

# Chapter 3

## Labor Productivity and Comparative Advantage: The Ricardian Model

### ■ Chapter Organization

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Summary

## ■ Key Themes

This chapter in the text begins to address the question of why countries trade with one another. Answering this question requires an understanding of the differences among countries and the implications of these differences for the potential for benefits to all countries that trade. As you work your way through the rest of Section I, Chapters 3 through 7, you will learn about the motives for trade when countries differ in a number of specific ways. If you can master the fundamental concepts introduced in Chapter 3, you will be off to a good start in learning international trade theory.

The first way in which countries can differ from each other is in the productivity of workers in producing different goods. This key point is emphasized by the Ricardian model of trade. The basic Ricardian model involves two countries, two goods, and one factor of production, labor. Differences in relative labor productivity across countries give rise to international trade. The Ricardian model, simple as it is, generates important insights concerning comparative advantage and the gains from trade. These insights are necessary foundations for the more complicated models that you will learn in later chapters.

One important principle to understand is that of *comparative advantage*. The Ricardian model demonstrates that the comparative advantage, or relative strength, of one country compared with another in producing a particular product depends on differences across countries in the productivity of their workers. In the Ricardian model, only one input into production is used, workers, and the differences in output per worker in different industries in different countries will determine the pattern of trade between the countries.

The *production possibility frontier* (PPF) depicts the limits on what a country can produce, given available inputs into production. It also shows the trade-offs in production that arise: when an economy has full employment and an additional unit of one of the goods is produced, there must be a reduction in the production of some other good. The shape of the PPF shows the opportunity cost of increasing production of a good.

The unit labor requirements for producing different goods (the amount of labor required to make one unit of a good) are important for determining the relative prices of goods in countries before they begin to trade with each other, and for determining the comparative advantage of a country in production. This information can also be used in determining the benefits from opening up an economy to trade.

Following the notation presented in the textbook, suppose  $a_{1w}$  and  $a_{1c}$  are the unit labor requirements in wine production and cheese production in the home country, and the economy is endowed with  $L$  workers. Suppose that the corresponding unit labor requirements and labor force for the foreign country are  $a_{1w}^*$ ,  $a_{1c}^*$ , and  $L^*$ . Unit labor requirements are the number of hours of labor needed to produce a good.

This means that the home country's production possibility frontier is defined by the line  $a_{1w}C + a_{1c}W = La_{1c}$ , so that the maximum amount of cheese that can be produced domestically is:  $C = L/a_{1c}$  (this happens when no wine is produced at home); and the maximum amount of wine produced at home is:  $W = L/a_{1w}$ . An analogous description can be provided for the foreign economy. The production possibility frontier is linear because of the assumption of constant returns to scale for labor, the sole factor of production. The opportunity cost of one good in terms of the other equals the price ratio since prices equal costs, costs equal unit labor requirements times wages, and wages are equal in each industry.

If the country is not involved in international trade, the production and consumption mix of a country will occur at the point of tangency of an indifference curve and the production possibilities frontier. As shown in Figures 3-1 and 3-2, since the PPF is a straight line in our example, the pre-trade price of cheese in terms of wine will always be the slope of the PPF.

$$P_c/P_w = a_{1c}/a_{1w}, P_c^*/P_w^* = a_{1c}^*/a_{1w}^*$$

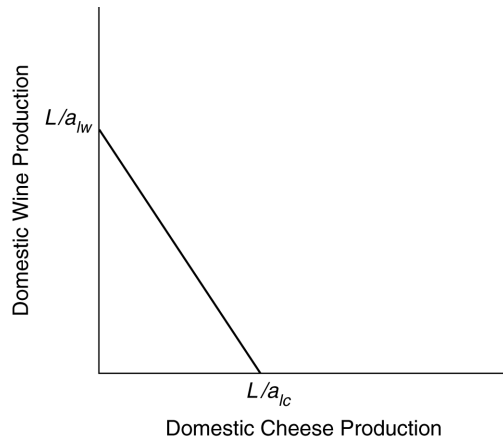


Figure 3-1

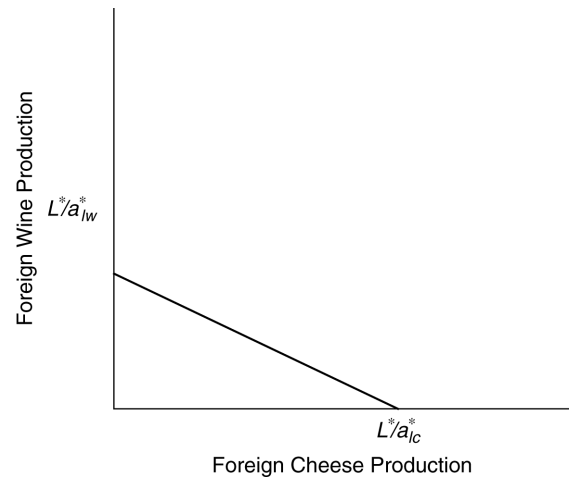


Figure 3-2

The pattern of trade that will arise between these countries is determined by the difference in these relative prices. If a higher relative price of cheese is offered than the foreign producers originally received, the foreign producers will shift out of production of wine, and earn more by producing just cheese. Similarly, the domestic producers would tend to specialize in wine.

If trade possibilities increase the relative price of cheese above the pre-trade level, the home country will specialize in cheese production. If trade possibilities reduce the relative price of cheese below the pre-trade level, the foreign country will specialize in wine. The *RD* (relative demand) curves show that the total world demand for cheese relative to wine is a decreasing function of the price of cheese relative to the price of wine. The *RS* (relative supply) curve shows the world supply of cheese relative to wine. This supply is an increasing function of the relative price. You can show that trade benefits each of these countries in one of two ways emphasized in the text. First, you can demonstrate this benefit by thinking of trade as an indirect method of production. Alternatively, you can show that trade enlarges a country's consumption possibilities.

The Ricardian model of trade has illustrated that countries whose relative labor productivities differ across industries will tend to specialize in the good in which they have a comparative advantage. Ultimately, the patterns of production and trade also depend on world demand patterns. When countries are permitted to trade with each other, they will export goods that their labor produces relatively efficiently and import those goods that their labor produces relatively inefficiently. In the text, this theme is also emphasized in the context of production with many goods—the multigood model.

The textbook chapter also considers many misconceptions regarding comparative advantage and trade which contribute to hostility towards trade. Misconceptions regarding the importance of being “more competitive” and other misconceptions about the way workers are affected by trade are dispelled using the basic analysis that has been developed in this chapter.

## ■ Key Terms

Define the following key terms:

1. Opportunity Cost \_\_\_\_\_  
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2. Relative Demand Curve \_\_\_\_\_  
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3. Relative Supply Curve \_\_\_\_\_  
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4. Gains from Trade \_\_\_\_\_  
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5. Pauper Labor Argument \_\_\_\_\_  
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## ■ Review Questions

1. Answer parts (a) through (c) using the information on unit labor requirements provided in the following table.

	<b>Home</b>	<b>Foreign</b>
Butter (labor–hours/lb.)	$1/5(a_{LB})$	$1(a_{LB}^*)$
Cloth (labor–hours/yard)	$1(a_{LC})$	$1/3(a_{LC}^*)$

- a. In which commodity does Home have an absolute advantage? In which commodity does Foreign have an absolute advantage? Why?

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- b. How much will Home gain if it trades 5 units of butter for 3 units of cloth? How much would Foreign gain from the same trade? Why?

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- c. How much will Home gain if it trades 5 units of butter for 6 units of cloth? How much would Foreign gain from the same trade?

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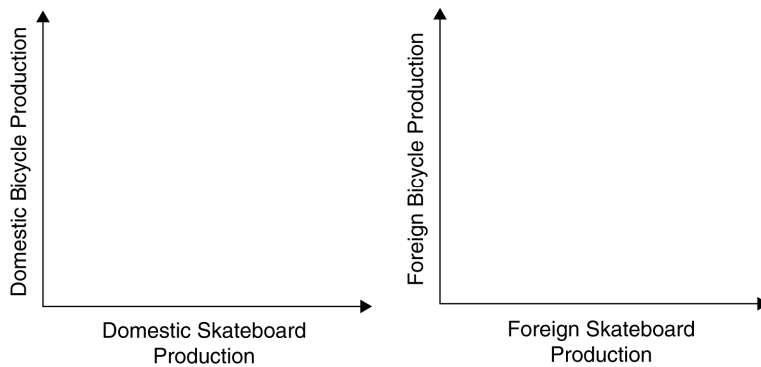
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2. Assume that the Home country has a total supply of labor hours of 1000 and the Foreign country has a total supply of labor hours of 1200. Each country can produce two goods: bicycles and skateboards. The unit labor requirements in Home production are 5 hours per bicycle and 2 hours per skateboard. Foreign requirements for both bicycles and skateboards are 3 hours per unit.

- a. Graph the production possibilities frontiers for the Home and Foreign economies.



- b. In the absence of trade, what is the relative price of bicycles in terms of skateboards in each country?

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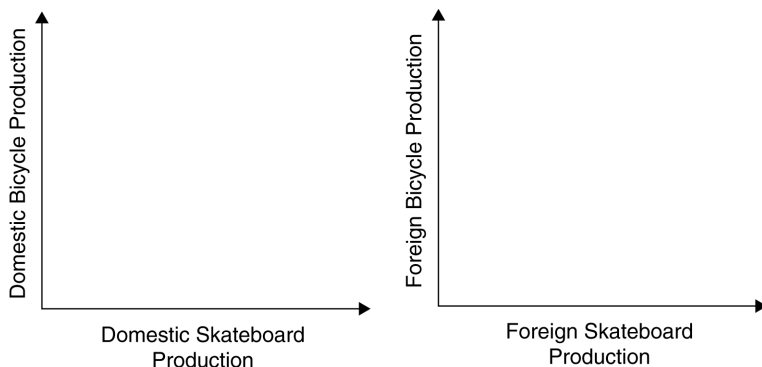


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- c. Trade is said to make each country better off by enlarging the range of consumption choices available to residents. Compare the consumption possibilities available to Home and Foreign consumers in the closed economy and open/trading economy cases. Graph the expanded consumption opportunities. The relative price of skateboards in terms of bicycles under free trade is  $4/5$ .



3. Suppose that Home and Foreign have the unit labor requirements shown below.

	<b>Baseball Bats</b>	<b>Tennis Rackets</b>
Home	$a_{LB} = 6$	$a_{LR} = 2$
Foreign	$a_{LB}^* = 1$	$a_{LR}^* = 4$

- a. In which good does Home have the relative productivity advantage (that is, comparative advantage)? Why?

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- b. What is the opportunity cost of rackets in terms of bats for the Home country? For the Foreign country?

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- c. At world equilibrium *with trade*, what do you know about the relative price of tennis rackets?

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- d. Assume that a tennis racket trades for a bat on world markets at an equilibrium price of  $P_R/P_B = 2$ . Why will each country will specialize? (Home will specialize in rackets and Foreign in bats.)

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- e. Demonstrate that there will be gains from trade reaped by the Foreign country when it specializes in bat production.

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4. Assume that Home and Foreign are both able to produce and consume the following four goods in autarky according to the unit labor requirements provided below.

Good	Home Unit Labor Requirement	Foreign Unit Labor Requirement
A	1	12
B	2	18
C	4	24
D	15	30

- a. In which good does Home have the greatest relative productivity advantage? In which good does Home have the lowest productivity advantage?

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- b. If the Home wage rate is 8 times the Foreign wage rate, what goods will be produced by Home? What goods will be produced by Foreign?

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- c. Show how this pattern of specialization, and hence trade, is beneficial to each country.

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- d. Would this pattern of specialization and trade change if the relative wage were  $w/w^* = 6$ ? What would be the new pattern?

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- e. Discuss the reasons why, in practice, specialization is not as extreme as suggested by your response to part (b).

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5. Assume that labor is the only factor used in production, and that the costs of producing butter and cloth are given by the table below.

	<b>Home</b>	<b>Foreign</b>
Cost in labor–hours to produce:		
1 unit of butter	1/8	1
1 unit of cloth	1/4	1/2

- a. Express the (cost or) price of butter relative to the price of cloth in terms of labor content for Home and Foreign in the absence of trade.

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- b. What do these relative prices reveal about each country’s comparative advantage?

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- c. What do these relative prices suggest about the world price of butter relative to cloth that will exist once these countries trade with each other?

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- d. If the world price  $(p_b/p_c)^w$  stabilizes at 1 with trade, what are the gains by the Home country achieved through trade with the Foreign country?
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## ■ Answers to Odd-Numbered Textbook Problems

1.
  - a. The production possibility curve is a straight line that intercepts the apple axis at 400 (1200/3) and the banana axis at 600 (1200/2).
  - b. The opportunity cost of apples in terms of bananas is 3/2. It takes 3 units of labor to harvest an apple but only 2 units of labor to harvest a banana. If one foregoes harvesting an apple, this frees up 3 units of labor. These 3 units of labor could then be used to harvest 1.5 bananas.
  - c. Labor mobility ensures a common wage in each sector and competition ensures that the price of goods equals their cost of production. Thus, the relative price equals the relative costs, which equals the wage times the unit labor requirement for apples divided by the wage times the unit labor requirement for bananas. Since wages are equal across sectors, the price ratio equals the ratio of the unit labor requirement, which is 3 apples per 2 bananas.
  
3.
  - a. The relative demand curve includes the points (1/5, 5), (1/2, 2), (1, 1), (2, 1/2).
  - b. The equilibrium relative price of apples is found at the intersection of the relative demand and relative supply curves. This is the point (1/2, 2), where the relative demand curve intersects the vertical section of the relative supply curve. Thus the equilibrium relative price is 2.
  - c. Home produces only apples, Foreign produces only bananas, and each country trades some of its product for the product of the other country.
  - d. In the absence of trade, Home could gain three bananas by foregoing 2 apples, and Foreign could gain by 1 apple foregoing 5 bananas. Trade allows each country to trade 2 bananas for 1 apple. Home could then gain 4 bananas by foregoing 2 apples while Foreign could gain 1 apple by foregoing only 2 bananas. Each country is better off with trade.
  
5. This answer is identical to that in 3. The amount of “effective labor” has not changed since the doubling of the labor force is accompanied by a halving of the productivity of labor.
  
7. The problem with this argument is that it does not use all the information needed for determining comparative advantage in production: this calculation involves the four unit labor requirements (for both the industry and service sectors, not just the two for the service sector). It is not enough to compare only service’s unit labor requirements. If  $a_{ls} < a_{ls}^*$ , Home labor is more efficient than foreign labor in services. While this demonstrates that the United States has an absolute advantage in services, this is neither a necessary nor a sufficient condition for determining comparative advantage. For this determination, the industry ratios are also required. The competitive advantage of any industry depends on both the relative productivities of the industries and the relative wages across industries.
  
9. Gains from trade still exist in the presence of nontraded goods. The gains from trade decline as the share of nontraded goods increases. In other words, the higher the portion of goods that do not enter international marketplace, the lower the potential gains from trade. If transport costs were high enough so that no goods were traded then, obviously, there would be no gains from trade.

