidumping duty petition? What was the final decision? Was a duty applied? If so, how much? What is the current status of the antidumping duty?

Answer:

<table>
<thead>
<tr>
<th>Product</th>
<th>Initiation</th>
<th>Provisional Measures</th>
<th>Final Measures</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(AD Measure)</td>
<td>(AD Investigation)</td>
<td>U.S.: 33.45%</td>
<td>U.S.: $181/MT</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Korea: 27.28%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taiwan: 21.20%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

14. In regards to New Suspension Agreement ~ Fresh Tomatoes from Mexico (http://ia.ita.doc.gov/tomato/), the Import Administration states that . . . On December 4, 2002, the Department of Commerce and producers/exporters accounting for substantially all imports of fresh tomatoes from Mexico signed this agreement suspending the antidumping investigation on fresh tomatoes from Mexico. The basis for the agreement was a commitment by each signatory producer/exporter to sell the subject merchandise at or above the reference price, which will eliminate completely the injurious effects of exports of fresh tomatoes to the United States.

Pursuant to section IV.G. of the 2002 Suspension Agreement on Fresh Tomatoes from Mexico, the Department of Commerce has conducted an analysis of the reference prices. Effective November 1, 2003, the reference price below which signatories to the agreement may not sell fresh tomatoes from Mexico in the United States during the winter season (October 23–June 30) will be $0.2169/lb. The reference price for the summer season (July 1–October 22) will remain at $0.172/lb.

Who will gain from this agreement? Who will lose from this agreement? Explain.

Answer: Tomato producers in the United States will gain from the agreement due the decrease in competition from Mexico although the U.S. consumers will lose because of the higher price.

15. Why is the equilibrium quantity and price the same with a home monopoly and perfect competition under free trade?

Answer: Under free trade, consumers are able to purchase the homogenous product from the Foreign firm if the domestic monopoly charges a price above the world price. As a result of the foreign competition, the domestic monopoly loses its market power and views the world price as its demand curve.
Notes to Instructor

Chapter Summary
The trade policy we examine in this chapter is one that promotes exports, often at the expense of domestic consumers. Export subsidies are used by many countries, developed and developing, to increase the competitive efforts of domestic producers. In this chapter, we discuss the impact of export subsidies in the agricultural and high-tech industries on domestic and world welfare. Generally, for a small country, the use of agricultural export subsidies benefits domestic producers through increased production and higher prices but hurts consumers in terms of the rise in price paid. For a large country, in addition to the deadweight loss from the decline in consumer surplus and production inefficiency, the exporting country experiences a terms-of-trade loss resulting from the decrease in world price driven by the additional exports. The effect of export subsidies in high-tech industries depends on whether the government assistance succeeds in preventing entry.

Comments
In presenting export subsidies, this chapter covers a number of topics, including the World Trade Organization (WTO) and game theory. Therefore, it may be worthwhile to present an overview of the topic so that students understand the main theme. Namely, start by discussing the agreements proposed during
the Geneva and Hong Kong meetings of the WTO and elicit reasons why a government may use export subsidies under perfect and imperfect competition. Then, under perfect competition, explain the impact of an export subsidy on a small country versus a large country. Contrast the impact of the export subsidy with a production subsidy. Return to the use of export subsidies under imperfect competition.

Lecture Notes

Introduction

Reminiscent of earlier meetings, the Geneva gathering of the 152 members of the WTO in July 2008 was met with protests. The root of the recent objections was due to proposals to eliminate agricultural support used in many countries such as South Korea, Japan, Europe, and the United States, which inflates the price of their crops while depressing the world prices. Proponents of the removal of the agricultural support consisted of exporters in land-rich developing countries, such as Brazil, India, and China, that were hurt by the low prices. However, the current regimes of tariff and subsidy benefit land-poor developing countries capable of importing the agricultural products at the lower prices.

1 WTO Goals on Agricultural Export Subsidies

Table 10-1 presents a summary of tentative agreements discussed during the Hong Kong meeting of the WTO held in December 2005. Since they were never ratified by the countries involved it is best to think of these as goals rather than definite outcomes.

Agricultural Export Subsidies

The first on the list deals with agricultural export subsidy, which is a governmental support made available to farmers to boost output. Examples include payments to sugar growers by the European Common Agricultural Policy (CAP) valued at five times that of the world market price. As a result of the subsidy, Europe is the leading world supplier of sugar despite a lack of natural comparative advantage relative to countries in more temperate climates. The United States has similar programs to assist cotton farmers. Namely, in addition to direct payments made to the farmers to increase growth, agribusinesses and manufacturers are encouraged to purchase American cotton through subsidies. Building on discussions initiated in previous WTO meetings, the member countries agreed in Hong Kong to abolish the export subsidies in agriculture by late 2013.

Indirect Subsidies As part of the Hong Kong agreement, the member countries also approved the elimination of indirect subsidies to agriculture. Food aid to poor countries is a form of indirect subsidy practiced by the United States. In contrast, Europe assists poor countries through cash aid.
Domestic Farm Supports  The Hong Kong meetings also initiated steps toward the removal of domestic farm supports. Although not directly tied to exports, domestic assistance given to farmers may indirectly affect exports by lowering the costs of production.

Cotton Subsidies  Of all the agricultural products, the WTO members focused on cotton because many low-income African countries export this crop. Under the agreement, the United States will work toward eliminating its export subsidies to cotton growers and reduce other domestic farm supports. Furthermore, producers in West African and other least-developed countries (LDCs) are granted unrestricted access in their cotton exports.

Other Matters from the Hong Kong WTO Meeting
In addition to proposing the removal of export subsidies, the WTO members discussed eliminating tariffs that are placed by the importing country in response to government assistance received by the exporting firms. In return for their agreement to reduce export subsidies, the richer countries negotiated with the poorer countries for access to the services markets. These issues have proven as contentious as to break up the Geneva meeting in 2008, and have threatened the entire Doha Round of negotiations.

Tariffs in Agriculture  Aside from subsidies, the WTO members also discussed the reduction of countervailing duties and other agriculture-related tariffs, particularly those imposed by industrial countries. Poor nations, however, are allowed to raise tariffs to counter the surge of imports.

HEADLINES

Developing Countries Split over WTO Farm Protection
This article discusses the disagreement of developing countries over proposed special product and special safeguard mechanisms, which have been proposed for agricultural products during the Geneva meeting of the WTO. These special safeguards aim to protect developing countries concerned about removing tariffs on imported agricultural goods. The safeguards exempt some “special” products from tariff removal and develop mechanisms to allow countries to use temporary tariffs to counter sudden changes in prices or quantities of imports. Developing countries have been unable to agree on this matter because some fear their exports will be harmed if safeguard mechanisms can be too easily applied, while others fear that for their local producers as a result of increased import competition.

Issues Involving Trade in Industrial Goods and Services  In terms of industrial goods, they agreed to establish a formula to further cut tariffs. To further assist the 50 LDCs, members are to extend tariff-free and duty-free access for 97% of imported products with the exception of textiles. Another item of discussion during the Hong Kong meeting deals with the opening of service trade to the benefit of industrial countries. In exchange for the compromise, developing countries want more temporary service workers allowed in the developed countries.
2. **Agricultural Export Subsidies in a Small Home Country**

We begin our analysis of agricultural export subsidies with a small exporting country that takes the world price as fixed. Panel (a) of Figure 10-1 shows that at the world price of $P^w$, the quantity of sugar supplied by Home producers is $S_1$, whereas the quantity demanded is $D_1$. Given its excess supply, Home exports $X_1 = S_1 - D_1$ under free trade, which corresponds to point $B$ in panel (b).

**Impact of an Export Subsidy**

Now suppose the Home government decides to improve the sugar growers’ international competitiveness by allocating a subsidy of $s$ dollars per ton exported. The subsidy translates to a guaranteed price of $P^w + s$ per ton exported. Due to the opportunity to receive the higher price through exports, Home growers will only supply to the local market if the domestic price increases accordingly. Moreover, we assume that the government places an import tariff, which effectively eliminates any savings Home consumers could have earned from importing sugar at the lower world price, $P^w$.

With price higher at $P^w + s$, Home exports increase because the quantity demanded falls, whereas the quantity supplied rises (i.e., $X_1 > X_2 = S_2 - D_2$). In panel (b) the change in the amount of exports from points $B$ to $C$ relates to the movement along the export supply curve due to the increase in the Home price in panel (a). By contrast, the movement from points $B$ to $C'$ results from the downward shift of the export supply curve by the amount of the subsidy at the fixed world price of $P^w$.

**Summary** As a result of the export subsidy, the price domestic exporters receive, $P^w + s$, is different from what foreign importers pay, $P^w$.

**Impact of the Subsidy on Home Welfare** As a consequence of the subsidy, consumer surplus at Home decreases by the amount $(a + b)$ as shown in panel (a) whereas producers gain the additional surplus denoted by area $(a + b + c)$. The government spends $s$ dollars per unit exported, such that the cost of the subsidy is $s \cdot X_2$, represented by the area $(b + c + d)$. The overall impact of the subsidy on Home welfare can be summed up by the following:

<table>
<thead>
<tr>
<th>Effect</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall in consumer surplus</td>
<td>$-(a + b)$</td>
</tr>
<tr>
<td>Rise in producer surplus</td>
<td>$+(a + b + c)$</td>
</tr>
<tr>
<td>Fall in government revenue</td>
<td>$-(b + c + d)$</td>
</tr>
</tbody>
</table>

| Net effect on Home welfare                  | $-(b + d)$      |

Therefore, the subsidy creates a deadweight loss equal to the triangle $(b + d)$ for the small country similar to that of an import tariff.

3. **Agricultural Export Subsidies in a Large Home Country**

We will now turn to the case in which the Home country is a large supplier of sugar, capable of influencing the world price. Without any barriers to trade, $P^w$ is both the Home and world price so that the quantity exported by the
large country \((X_i = S_i - D_i)\) is equal to the amount imported by the Foreign country as illustrated in Figure 10-2.

**Effect of the Subsidy**

With the allocation of an export subsidy in the amount of \(s\) dollars per ton, the price received by the sugar growers increases, which leads to an increase in the quantity supplied. The additional output coupled with the decrease in the quantity demanded increases the amount available for exports as represented by the downward shift of the export supply curve in the amount of the subsidy, \(s\) in panel (b). The intersection of the new Home export supply, \(X - s\), with the Foreign import demand, \(M^*\), gives the new world price of \(P^*\) and export quantity \(X_2\).

Note that the postsubsidy world price, \(P^*\), is lower than the free-trade world price, \(P^w\). Defined as the ratio of export prices to import prices, the decrease in the world price means that the large Home country suffers a **terms-of-trade** loss due to the overproduction motivated by the export subsidy. Alternatively, the Foreign country experiences a terms-of-trade gain since it now faces a lower import price of sugar.

**Home Welfare** We can analyze the effect of the export subsidy on Home welfare using the representative areas pictured in panel (a). Similar to the small-country situation, the loss in consumer surplus due to the increase in the Home price from \(P^w\) to \(P^* + s\) is the area \((a + b)\). Once again the increase in producer surplus is given by the amount \((a + b + c\). However, in contrast to the small-country case, the cost of the subsidy to the government not only includes the area \((b + c + d)\) but also the rectangle \(e\) (i.e., \(s \cdot X_2\) equals area \((b + c + d + e)\). Thus, the net impact of the subsidy is as follows:

- Fall in consumer surplus: \(- (a + b)\)
- Rise in producer surplus: \((a + b + c)\)
- Revenue cost of subsidy: \(- (b + c + d + e)\)

**Net effect on Home welfare:** \(- (b + d + e)\)

Therefore, relative to a small country, an export subsidy has a greater negative effect on a large exporter. Aside from the deadweight loss denoted by the triangle \((b + d)\), the additional supply encouraged by the subsidy depresses the world price so that the large country has a terms-of-trade loss, which is denoted by area \(e\) in panel (a). More specifically, the large country loses \(P^w\) minus \(P^*\) dollars on each unit exported.

**Foreign and World Welfare** Overall world welfare decreases due to the export subsidy because the losses of the Home country \((b + d + e)\) are not offset by the gains of the Foreign country \((e')\). The world deadweight loss measured by the area \((b + d + f)\) is shown in panel (b).

**APPLICATION**

**Who Gains and Who Loses?**

We can predict the winners and losers when the export and indirect subsidies are eliminated by 2013.
Gains With the removal of the export subsidies by industrialized countries including Europe and the United States, the world agricultural prices should increase to their free-trade levels to the benefit of exporters in developing countries like Brazil, Argentina, Indonesia, and Thailand. Additionally, the deadweight and terms-of-trade losses would be reversed for the industrial countries with the abolishment of the export subsidies and import tariffs in agriculture.

Losses By contrast, the higher agricultural prices would hurt food-importing countries, many of whom are poor nations. Empirical studies show that the current system of agricultural supports lifts the per-capita income of over 50 of the 77 developing nations. In addition, farmers in the United States and Europe would lose their competitive edge in the international markets and would be worse off with the abolishment of the subsidies.

Food Aid Unlike the elimination of export subsidies, the removal of indirect subsidies such as food aid would help developing countries. Championed by European countries, which substitute food aid for cash, the understanding is that when the United States sends food to regions not in need, the excess surplus drives down the local prices, harming the regional producers. Similar results occur when used clothing is donated to some African nations.

**Headlines**

**G8 Shifts Focus from Food Aid to Farming**
This article describes a new “food security initiative” announced by the G8 countries, which commits more than $12 billion for agriculture development. This announcement marks a change in Washington's approach to fighting hunger. For decades the focus had been on food aid, while this new program aims to combat the root cause of hunger and the lack of domestic production. This move, stressing sustainability, could harm U.S. farmers. The United States currently supplies nearly $2 billion in food aid (mostly grown in the United States) each year.

**Headlines**

**Hunger and Food Security Back on Political Agenda**
This article expresses skepticism about the promises announced by the G8 discussed in the previous Headlines. The author discusses the poor record in making good on promises by the G8 and other groups and asks if the promised $12 billion will be new funds or simply a repackaging of previously promised, and yet delivered, funds. The author applauds the sentiment but reminds us that it has been over thirty-five years since Henry Kissinger pledged at the first such summit that “within ten years, no child will go to bed hungry.”

**4 Agricultural Production Subsidies**
The Hong Kong meeting of the WTO focused primarily on export subsidies in agriculture because these government supports have a greater impact on the world markets than other forms of domestic assistance, such as a production subsidy. The impact of a production subsidy is less severe because the government offers a dollar amount of $s for each unit produced regardless of whether the final consumers are domestic or foreign. Alternatively, it could
guarantee a minimum price to growers by substituting for any difference between the target and market rates. As in the U.S. cotton industry, the government could also subsidize crop users to stimulate demand.

**Effect of a Production Subsidy in a Small Home Country** To understand the less harmful effect of production subsidies as compared with direct export subsidies, we will examine the effect of the former, beginning with a small-country. As illustrated in panel (a) of Figure 10-4 at the fixed world price of $P^W$, the Home country will export the excess surplus given by $X_1 = (S_1 - D_1)$. With the production subsidy, $s$, Home producers are guaranteed a price of $P^W + s$ for each unit of output. Therefore, they will increase the quantity supplied from $S_1$ to $S_2$. However, domestic prices and quantity demanded remain unchanged because Home producers will receive the additional payment per unit from the government regardless of the residence of the consumers.

**Home Welfare** Adding up the impact of the production subsidy on consumers, producers, and the government gives us the overall effect on Home’s welfare. It is clear that consumer surplus is unaffected because the price paid by domestic consumers and the quantity purchased are the same. The gain in surplus for the producers from the rise in price received is equal to the amount $(a + b)$. The cost to the government is the area $(a + b + c)$, which is calculated by multiplying the subsidy $s$ with Home production, $S_2$. Thus the net effect of the production subsidy is:

| Change in consumer surplus: none |
| Rise in producer surplus: $(a + b)$ |
| Revenue cost of subsidy: $-(a + b + c)$ |
| **Net effect on Home welfare:** $-c$ |

The deadweight loss of the production subsidy is smaller relative to the export subsidy because domestic consumption is unaffected. The remaining negative effect denoted by area $c$ is due to production inefficiency. Through the production subsidy, the small Home country experiences a smaller deadweight loss and achieves its goal of promoting exports.

**Targeting Principle** The use of the production subsidy is an example of the targeting principle stated as follows:

**Targeting principle:** To achieve some objective, it is best to use the policy instrument that achieves the objective most directly.

**Effect of the Production Subsidy in a Large Home Country** We will now extend our analysis of the production subsidy to the case of a large Home country. Continuing with Figure 10-4, we see that the subsidy $s$ leads to an increase in Home production from $S_1$ to $S_2$ as in the small-country case. With demand unchanged, the additional surplus is exported, which shifts the export supply curve from $X$ to $X'$ in panel (b). Contrary to an export subsidy, the production subsidy causes a smaller increase in export supply. The reason is that when producers increase the quantity supplied in response to the rise in price, consumer demand is unaffected. Although not illustrated, the slight increase in export supply would drive the world price down but by less than that of an export subsidy. It follows that a production subsidy has a
smaller net negative effect on Home, Foreign, and the world welfare compared with direct export subsidies.

**Summary** As such, production subsidy is of less concern to the WTO than other forms of domestic agricultural support.

## 5 High-Technology Export Subsidies

The previous sections show that although production subsidy has a less harmful effect on Home welfare than an export subsidy, both forms of government assistance generate deadweight loss in the domestic economy. Despite their negative impact on Home welfare, agricultural subsidies are widely used, in part because of the political clout of the domestic farmers. By contrast, governments offer subsidies to high-tech industries because there is a potential for positive externality to spill over from this sector to the rest of the economy.

Although there are many examples of subsidies for high-tech products, we will focus on government support of the aircraft industries in the United States and Europe. To support Boeing, the U.S. government offers low-interest loans to buyers of the American-made aircraft. Likewise, to assist Airbus, government programs in Europe include the funding of research and development.

### “Strategic” Use of High-Tech Export Subsidies

Although spillover is a strong motive for governments to support high-tech industries with export subsidies, another is to provide their domestic firm with a strategic advantage in the international market. This latter argument is particularly compelling when the playing field consists of few rivals competing under imperfect competition, as is the case for the aircraft industry. Through strategic export subsidies, the Home government could increase the profits of its domestic producer by altering the interaction between the international competitors.

**Payoff Matrix** We will use the concept of game theory to predict the outcome as well as the impact of strategic export subsidies on the behavior of the duopoly, Airbus and Boeing, when either the European or U.S. government or both provide their respective producers with financial support. Suppose Airbus and Boeing must make the decision on whether to produce aircrafts for the Chinese market. The payoff matrix under free trade is given below, where the profit earned by Boeing (Airbus) is presented in the bottom left (top right) triangle of each quadrant. For example, if Boeing produces and Airbus does not, the former earns a profit of $75 million whereas the latter earns nothing.
**Nash Equilibrium** The outcome of the game is obtained when each firm makes the best possible decision given the action of its rival. The strategies corresponding to the best response for both players is the *Nash equilibrium*.

**Best Strategy for Boeing** To determine the equilibrium outcome, we will begin by determining Boeing’s best response given every possible action that Airbus could take. Focusing on the left column, where Airbus chooses to produce, Boeing must decide between producing and receiving a negative profit of $10 million, given by the upper-left quadrant, or not producing and having no profits, as presented in the lower-left quadrant. Thus, Boeing is better off by not producing when Airbus produces. The column on the right refers to the case in which Airbus does not produce. If Boeing produces and Airbus does not, it earns a profit of $75 million. If Boeing also refrains from producing, its earnings are zero. Given these two choices, Boeing will produce. Boeing’s best response for each possible action Airbus could take is indicated by the circles in the following reproduction of the payoff matrix.

![Payoff Matrix](image)

**Best Strategy for Airbus** The best response for Airbus is obvious given that the payoffs are symmetric for the two firms, but we will proceed in steps similar to those for Boeing for a better understanding. Starting with the upper row where Boeing produces, Airbus would do better by refraining from producing and receiving no profit than to produce and lose $10 million. At the lower row, corresponding to Boeing’s strategy not to produce, Airbus would earn $75 million by producing, which is preferable to zero profit from not producing. Airbus’ best responses are also denoted by circles in the previous figure.

**Multiple Equilibria** The quadrants with the two circles (i.e., the upper-right and bottom-left quadrants) give each firm’s best response contingent on all possible strategies taken by its rival. Therefore, the Nash equilibriums are for Boeing to produce and Airbus not to produce as well as for Boeing not to produce when Airbus produces. To understand the motivation for the use of export subsidies by the European government, we will make the realistic assumption that Boeing has the *first-mover advantage*. Namely, by deciding to produce before Airbus, Boeing will earn profits of $75 million because its competitor would prefer not to produce rather than lose $10 million. However, by supporting Airbus through an export subsidy such as cash payments,
the government in Europe could affect the Nash equilibrium by altering the payoff Airbus receives.

**HEADLINES**

**Airbus, China and Quid Pro Quo**

With only a third of the Chinese market, Airbus is aiming to break Boeing’s dominance in supplying airplanes to China. The European aircraft producer has strategically negotiated plans to manufacture its A320 passenger plane in the growing Asian country in an effort to increase Chinese demand. Although Boeing has no plans to develop a direct presence in China, the American producer is not completely losing orders to Airbus, partly because some of its engines are from General Electric, which has many Chinese partnerships.

**Effect of a Subsidy to Airbus**

We know that without a first-mover advantage, Airbus will choose not to produce. To improve the aircraft producer’s competitive advantage, suppose the European governments provide Airbus with a subsidy of $25 million. This means that when Airbus produces, its profits will increase by $25 million regardless of Boeing’s action. The new payoff matrix, similar to Figure 10-6, is presented below.

![Payoff Matrix](image)

**Best Strategy for Airbus** To uncover the outcome of this new game, we will need to determine each firm’s best strategy. For Airbus, we see that it will now produce even if Boeing produces because it will receive the profit of $15 million compared with nothing if it does not produce. Moreover, Airbus will definitely produce if Boeing does not produce because a profit of $100 million is preferable to zero profit. Thus, the subsidy alters Airbus’ strategy such that it will always choose to produce, regardless of Boeing’s action.

**Best Strategy for Boeing** Note that the payoff for Boeing is the same as the original game because we are assuming that only Airbus receives the subsidy. Therefore, Boeing’s best response is identical to that before the subsidy to Airbus. Namely, Boeing will not produce if Airbus produces, and it will produce if Airbus does not produce.

**Nash Equilibrium** The new Nash equilibrium is given by the bottom-left quadrant, where Boeing does not produce while Airbus produces. It follows
that the subsidy helped the governments of Europe in shifting the equilibrium so that Airbus is now the only producer rather than Boeing.

**European Welfare** In calculating the impact of the subsidy on European welfare, we can disregard the effect on domestic consumers because the airplanes are produced for China. The gain in producer surplus for Airbus is $100 million because it will produce with the assistance of the subsidy. The cost of the subsidy to the European governments is $25 million. Summing up, we have that the net effect of the subsidy is:

\[
\begin{align*}
\text{Gain in producer profits:} & \quad +100 \\
\text{Cost of export subsidy:} & \quad -25 \\
\hline
\text{Net gain in European welfare:} & \quad +75
\end{align*}
\]

In this case, the subsidy led to an overall increase in European welfare because the gain in profits for Airbus from producing outweighs the cost.

**Subsidy with Cost Advantage for Boeing**

In the original game there were two Nash equilibriums. By assuming that Boeing has a first-mover advantage over Airbus, we settled on the outcome that Boeing would produce while Airbus abstains from entering the market. Then with the subsidy, we get the result that not only will Airbus produce but their production raises the welfare in Europe. We will now assume that Boeing has a comparative advantage over Airbus in producing planes, then examine the net welfare effect on Europe when the European producer receives a subsidy.

The payoff matrix reflecting Boeing’s cost advantage is shown below, where the American producer earns a profit of $10 million if both firms produce and a profit of $100 if Airbus stays out of the market. Similar to the original game, the best strategy for Airbus is to produce if Boeing does not but refrain from producing if Boeing does. Given the assumptions of this game, we obtain a unique Nash equilibrium in which Boeing produces while Airbus does not produce.
Once again, we assume that the governments in Europe provide Airbus with a subsidy of $25 million to help the aircraft producer to compete against Boeing. Adding the subsidy to Airbus’ payoff while maintaining Boeing’s cost advantage gives the following matrix.

**Best Strategy for Airbus** With the subsidy, Airbus will now produce to earn the $15 million in profits rather than receiving zero from staying out of the market.

**Best Strategy for Boeing** With its cost advantage, Boeing can make a positive profit from producing versus zero if it does not participate in the market. Therefore, similar to the case before the subsidy, Boeing will always choose to produce. By contrast, however, Airbus will also choose to produce because it will receive profits of $15 million with the subsidy when it produces and an alternative of zero profit if it does not produce. The Nash equilibrium with the subsidy to Airbus and Boeing’s cost advantage is for both firms to produce.

**European Welfare Once Again** By summing the effect of the subsidy on Airbus and the European governments, we can determine the welfare implication of the assistance. Airbus earns profits of $15 million from producing, which is an increase compared with its presubsidy decision not to produce and earn zero in profits. Given that the cost of the subsidy is $25 million, the overall effect on the European economy is $-10 million as shown by the following:

\[
\begin{align*}
\text{Gain in producer profits:} & \quad +15 \\
\text{Revenue cost of subsidy:} & \quad -25 \\
\text{Net gain in European welfare:} & \quad -10
\end{align*}
\]

**Summary** The net negative effect follows because although the subsidy succeeded in allowing Airbus to enter the market, the profits earned by the European producer were not large enough to cover the cost of the assistance. More specifically, the gains to Airbus were not enough to offset the cost of the subsidy because Boeing did not exit the market compared with the case in which the American producer did not have a cost advantage.
APPLICATION

Subsidies to Commercial Aircraft

Boeing and Airbus have been receiving various types of subsidies from the United States and Europe, respectively, for many years. In the United States, the government supports include research and development (R&D) for military aircrafts that were later used in the development of the civilian versions. The assistance provided by the European government was directly used to fund R&D for new aircrafts. Both governments also indirectly helped their domestic producers by offering low-interest loans to aircraft purchasers.

1992 Agreement In recognition of the costly nature of these strategic behaviors, the United States and European governments reached an agreement in 1992 to limit the use of subsidies. As shown in Table 10-2, the provisions of the agreement include limiting direct subsidies to 33% of R&D expenditure for a new aircraft and indirect subsidies to less than 5% of annual sales. They agreed to eliminate production subsidies and restrict the use of low-interest loans. This agreement came into jeopardy with the development of a new wide-body aircraft by Airbus called the A380, when the European governments (France, Germany, The Netherlands, Belgium, Spain, Finland, and the United Kingdom) provided low-interest loans that covered more than 33% of the expected development costs. In 2005, the United States and the European Union both filed claims with the WTO accusing the other of “illegally” subsidizing their respective aircraft producer.

The Superjumbo By exceeding the limit set by the 1992 agreement, the European governments risked retaliation by the United States. However, their strategic behavior may have been worthwhile since Airbus is now the only producer of the new double-decker aircraft.

HEADLINES

W.T.O. Says Aid to Airbus for A380 Was Illegal

A report by the World Trade Organization determined that Airbus received nearly $13 billion in illegal subsides in developing the A380 superjumbo jet. The report also found that the EU did not “systematically abuse global trade rules” which was enough for both the United States and EU officials to claim victory. The ruling may require Airbus to repay its loans on commercial terms or restructure them. The EU has filed a countersuit accusing Boeing of receiving illegal financing in the form of U.S. military contracts.

National Welfare In particular, if the profits earned by Airbus from the A380 outweigh the cost of the subsidy, European welfare will rise. As of January 2010, Airbus has delivered only 25 of the 202 aircrafts ordered. It is believed that Airbus needs to sell 250 jets to cover its development costs, and it continues to experience delays in delivery.

Boeing is also having difficulties in the production of the 787 Dreamliner, which was originally scheduled for delivery in 2008 but only completed its first unit in December of 2009. Additionally, Boeing will be competing directly with Airbus with the A350 wide-body jet.
HEADLINES

Dreamliner Production Gets Closer Monitoring

This article chronicles the problems that Boeing faces in getting their 787 Dreamliner back on track after six years of work. The problems with the Dreamliner have stemmed from the aggressive outsourcing of its manufacturing process. Boeing gave unprecedented control to independent suppliers and has experienced serious problems in quality of components. Boeing’s problems have been compounded because it reduced its own engineering staff and is now stretched too thin to address its many problems.

6 Conclusions

Many countries use export subsidies to boost the competitiveness of their domestic producers in the international market. Among the goals of the WTO meeting in Hong Kong was the elimination of the use of agricultural export subsidies, particularly by industrialized countries. On a global scale, the flood of excess supply due to the export subsidy depresses world crop prices, which harms food exporters in developing countries. Domestically, the export subsidies raise the income of farmers at the expense of consumers. For a small country, the deadweight loss of an export subsidy is similar to that of a tariff. By contrast, the welfare implication of an export subsidy is different from a tariff for a large country. More specifically, although the large country may experience a terms-of-trade gain through an import tariff, it would have a terms-of-trade loss under an export subsidy. Furthermore, compared with an export subsidy, the losses due to a production subsidy are less severe. The reason is that production subsidies have a smaller impact on world prices because domestic consumption remains unchanged when additional payments are made for each unit of output regardless of the residence of the consumer. In the high-tech industry, where few firms compete under imperfect competition, the use of export subsidies may increase a country’s welfare.

TEACHING TIPS

Tip 1: Nash Equilibrium

Students who have not taken a course in game theory may have difficulty with the concept of a Nash equilibrium. If this is the case in your class, it may be helpful to spend extra time reviewing this important concept before covering Chapter 10.

Tip 2: Agricultural Subsidies and the Doha Round

Agricultural subsidies can be quite complex in terms of who they may benefit or harm. This fact is well demonstrated by the current state of the Doha Round, and more specifically the failure of the 2008 Geneva meeting. Have students find articles about the breakdown of the Geneva meeting and have a class discussion about its causes.
Tip 3: High-Technology Export Subsidies
Chapter 10 tackles the subject of strategic trade using the example of Europe and the United States subsidizing Airbus and Boeing. To help students become more familiar with the topic, it may be helpful to ask them to look for other examples of high-tech export subsidies. Then ask the students to construct their own payoff matrices.

IN-CLASS PROBLEMS

1. What are export subsidies? Why do countries use them? Provide examples of such support programs.

   Answer: An export subsidy is a payment given by the government to firms for every unit exported. By subsidizing the firm, the government encourages the domestic firm to produce more in a particular industry. Examples include the sale of discounted milk to Canadian processors under the Commercial Export Milk (CEM) program to assist the dairy industry. Another is the payment of 50 euros per ton of harvested sugar beets to European farmers by the Common Agricultural Policy (CAP). Cotton farmers in the United States are paid for the production of cotton and benefit indirectly through subsidies given to agribusiness and manufacturers buying the American cotton.

2. Suppose Boeing and Airbus are deciding whether to invest in R&D to improve the quality of their medium-capacity planes. Given the following payoff matrix in millions of dollars, what is the Nash equilibrium of the game?

   \[
   \begin{array}{c|cc}
   & \text{Invest} & \text{Not Invest} \\
   \hline
   \text{Invest} & 70 & 125 \\
   \text{Not Invest} & 90 & 100 \\
   \end{array}
   \]

   Answer: The two Nash equilibriums are Boeing does not invest while Airbus invests and Boeing invests while Airbus does not invest.

3. Refer to problem 2. Suppose the governments of Europe seek to expand Airbus’ international market share by providing the European aircraft producer with a subsidy of $40 million for R&D.

   a. Redraw the payoff matrix and find the Nash equilibrium.

   Answer: With the $40 million subsidy for R&D, the dominant strategy for Airbus is to invest. Now there is only one Nash equilibrium, in which Boeing will not invest while Airbus invests. The payoffs are $90 million for Boeing and $140 for Airbus.

   \[
   \begin{array}{c|cc}
   & \text{Invest} & \text{Not Invest} \\
   \hline
   \text{Invest} & 70 & 125 \\
   \text{Not Invest} & 140 & 80 \\
   \end{array}
   \]

   b. Is the subsidy successful in increasing European welfare? Explain.

   Answer: After subtracting the $40 million in subsidy from Airbus’ profit we see that the net gain in European welfare is zero. Therefore, the subsidy did not increase European welfare.

4. Refer to problems 2 and 3. Suppose the United States government decides to support Boeing with a matching subsidy.

   a. Redraw the payoff matrix and find the Nash equilibrium.

   Answer: The new Nash equilibrium is for both aircraft manufacturers to invest in R&D so that the payoffs are $110 million for Boeing and $100 for Airbus.
b. How do these subsidies affect welfare in the United States and Europe?

**Answer:** The net effect of the R&D subsidies on the United States and Europe can be summarized as follows:

<table>
<thead>
<tr>
<th>European Welfare</th>
<th>United States Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain in producer profits: +100</td>
<td>Gain in producer profits: +110</td>
</tr>
<tr>
<td>Revenue cost of subsidy: −40</td>
<td>Revenue cost of subsidy: −40</td>
</tr>
<tr>
<td>Net gain in European welfare: 60</td>
<td>Net gain in United States welfare: 70</td>
</tr>
</tbody>
</table>

Although the net gain in welfare is positive for the United States and Europe, both would be better off without the R&D subsidies because the Nash equilibriums in problem 2 give higher payoffs than the case in which Boeing and Airbus receive the export subsidy.

5. Tradia is a small export country. Suppose initially that the world price is $150. Due to successful lobbying activities, Tradia producers will now receive a subsidy of $25 per unit exported. Use the following figure to answer the following questions.

a. Do you expect Tradia to export more with the subsidy? If so, by how much?

**Answer:** The producers will export more because they are guaranteed to receive a payment of $25 for each unit they export. From the previous figure, they will supply 150 units at the price of $175 = (P^W + s). At the higher price, quantity demanded is 30 units, so the amount exported equals 120 units ($X = S - D$).

b. What is the change in consumer surplus due to the subsidy?

**Answer:** The loss in consumer surplus is equal to areas $a + b$.

\[
\text{Area } a = 30 \times (175 - 150) = 750
\]

\[
\text{Area } b = \frac{1}{2} \times (60 - 30) \times (175 - 150) = 375
\]

Loss in consumer surplus: −1125

c. What is the gain/loss in producer surplus with the subsidy?

**Answer:** The gain in producer surplus is equal to areas $a + b + c$.

\[
\text{Area } a + b + c = 120 \times (175 - 150) + \frac{1}{2} \times (150 - 120) \times (175 - 150) = 3375
\]

Gain in producer surplus: +3375

d. How does the subsidy affect welfare in Tradia?

**Answer:** The net effect on welfare can be summarized by the following:

| Loss in consumer surplus: −1125 |
| Rise in producer surplus: +3375 |
| Revenue cost of subsidy: −3000 |

**Net effect on Tradia welfare: −750**

6. Islandia is a small exporting country with supply and demand given by the following equations:

\[
D = 100 - 5P
\]

\[
S = 10P - 50
\]

Suppose the free-trade world price is $12 per unit.

a. In the absence to any barriers to trade, what is the domestic consumption and production? How much is exported?

**Answer:** The amount exported is 30 units.
Chapter 10 ■ Export Subsidies in Agriculture and High-Technology Industries

\[ D = 100 - 5P \quad S = 10P - 50 \]
\[ = 100 - 5(12) \quad = 10(12) - 50 \]
\[ = 100 - 60 \quad = 120 - 50 \]
\[ D = 40 \quad S = 70 \]

b. Suppose the Islandia government offers the island producers an export subsidy of $3 per unit. In addition, the government imposes a tariff of $3 per unit on imports. Calculate the price paid and quantity demanded by island consumers.

**Answer:** \( P^W + s = 12 + 3 = 15 \)

\[ D = 100 - 5P \]
\[ = 100 - 5(15) \]
\[ = 100 - 75 \]
\[ D = 25 \]

c. Calculate the net effect of the export subsidy on Islandia welfare.

**Answer:**

\[ \text{Area } a = 25 \cdot (15 - 12) = 75 \]
\[ \text{Area } b = \frac{1}{2} \cdot (40 - 25) \cdot (15 - 12) = 22.5 \]
Loss in consumer surplus: \(-97.5\)
\[ \text{Area } a + b + c = 70 \cdot (15 - 12) + \frac{1}{2} \cdot (100 - 70) \cdot (15 - 12) = 255 \]
Gain in producer surplus: \(+255\)

Loss in consumer surplus: \(-97.5\)
Rise in producer surplus: \(+255\)
Revenue cost of subsidy: \(-225\)

**Net effect on Islandia welfare:** \(-67.5\)

7. It is more efficient for the government of a small country to impose an import tariff than a production subsidy to stimulate output because it does not have to pay the producers directly. Comment.

**Answer:** Unlike an import tariff, a production subsidy does not alter consumption because the price faced by the consumers remains unchanged. Therefore, a production subsidy is more efficient because it does not create a consumption loss. Similar to an import tariff, a production subsidy results in a production loss or efficiency loss for the economy.

8. Suppose the supply and demand for Continentia, a large country, is as follows:

\[ D = 900,000 - 150P \]
\[ S = 100,000 + 50P \]

Assume that the free-trade world price is $5,000 per unit. Further assume that the Continentia government offers an export subsidy that increases the domestic market price to $5,500 and lowers the world price to $4,500. However, starting next month, the Continentia government will be removing the export subsidy in compliance with the latest international trade pact.

a. What is the impact of the removal of the subsidy on domestic consumers?

**Answer:**
The quantity demanded by consumers increases from 75,000 to 150,000 with the removal of the export subsidy because the price faced by the domestic consumers decreases from $5,500 to the world price of $5,000. The net gain to consumers equals $56,250,000.
Demand without export subsidy:
\[ D = 900,000 - 150P \]
\[ = 900,000 - 150(5,000) \]
\[ D = 150,000 \]

Demand with export subsidy:
\[ D = 900,000 - 150P \]
\[ = 900,000 - 150(5,500) \]
\[ D = 75,000 \]

b. What is the change in producer surplus due to the movement to free trade?

Answer: The quantity supplied by producers decreases from 375,000 to 350,000 because they receive a lower price without the export subsidy. The net loss to producers equals $181,250,000.

Supply without export subsidy:
\[ S = 10,000 + 50P \]
\[ = 100,000 + 50(5,000) \]
\[ S = 350,000 \]

Supply with export subsidy:
\[ S = 100,000 + 50P \]
\[ = 100,000 + 50(5,500) \]
\[ S = 375,000 \]

c. What is the net effect of moving to free trade on Continentia welfare?

Answer: The net effect on Continentia from the removal of the export subsidy is positive. Given that Continentia is a large country, the export subsidy resulted in lowering the world price due to the increase in the amount exported. The net effect is summarized by the following:

Gain in consumer surplus: $56,250,000
Loss in producer surplus: $181,250,000
Revenue cost of subsidy: $300,000,000

Net effect on Continentia welfare: +$175,000,000

d. Would Continentia consumers support or oppose the policy for free trade? What about producers? Explain.

Answer: Consumers would support the removal of the export subsidy because they would be better off with the lower domestic price, whereas producers would oppose it because they are worse off by receiving less per unit.

9. Consider a small exporting country. Compare the cost to the government and the net effect on welfare between an export and production subsidy in the amount of \( s \) per unit.

\[ D \quad S \]
\[ PV+S \]
\[ PW \]
\[ b \quad c \quad d \]

Answer: With an export subsidy, the loss in consumer surplus is equal to the areas \( a + b \) because the price in the domestic market increases to \( PV_s \), leading the quantity demanded to drop to \( D_1 \) from \( D_0 \). The gain to the producers is equal to areas \( a + b + c \), whereas the cost to the government from the export subsidy is given by areas \( b + c + d \). The net effect of the export subsidy is the sum of the losses to the consumers and government minus the producers’ gain. Namely, the small country experiences a loss equal to areas \( b + d \) with an export subsidy. By contrast, a production subsidy would not raise the domestic price, so there are no changes to the consumer welfare. The gain to the producer with the production subsidy is the same as the export subsidy (i.e., areas \( a + b + c \)). The payment of the production subsidy is equal to areas \( a + b + c + d \). Thus, the net effect of the production subsidy is the loss denoted by area \( d \). Although the cost of the production subsidy to government is larger relative to an export subsidy, the net effect of the former is smaller on the country because consumption is unaltered, unlike that with the latter.
10. Suppose Home is a small country trading with a large exporter. The supply and demand curve for Home is illustrated by the following figure, where \( P^W \) denotes the free-trade world price. Assume that the Foreign government supports its producer with an export subsidy that lowers the world price to \( P^* \).

Should Home consider levying a countervailing duty that would raise the import price back to \( P^W \) (i.e., the level without the subsidy)? Answer by ranking the following situations. Be sure to justify your ranking.

1. Home without the Foreign export subsidy.
2. Home with the Foreign export subsidy.
3. Home with the Foreign export subsidy and the countervailing duty.

**Answer:** If Home levies a countervailing duty that raises the import price back to \( P^W \), producers would experience a gain equal to area \( a \), whereas the loss to consumers is given by areas \( a + b + c + d \). The government receives area \( c \) in tariff revenue with the countervailing duty. Therefore, the ranking is as follows from best to worst in terms of Home's welfare: (2) > (3) > (1).

11. Recall that WTO guidelines allow an importing country to impose a countervailing duty to raise the price of the imported good in response to illegal government support such as an export subsidy on the part of the exporting country. Go to the WTO Web site given by the link, http://www.wto.org/english/tratop_e/scm_e/scm_e.htm, to determine which five sectors were the subject of the largest number of claims with the WTO in 1995 to 2005.

**Answer:**

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International Agreements: Trade, Labor, and the Environment

Notes to Instructor

Chapter Summary
This chapter shows that without international agreements, countries have a strong incentive to choose policies that could result in the prisoner’s dilemma. Namely, a country would impose tariffs to benefit its own welfare. When all countries act in the same manner, world welfare decreases due to the deadweight loss created from the trade restrictions. To avoid this outcome, multilateral agreements such as the World Trade Organization (WTO) promote free trade by requiring members to reduce tariffs. This chapter also presents the difference between regional trade agreements such as free-trade areas and customs unions. The discussion on regional trade agreements details the impact on welfare when international pacts lead to either trade creation or trade diversion.

Also discussed in this chapter are international agreements on labor and the environment. Global agreements on labor are controversial because they require judgment and comparison of labor standards across countries. Pressures from consumers and unions are changing the behaviors of firms to take on corporate responsibility in the manufacture of products under their logos. International agreements on the environment help to avoid outcomes such as the tragedy of the commons in which exhaustible resources like fish are overharvested due to the lack of clearly defined property rights for the common property. In addition, the treaties also set guidelines for pollution emission. Without the international agreements, a country may fail to regulate its pol-
olution emission when the pollutant is not local. More specifically, if the pollutant is global, a country may choose not to regulate since it endures only part of the harmful effect of its pollution. When all countries behave collectively, world welfare decreases with the increased pollution.

Comments
This chapter presents topics that allow for class discussions. Although the benefits of multilateral agreements over regional trade agreements are clear, students may be divided over international agreements pertaining to labor and the environment. Encourage students to voice their opinions, especially whether they would pay more for a product to ensure good labor standards. Issues relating to the environment are particularly interesting because the chapter presents examples that show how free trade can harm the available natural resources. In NET WORK, students are asked to find examples of corporate responsibility. A good example is the deal between McDonald’s and Greenpeace to protect the Amazon rainforest by having the fast-food giant agree to stop selling chicken fed on soya grown in deforested areas.

Lecture Notes

Introduction
In 1999, environmental and political interest groups gathered in Seattle, Washington, to protest the meeting of the WTO. The activists voiced their discontent with the making of WTO rulings that would affect U.S. regulations. In addition to direct guidelines governing the reduction of tariffs, the WTO also discussed other issues that have an indirect affect on trade. One such issue is the formation of a panel in which countries excluded from a foreign market due to unreasonable environmental standards could bring a dispute before the WTO.

Through the WTO, countries can avoid losses by agreeing to reduce tariffs and move toward free trade. Aside from the international agreements to cut import taxes, countries also form pacts on issues relating to labor and the environment. These agreements aim to protect the rights of workers as well as the environment from overharvesting of exhaustible resources and emissions of pollutants.

1 International Trade Agreements
A trade agreement is a pact between two or more countries to reduce or eliminate trade restrictions. The WTO is an example of a multilateral trade agreement. Under the most-favored-nation (MFN) principle of the WTO, countries agree to extend the tariff set for their MFN to all members. Therefore, to benefit from the lower tariffs via membership, countries must also reciprocate by agreeing to lower their own trade barriers.

The trade agreements can be at the global or multilateral level, such as the WTO, or at the regional level, such as the North American Free Trade Agree-
ment (NAFTA) between the United States, Canada, and Mexico. Countries can also engage in bilateral agreements. The United States has many, including separate pacts with Australia, Jordan, Morocco, and Peru, and new agreements are planned with South Korea, Panama, and Colombia. Some South American countries are joined by the Mercosur (Argentina, Brazil, Paraguay, Uruguay, and Venezuela). Formed in 1989, the Asia-Pacific economies have an agreement known as the Asia-Pacific Economic Cooperation or APEC (Australia, Brunei, Canada, Chile, China, Hong Kong, Indonesia, Japan, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, South Korea, Taiwan, Thailand, United States, and Vietnam). There are many free-trade agreements between countries, numbering over 200.

The Logic of Multilateral Trade Agreements

We will briefly review the effects of a tariff imposed by a large country under perfect competition before analyzing the impact of trade agreements.

Tariffs for a Large Country Recall that a large importer may benefit by imposing a tariff if the terms-of-trade gain is greater than the deadweight loss (i.e., $e > (b + d)$ in panel [a] of Figure 11-1, which is a reproduction of Figure 8-7). By contrast, the exporting country is worse off due to a combination of the deadweight and terms-of-trade loss denoted by area $(e + f)$ in panel (b).

Payoff Matrix We will now assume that both Home and Foreign are large countries and examine the change in welfare when both decide whether or not to impose a tariff on the other. The payoff matrix is shown in Figure 11-2, where the lower-left corner of each quadrant gives Home’s payoff and the upper-left corner denotes Foreign’s payoff.

Free Trade Starting with the upper-left quadrant where neither country imposes a tariff, the change in welfare is zero as compared with free trade. In other words, there is neither any harm nor gain from a tariff because an import tax is not imposed.

Tariffs However, if Home imposes a tariff and Foreign does not, then the former potentially gains relative to free trade as long as $e - (b + d) > 0$, whereas the latter loses by the amount $-(e + f)$. By symmetry, the results are opposite if Foreign imposes the tariff rather than Home. When both countries impose optimal tariffs, we are at the lower-right quadrant. In this case, their terms-of-trade gain is cancelled by their terms-of-trade loss. In addition to the deadweight loss generated from their own tariff, they acquire an extra deadweight loss from the tariff imposed by their rival such that their total losses equal $-(b + d + f)$.

Prisoner’s Dilemma The payoffs described in Figure 11-2 have a special structure called the prisoner’s dilemma. It takes this name from the story of two accomplices caught for a crime they committed, where each must decide to confess or remain silent in solidarity with their partner in crime. The payoffs for their actions mirror that of 11-2, but they decide to confess, leading to a worse outcome for both than if they had remained silent.
**Nash Equilibrium** Working out the solution of the game, we find that both countries will impose a tariff even though they are clearly better off when neither impose the trade restriction. Given their payoffs, each country does not have an incentive to individually move toward free trade because $c > (b + d)$. By acting on its own, a country is worse off by removing its import tax because the loss from not imposing a tariff when its rival does $(e + f)$ is greater than the loss $(b + d + f)$. This result is often referred to as the prisoner’s dilemma. Namely, the Nash equilibrium of both countries imposing their optimal tariff is an undesirable outcome for all parties. However, the outcome is the best strategy for each country given that its rival will impose a tariff. Such undesirable outcomes can be avoided by having countries enter into trade agreements.

**Trade Agreement** By entering into a trade agreement such as the WTO, the prisoner’s dilemma outcome is eliminated because all members agree to reduce or avoid imposing tariffs on one another.

**Regional Trade Agreements**
When countries within a region make a pact to eliminate tariffs, these arrangements are referred to as regional trade agreements (RTAs). Under such agreements, member countries reduce trade barriers on one another but may maintain separate tariffs against nonmember countries. RTAs are permitted under Article XIV of the General Agreement on Trade and Tariffs (GATT) as long as member countries do not jointly increase their tariffs against outside members. These agreements are sometimes called preferential trade agreements (PTAs) because member countries are favored over nonmember, hence violating the most-favored nation (MFN) principles of the GATT.

**Free-trade Area** A free-trade area (FTA) consists of a group of countries that agree to eliminate tariffs among themselves while maintaining their separate tariffs on nonmembers. An example of an FTA is the Canada–U.S. Free Trade Agreement formed between the United States and Canada in 1989. This FTA was extended to the North American Free Trade Agreement (NAFTA) with Mexico’s membership in 1994.

**Customs Union** In addition to agreeing to eliminate tariffs, a customs union has the additional condition that member countries hold a common tariff against the rest of the world. The European Union is an example of a customs union consisting of Austria, Belgium, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

**Rules of Origin** Although a free-trade area allows each country the flexibility to impose different tariffs on the rest of the world, it creates an incentive for a nonmember country to take advantage of the duty-free zone by first exporting to the member with the lowest tariff. To counter this problem, NAFTA members trade areas establish rules of origin that require each product to contain enough “North American content” to qualify for duty-free access. In other words, a product originating from a nonmember country must go through further processing in a member country before it may be
traded within the free-trade area without being taxed. The content requirement is determined by value added or the use of some key inputs.

**Trade Creation and Trade Diversion**

When countries form a regional trade agreement that results in one country importing from another member rather than producing the product on its own, there are welfare gains analogous to the opening of trade. Countries outside the pact are unharmed by this trade creation because the good was previously not traded. By contrast, trade diversion has a negative impact on nonmember countries because the tariff reduction via the regional agreement leads one member to import from another instead of outside exporters. Although producers of the exporting member gain from this new pattern of trade, the importing country may be worse off by switching away from the lowest cost producers (i.e., nonmember exporters).

**HEADLINES**

**China-ASEAN Treaty Threatens Indian Exporters**

This article discusses how the new China-ASEAN free-trade agreement, which took effect January 1, 2010, could negatively impact India’s exporters as a result of trade diversion. India currently faces tariffs on exports to China, which will make it difficult to compete with duty-free goods from ASEAN countries. The new free-trade area, which involves eleven countries with a total population of nearly 1.9 billion people, will likely increase pressure on India to sign a similar agreement with ASEAN and China in the near future.

**Numerical Example of Trade Creation and Diversion**

The following numerical example shows the effect of the formation of the Central America–Dominican Republic–United States Free-Trade Agreement (CAFTA-DR) on members and nonmember countries. The hypothetical costs to the United States of importing jewelry from Honduras or China given by the table below are similar to Table 11-1 in the textbook. The three columns to the right show the total costs of the jewelry import with 0% tariff (free trade), a 15% tariff, and a 25% tariff, respectively. Without barriers to trade, the United States would import the product from the lowest cost producer, namely China, for $10 rather than purchasing from Honduras for $11 or producing the good domestically at a cost of $12. Prior to CAFTA-DR, a 15% tariff would increase the cost of importing from Honduras (China) to $12.65 ($11.5). Likewise, without CAFTA-DR, a 25% tariff would raise the import cost to $13.75 and $12.5 for Honduras and China, respectively. Under the trade agreement, jewelry from Honduras would be imported duty free so that the cost remains at $11 regardless of the size of the tariff levied on outside members.
Trade Creation

Beginning with a 25% tariff before the formation of CAFTA-DR, the United States would find it cheaper to produce the product domestically ($12.0) rather than importing jewelry from Honduras ($13.75) or China ($14.4). With the establishment of CAFTA-DR, jewelry imports from Honduras enter duty free and those from China are still subject to the 25% tariff. Therefore, the United States will import jewelry from Honduras at $11, which is less costly than producing the product domestically. This trade creation benefits the consumers in the United States via the lower price in addition to providing gains to producers in Honduras. Notice that China is unharmed from this newly created trade pattern because the United States did not import from the Asian country before CAFTA-DR.

Trade Diversion

With the tariff lower at 15%, the least costly option for the United States, before CAFTA-DR, is to import the product from China for $11.5 instead of Honduras for $12.65 or producing it locally at $12.0. However, after CAFTA-DR, the United States switches import partners because the cost of importing from China with the 15% tariff ($11.5) is higher than from Honduras duty free ($11.0). As a result of the trade diversion, producers in Honduras are better off but those in China are worse off. For the United States, before CAFTA-DR, it imported from China at a price of $10 and received $1.5 per unit from the 15% tariff for a total cost of $11.5. Due to CAFTA-DR, the United States imports jewelry from Honduras at a price of $11 with no additional tariff revenue. Therefore, because of the higher net-of-tariff price and lack of tariff revenue by importing from Honduras rather than China, the United States is actually worse off with the regional trade agreement.

Trade Diversion in a Graph

For the graphical analysis of trade diversion, Figure 11-3 is reproduced below, where Mexico is replaced by Honduras and China is substituted for Asia. To begin with, we assume that the United States is a small importer of jewelry as denoted by the horizontal free-trade price labeled $P_{China}$. With a tariff, the import price from China raises to $P_{China} + t$. Honduras’ export supply without and with a tariff are illustrated by the upward sloping curves marked $S_{Honduras}$ and $S_{Honduras} + t$, respectively.
Suppose a tariff in the amount of $t$ dollars is applied on all importers before CAFTA-DR. Then the United States imports $Q_1$ units of jewelry at a price of $P_{China} + t$ given by point $A$, where the quantity $Q_2$ is supplied by Honduras with the remaining amount arriving from China (i.e., $Q_1 - Q_2$). The tariff revenue collected from the $Q_1$ units of import is area $(a + b + c + d)$, of which the amount given by area $a$ is from Honduras.

After CAFTA-DR, imports from Honduras increase because the jewelry enters the United States duty free, unlike the jewelry from China. The quantity supplied by Honduras increases to $Q_3$ on its tariff-free supply curve, $S_{Honduras}$. With an upward-sloping supply curve, the additional outputs $(Q_3 - Q_2)$ are produced through raising marginal costs so that the price charged by Honduras is equivalent to that of China with the tariff (i.e., $P_{Honduras} = P_{China} + t$). Without the duty on Honduras, tariff revenue decreases by the amount $t \cdot Q_3$ or area $(a + b + c)$. The producers in Honduras realize a gain of $(a + b)$ from increasing the quantity imported to the United States at the $P_{China} + t$ but without having to pay the tariff. Summing the changes in welfare in the United States and Honduras, we get:

\[
\text{Loss in U.S. tariff revenue:} - (a + b + c) \\
\text{Gain in Honduras's producer surplus:} + (a + b) \\
\text{Combined effect due to CAFTA-DR:} \ - \epsilon
\]

**Interpretation of the Loss** Thus, the net effect of the regional trade agreement on the United States and Honduras is negative. In particular, the loss in tariff revenue to the United States outweighs the gain to Honduras from being able to import duty free to the latter. The net loss denoted by area $\epsilon$ results from diverting trade from a more efficient producer (China with marginal costs of $P_{China}$) to one with rising marginal costs (Honduras) for imports $Q_3 - Q_2$. Area $\epsilon$ is similar to the “efficiency loss” that arises when a small country imposes a tariff, except that in this case, it is caused by the removal of a tariff between countries of a regional agreement.

**Not All Trade Diversion Creates a Loss** It should be noted that the result of the previous example is not a necessary condition. Namely, members of a
regional trade agreement may experience gains from removing a tariff despite any trade diversions. To see this, let us suppose that after joining CAFTA-DR, Honduras improves its jewelry production, which leads to a rightward shift of the supply curve to $S'_{\text{Honduras}}$. The new post–CAFTA-DR equilibrium is now at point $D$ at the price of $P_{\text{China}}$. There is an increase in imports relative to the free-trade quantity, $Q_t$, and the entire amount comes only from Honduras. Although there are no tariff revenues to collect, the gain to American consumers from the lower price given by area $(a + b + c + d + e)$ more than compensates the loss to the U.S. government. The overall effect of the regional agreement on U.S. welfare can be summarized by the following:

<table>
<thead>
<tr>
<th>Gain in consumer surplus:</th>
<th>$+ (a + b + c + d + e)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss in tariff revenue:</td>
<td>$- (a + b + c + d)$</td>
</tr>
</tbody>
</table>

Net gain in U.S. welfare: $+ e$

Aside from the net gain of area $e$ in the United States, producers in Honduras benefit from improving its production efficiency, which allows it to increase exports to the American market. Therefore, countries may be better off under a regional trade agreement provided that the amount of trade diversion is less than the amount of trade creation.

**APPLICATION**

**Trade Creation and Diversion for Canada**

The gains and losses for Canada from joining the Canada-U.S. Free Trade Agreement (CUSFTA) are examined by economist Daniel Trefler. Using data from 1989 to 1996, Trefler found that the reduction in Canadian tariffs on U.S. goods increased imports by 54 percent, which we consider trade creation. Trefler also found that Canada’s demand for imports from the rest of the world dropped by 40 percent, which we consider trade diversion. Weighting these changes by the relative share of imports from the United States (80 percent of Canadian imports) and imports from the rest of the world (20 percent of Canadian imports), Trefler found that trade creation outweighed trade diversion. This result implies that Canada is better off under the free-trade agreement with the United States.

$\square$

**2 International Agreements on Labor Issues**

In addition to issues regarding tariffs and trade, regional agreements also deal with labor standards, which we will refer to as all matters directly impacting workers, such as occupational health, job safety, child labor, minimum wages, and so forth. Concerned about working conditions in foreign factories, consumers and policy makers argue against exploiting workers in “sweat shop” conditions. Unions also rally for improved labor standards, partly to level the foreign competition for U.S. workers. However, economists, developing countries, and the United Nations note that labor standards may be a disguise for trade barriers and therefore may result in greater harm.

**Labor Side Agreement under NAFTA**

Under NAFTA, the Labor Side Agreement allows each country to bring forth a complaint before the commission of the North American Agreement on La-
bor Cooperation (NAALC) if the country believes that a member fails to properly enforce the labor laws. Although critics of the NAALC agreement argue that the resolution process is slow and ineffective, proponents, including unions and labor activists, cite its usefulness in building solidarity and leading firms to rectify their practices.

Other Labor Agreements

Enforcement of labor standards also occurs outside of international agreements. Pressures from unions and grass-roots organizations can make positive strides in improving the working conditions in foreign countries. Demand by consumers for products produced by companies respecting the rights of workers also leads to improvements in labor practices in factories abroad.

Consumer Responsibility  Table 11–2 presents the responses to a survey conducted by the National Bureau of Economic Research questioning people on their attitudes toward the working conditions of the production of a product. Although most respondents claimed that they at least somewhat cared “about the condition of workers who make the clothing they buy,” most are only willing to pay a small amount to ensure good labor standards. In addition, the survey findings suggest that the requirement for a larger discount on an item produced under poor conditions is greater than consumers’ willingness to pay for the product made under good labor standards.

Corporate Responsibility  Due to pressures from consumers and unions, corporations such as Wal-Mart are insisting that factories in China meet strict guidelines on both labor and environmental standards.

HEADLINES

Wal-Mart Orders Chinese Suppliers to Lift Standards

In order to improve its reputation, Wal-Mart has recently required its more than one thousand Chinese suppliers to meet strict environmental and social standards. Suppliers are required to demonstrate compliance with Chinese environmental laws, improve energy efficiency, and disclose the names and locations of all factories involved in production.

NETWORK

Ernst & Young practices corporate responsibility through their relationship with key suppliers. The environmental management of their suppliers is one of the criteria in their selection of their supply chain partner.

The Walt Disney Company implements the International Labor Standards (ILS) program to protect the interests of workers engaged in the manufacture of Disney merchandise. To promote compliance with the strict codes of conduct for their licensees and manufacturers, Disney undertakes educational, monitoring, and remediation efforts. In the event of a violation, Disney works with the concerned factory to remedy the situation and will terminate the use of the factory if necessary.
**Country Responsibility** Aside from consumers, unions, and corporations, the U.S. trade laws provide the President the power to deny trading privileges to countries that lack proper labor standards. Withholding trade from a country that violates the basic rights of workers creates potential issues because the measure would affect an entire nation when the culprit may be at the microlevel particular to certain companies. Moreover, exercising the trade law would require judgments that compare foreign and domestic labor standards. There are those who believe that countries should not be subjected to the preferences of another. More importantly, pressures from nongovernmental organizations (NGOs) may lead to a more desirable outcome than government sanctions. Namely, a research study on Indonesia concluded that by focusing on the concerned plants, the activists helped to raise the workers’ wages with minor negative impact on employment relative to threats by the U.S. government to withdraw tariff privileges, which resulted in increasing the wage but at a cost of higher unemployment.

**Living Wage** The issue of whether foreign workers should receive a wage above the norm in the developing country is controversial partly because of the difficulties in comparing labor standards across countries. Although this living wage may benefit some workers, others may be harmed as the quantity of labor supplied exceeds the quantity demanded for labor, leading to unemployment.

### 3 International Agreements on the Environment

The WTO indirectly affects the environment, unlike the 200 multilateral environmental agreements that specifically deal with environmental issues.

**Environment Issues in the GATT and WTO**

The “green provision,” or Article XX of the GATT, states that countries are allowed to adopt their own environmental laws as long as these laws are uniformly applied to all producers, both foreign and domestic, such that imports are not discriminated against. Table 11-3 provides a summary of some specific cases brought to the GATT/WTO.

**Tuna–Dolphin Case** In response to the U.S. ban on tuna imported from its southern neighbor, Mexico filed a case against the United States with the GATT (former WTO) in 1991. The GATT concluded that the import restriction resulting from the requirement by the U.S. Marine Mammal Protection Act that fishermen use dolphin-safe nets violated GATT principles. This is because the ban applied to the production process method rather than the product. They also concluded that the United States could not impose its own domestic laws on another country. However, due to overwhelming consumer response, major companies switched to selling tuna labeled “dolphin-safe” or “dolphin-friendly,” even products imported from Mexico.

**Shrimp–Turtle Case** In 1996, four Asian countries (India, Malaysia, Pakistan, and Thailand) brought a case to the WTO to appeal the U.S. ban on shrimp caught without the use of turtle-safe nets. Although the WTO ruled against the United States as with the tuna–dolphin case, the decision was not based on the extension of the same production process method on both domestic and Asian
fishermen but rather that the United States failed to provide notice and consultation with the exporting countries involved. By working with the Asian producers, the 2001 ruling of the WTO established that the United States could continue to adopt its requirements for turtle-safe nets for exporters.

**Gasoline from Venezuela and Brazil** In the case against the United States concerning gasoline from Venezuela and Brazil, the GATT/WTO ruled in 1996 that the import restriction was illegal because the 3-year grace period given to domestic producers to meet the Clear Air Act goals was not extended to the foreign producers.

**Biotech Food in Europe** In 2006, the United States, along with Argentina and Canada, won their case with the WTO against the European Union regarding a ban on genetically modified food. The WTO ruled that import restrictions must be based on “scientific risk assessments” rather than precautionary reasons.

**Summary of GATT/WTO Cases** The outcomes of the cases presented in Table 11-3 suggest that environmental concerns are recognized by the WTO. More specifically, protests at the Seattle meetings and lobbying activities by environmentalists shift public opinion and influence WTO rulings in favor of environment protection.

**Does Trade Help or Harm the Environment?**

We will examine some examples to understand how the environment could be helped and harmed by trade.

**U.S. Sugar Quota** Because of the import quota on sugar, American consumers and firms pay up to double the world price. The higher price causes firms to shift their demand to corn rather than using sugar cane as an input for the production of ethanol. Sugar cane, however, is more energy-efficient than corn as a substitute for gasoline. Therefore free trade in sugar would benefit the environment because the net energy savings from using corn rather than sugar cane to make ethanol is lower.

**HEADLINES**

**The Power of Big Corn**

Due to the U.S. import restriction on sugar cane, ethanol producers use corn, which requires more energy than the sugar-based version. This is because corn requires fertilizers and is harsh on the soil. The removal of the import quota on U.S. sugar would be better for the environment.

**U.S. Automobile VER** The “voluntary” export restraint (VER) on Japanese cars sold to the United States led automobile manufacturers to export more luxurious models, larger in engine size and weight. Consequently, the average gas mileage of the imported Japanese cars fell as shown in Figure 11-4, using data from 1979 to 1982 and covering periods before and after the VER, which began in 1981. The data show that sales of the more luxurious models increased relative to the economy models. This is because the rise in price of
the latter was higher relative to the former. Thus, the trade restriction harmed the environment by shifting consumer demand to larger cars requiring more energy and emitting greater carbon dioxide.

The Tragedy of the Commons
The relationship between free trade and the environment can also be negative, as we will see in the next examples.

Trade in Fish
Because fish in the ocean are a common property that anyone can harvest, competition over this resource leads to overfishing, which results in the tragedy of the commons. Free trade escalates the depletion of this resource as demand for fish from a particular country or region increases.

The Solution to the Tragedy of the Commons
The tragedy of the commons may be avoided with international agreements to prevent over-harvesting of fish and other endangered species. An example of such a global arrangement is the Convention on International Trade in Endangered Species (CITES).

HEADLINES

Europe Leans Toward Bluefin Trade Ban
In 2009, Monaco suggested that bluefin tuna be placed on the endangered species list, which would ban the international trade of the tuna. Though the bluefin tuna is thought by many experts to be close to extinction, there is much opposition to placing the fish on the endangered species list. Opposition has come from the fishing industry, which stands to lose if this fish, used extensively in sushi, was to be made illegal to trade. It is also expected that Japan will come out in opposition to the ban.

Trade in Buffalo
A recent research study indicated that international trade contributed to the slaughter of the Great Plains buffalo to near-extinction between 1870 and 1880. Following a tanning invention in 1871 that allowed the buffalo hide to be used industrially, the import demand for untanned hides grew significantly in Europe, as illustrated in Figure 11-5.

International Agreements on Pollution
Pollution is another example of the tragedy of the commons as companies and countries allow pollutants to enter the air and water, which they view as common-property resources. We define substances that cross country borders as “global pollutants.” Examples include chlorofluorocarbons and carbon dioxide. By contrast, “local pollutants” mostly remain within a country, such as smog caused by carbon monoxide.

Global Pollutants
Because global pollutants are not borne entirely by the country that releases the substance, the incentive to regulate pollution is low, which leads to an undesirable outcome such as the prisoner’s dilemma.

Payoff Matrix
In the payoff matrix shown in Figure 11-6, the lower-left (upper-right) corner of each quadrant is the payoff for Home (Foreign). We will assume that if a country decides to regulate the emissions of a pollutant, consumers are
better off because of lower pollution but producers bear the higher cost from the installation of special equipment. If both countries regulate, we are at the top-left quadrant, in which consumers in each country experience a gain and producers suffer a loss. Instead if Home (Foreign) regulates but Foreign (Home) does not then the result is the top-right (bottom-left) quadrant such that both producers and consumers are worse off at Home (Foreign). In contrast, Foreign producers gain, whereas Foreign consumers suffer a loss, when Home regulates but Foreign does not require pollution reduction. Lastly, both countries will have a net loss if neither regulates pollution, as given by the bottom-right quadrant.

**Nash Equilibrium** From the perspective of a particular country, say Home, if the pollutant is global, the gain to its producers from nonregulation may outweigh loss to its consumers because some of the substance would cross borders to Foreign. Consequently, the Nash equilibrium would be that both countries do not regulate their emissions because neither country has an incentive to impose the higher cost on its producers. Without any regulations, consumers in both countries suffer a larger loss than the small gains to the producers in either country.

**Multilateral Agreements** To avoid the prisoners' dilemma outcome in which countries do not regulate their pollution emissions, countries engage in multilateral agreements such as the Montreal Protocol on Substances that Deplete the Ozone Layer. As a result of the Montreal Protocol, a ban on the use of chlorofluorocarbons (CFCs) has been in place since 1989.

**APPLICATION**

**The Kyoto Protocol and the Copenhagen Accord**

Building on the 1992 United Nations (UN) treaty on climate change, representatives from many nations met in Kyoto, Japan, in December 1997 to discuss nonbinding targets aimed at reducing emissions of greenhouse gases. The Kyoto Protocol focused mainly on the reduction of carbon dioxide (CO₂). The agreement, endorsed by more than 160 countries, set different reduction targets for each country. When the treaty came into effect on February 16, 2005, the United States remained the only major industrial country choosing not to ratify the treaty. In a speech given by President George W. Bush, the reason the United States abstained from the Kyoto Protocol was due to (1) a lack of understanding of all the consequences of policy actions dealing with global warming; (2) the large negative impact on the U.S. economy from switching to activities that reduce CO₂ emission; (3) the exclusion of developing countries such as China and India in the discussion; and (4) the possibility that other methods to limit greenhouse gas emissions exist. The Copenhagen Climate summit twelve years later, which brought together 119 countries, was thought to be an important opportunity to pick up where Kyoto left off. Unfortunately, the meetings ended with only modest goals called the Copenhagen Accord. The accord stated that: (1) further increases in global temperature should be kept below two degrees centigrade; (2) industrialized countries will submit goals for greenhouse gas emission reduction; and (3) a fund should be established to finance the needs of developing countries in fighting the effect of climate change. However, without any means of enforcement these already modest goals seem to be quite trivial.
Dismal Outcomes at Copenhagen Fiasco

This article discusses the limited success of the Copenhagen Accord and suggests a way forward for global climate change. The author suggests that Copenhagen’s failure was due in part to the inability of participants to “unpack” the problem they faced. By trying to do too much in too rigid a framework, little was actually accomplished. Though a global cap and trade system for greenhouse emissions might be the first best solution, progress should not be held captive in the name of cap and trade. Collective action and aid for developing countries are both very important, but need not both be decided at the same time.

4 Conclusion

This chapter explains how international agreements are necessary to avoid outcomes that would make countries worse off. A multilateral agreement such as the WTO promotes free trade by requiring all members to lower or reduce their tariffs. Without the international agreement, countries have an incentive to use tariffs to their own benefit. However, when all countries behave similarly, the outcome known as the prisoner’s dilemma results, in which all trading partners experience losses due to the trade restrictions.

Another type of international agreement on trade is the regional trade agreements. These agreements are also referred to as preferential trade agreements because they violate the MFN principle of the WTO by excluding nonmembers from enjoying the tariff reduction. Such agreements may make member countries worse off when they switch from the lowest cost producers that are excluded from the agreement. The resulting trade diversion has a negative impact on the welfare of the member countries in terms of higher prices and loss of tariff revenues.

International agreements on labor promote standards that protect the rights of workers. An example is the North American Agreement on Labor Cooperation (NAALC) formed between Canada, Mexico, and the United States. Proper labor standards are also upheld due to pressure from consumers and unions.

Global agreements also exist for the environment. One of the main purposes of these agreements is to promote free trade while protecting the environment. Another is to prevent the near-extinction or extinction of exhaustible resources such as fish through export bans and restrictions. The limitations set by international agreements such as the Convention on International Trade in Endangered Species help to avoid the phenomena known as the tragedy of the commons, in which each country overharvests the common resources. Countries also have international agreements on pollution emissions. Without such agreements to cut pollutants like CO₂, the prisoner’s dilemma outcome may result, in which all countries fail to regulate the amount of pollution they contribute to the environment.
TEACHING TIPS

Tip 1: International Trade and the Environment Debate
Chapter 11 tackles the very important issue of international trade and the environment. Have students do independent research on the environmental cases that the GATT and WTO presented in this chapter, as well as any other cases they can find. Debate whether the trade helps or harms the environment.

Tip 2: By 2005, Mongolia was the only member of the WTO that was not party to a regional trade agreement. By 2010, over four hundred regional trade agreements were notified to the WTO. Given their importance, it may be fruitful to have a discussion with your students regarding the role these RTAs play in helping or hindering the goal of free trade.

Tip 3: Trade Diversion Data Exercise, ASEAN-CHINA FTA
Ask students to look up the most recent ASEAN trade data to investigate if trade creation or trade diversion has taken place since the China-ASEAN FTA. ASEAN trade data can be found at ASEAN stats. Have students go to http://www.aseansec.org/, follow the link for Resources, and then Statistics. Look up Asian trade with various countries and regions, making note of the trade share of China and India.

In 2009, total trade between ASEAN countries was $376 billion dollars (24.3 percent of total ASEAN trade). Trade between the ASEAN countries and China was $178 billion dollars (11.6 percent of total ASEAN trade), and between the ASEAN countries and India, 2009 trade was $39 billion (2.5 percent of total ASEAN trade). If data for 2010 or beyond is available, ask students to compare trade flows and hypothesize whether trade creation or trade diversion had occurred.
1. How does trade creation and trade diversion increase and/or decrease economic welfare?

**Answer:** Trade creation increases economic welfare because a member country imports a product from another member rather than producing the good for itself at a higher cost. In comparison, when a member country switches from the lowest cost producer excluded from the international agreement to another member country, trade diversion decreases economic welfare.

2. Suppose Belarus, a small country, imposes a tariff in the amount of \( t \) per unit on imported coal. Assume that it imports coal from Ukraine rather than Poland because the former has a lower net-of-tariff price. Furthermore, suppose that the Belarusian government is considering whether to apply for membership to the European Union. As a member of the EU, Belarus would have to remove its tariffs on all countries within the customs union, such as Poland. Using the following figure, analyze the welfare effect of EU membership on Belarus.

**Answer:**

Currently, the price faced by Belarus with the per-unit tariff is \( P_{\text{Ukraine}} + t \). At this price, quantity demanded is given by \( D_1 \), whereas quantity supplied is denoted by \( S_1 \) so that the amount imported is \( X_1 = D_1 - S_1 \). As a member of the EU, Belarus would import from Poland rather than Ukraine because the tariff removal from the former would result in a lower price. At the reduced price of \( P_{\text{Poland}} \), imports would expand to \( X_2 = (D_2 - S_2) \). The loss in producer surplus due to the drop in price is area \( a \). In comparison, the gain to consumer surplus is given by areas \( a + b + c + d \). Without the import tax the Belarusian government loses areas \( c + e \). To summarize, the net effect on the Belarus welfare from joining the EU is as follows:

- **Gain in consumer surplus:** \(+ (a + b + c + d)\)
- **Loss in producer surplus:** \(- a\)
- **Loss in tariff revenue:** \(- (c + e)\)

**Net effect in Belarus welfare:** \((b + d) - e\)

Thus, Belarus would be better off joining the EU if \((b + d) > e\). Namely, the gain in consumer surplus outweighs the loss in tariff revenue.

3. Suppose the United States could import footwear from Thailand at the price of $20 per pair or from Mexico at $24 per pair. The domestic price of footwear in the United States is $35. Suppose prior to NAFTA, the U.S. customs imposed a 50% tariff on all footwear entering the country. Would the United States import footwear? If yes, from which country? Why?

**Answer:** Before NAFTA, the United States would import footwear from Thailand because even with the 50% tariff the price of the product from the Asian country, $30, would still be lower than the domestic price of $35. It would not import footwear from Mexico before the formation of NAFTA because the price with the tariff, $36, is higher than its domestic price.

4. Under Article XIV of the GATT, regional trade agreements are permitted provided that countries within the arrangement do not change their tariffs against outside members. Because the tariffs on nonmember countries are unchanged while those levied on partners in the pact are removed or reduced, the formation of free-trade areas and customs unions leads to an overall increase in the gains from international trade. Comment.

**Answer:** The statement would be correct if the formation of the regional trade agreement does not lead a member country to substitute a low-cost producer excluded from the agreement with another member supplying at a higher cost. In other words, regional trade agreements would result in an overall increase in the gains from inte-
national trade as long as the amount of trade creation is greater than trade diversion.

5. How do regional trade agreements violate the most-favored nation principle of the GATT/WTO?

Answer: The most-favored nation principle of the GATT/WTO requires each country to extend to all members the same preferential treatment enjoyed by its most-favored trading partner. With the regional trade agreements, members of the agreement trade with zero tariffs but import taxes are imposed on countries outside the region. For example, although Canada, China, and the United States are all members of the WTO, goods exchanged between Canada and the United States are duty free because both belong to NAFTA, whereas products from China are subject to tariffs.

6. What is the relationship among regional trade agreements, free-trade areas, and customs unions? What are the similarities and differences between the latter two? How do they impact world welfare?

Answer: Free-trade areas and customs unions are two different types of regional trade agreements. In a free-trade area, members of the agreement reduce or remove tariff on goods traded between them but maintain different duties on imports from the rest of the world. Similar to a free-trade area, members of a customs union also trade duty free with one another. The difference is that countries in a customs union have a uniform tariff on imports from nonmembers. Depending on whether these regional trade agreements lead to trade creation or trade diversion, they may have a positive or negative impact on world welfare.

7. Explain how the elimination of the system of quotas under the Multifibre Arrangement (MFA) should reverse some of the trade diversion caused by regional agreements such as NAFTA?

Answer: Under NAFTA, Mexico is given preferential tariffs relative to lower-cost producers such as China on U.S. textile imports. Thus, the removal of the MFA should redirect trade to China, thereby reversing some of the trade diversion.

8. Suppose the United States imports 1,000 pounds of bananas from Nicaragua at $0.28 per pound. Due to a 25% tariff, the consumer price in the United States is $0.35 per pound. Farmers in the United States can provide the bananas at a price of $0.40 per pound. Furthermore, suppose that the proposal to eliminate tariffs on the 50 poorest nations passes. As a result, Angola devotes more resources to the production of bananas and can supply the fruit at $0.40 per pound.

a. Does the proposal lead to trade creation or trade diversion? Explain.

Answer: The proposal would lead to neither trade creation nor trade diversion since the United States would continue to import bananas from Nicaragua at $0.35 per pound inclusive of the 25% tariff.

b. If the banana tariff was doubled, would there be trade creation or trade diversion?

Answer: If the tariff doubled, there would be trade diversion because the United States would start to import bananas from Angola rather than Nicaragua because the price from the former at $0.50 per pound would be cheaper than the latter at $0.42 per pound. However, the price exclusive of the tariff is lower for bananas from Nicaragua, so the United States is diverting trade from a lower-cost producer to one with a higher cost.

c. Assuming that the banana tariff is 50%, what is the net effect of the proposal on U.S. consumers, U.S. producers, U.S. government, and the world welfare?

Answer: Because the foreign producers supplied the bananas (Nicaragua before and Angola after the tariff increase), the net effect on U.S. producers is nil. U.S. consumers pay a higher price under the proposal so they are worse off. The U.S. government also experiences a loss with the proposal since they would lose the tariff revenue. Therefore the net effect of the proposal would be negative for the United States due to the trade diversion. The net effect on world welfare is also likely to be negative since the gain to the Angola producer will be small compared with the losses faced by the Nicaraguan producers and the United States.

9. Adanac, a small country, is considering whether to join the regional trade agreement known as RTA-R-US. Currently, it can import tires from countries outside the regional agreement at the price of $20 each or from those inside the pact at $40 each. In addition, Adanac has a 50% tariff on all imported tires. Predict whether Adanac’s decision to join RTA-R-US will lead to any trade diversion or trade creation. Explain.

Answer: Even if Adanac joins RTA-R-US, it will continue to import tires from countries outside the regional agreement because the price with the tariff ($20 + 50% * $20 = $30) is still lower than the price from those inside the pact. Thus, there will neither be any trade diversion nor trade creation.