

Comparative Advantage

3

In Chapter 2, we used the concept of absolute advantage to examine trade in rice between Vietnam and Japan. For Vietnam, rice is a significant component of the country's total production and an important component of domestic consumption. As incomes increase in Vietnam, however, there is another product that many Vietnamese begin to think about buying. That product is a motorcycle. Motorcycles in general, and the Honda Dream motorcycle in particular, are all the rage in Vietnam. Hundreds of new motorcycles are registered daily in the city of Hanoi alone, and tourists visiting this city report being overwhelmed by the chaos of motorcycle traffic, reminiscent of Italian driving styles in Rome.

In this chapter, we will place motorcycles alongside rice so that you can begin to understand the powerful concept of comparative advantage and its role in generating patterns of trade among the countries of the world. This, in turn, requires that we utilize the concept of a production possibilities frontier (PPF). The PPF should be familiar to you from an introductory microeconomics course. If it is not, please see the appendix to this chapter.¹

Autarky and Comparative Advantage

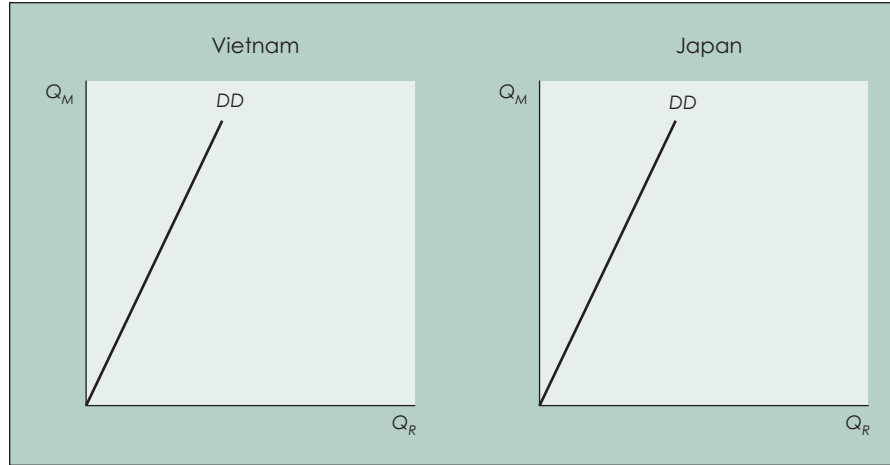
Consider again our two countries, Vietnam and Japan. Both of these countries produce two goods, rice and motorcycles. To help us in our analysis of comparative advantage, we will assume that demand for rice and motorcycles in both Vietnam and Japan is such that these two goods are consumed in the *same, fixed proportions*.² This assumption is depicted in Figure 3.1. In the diagrams for Vietnam and Japan, the quantity of rice (Q_R) is measured on the horizontal axes, and the quantity of motorcycles (Q_M) is measured on the vertical axes. Because demand for these two goods is in the same, fixed proportions, we can represent it by diagonal lines from the origins. We label both of these lines *DD* for “demand diagonal.” Any change in preferences for the two products would rotate these diagonal demand lines either up or down, maintaining the intercept at the origin. Changes in income would move a country up and down a given demand diagonal.³

¹ See also Chapter 2 of Mankiw (2004).

² We use this assumption to simplify the presentation of comparative advantage for the introductory student. However, this assumption can be relaxed without changing any of the results of this chapter. Indeed, this is exactly what is done in more advanced texts.

³ Some caution is necessary here. The *DD* lines in Figure 3.1 are *not* demand curves. Demand curves show a relationship between price and quantity demanded, but no price appears in Figure 3.1. Furthermore, demand curves are downward sloping, not upward sloping as the *DD* curves are in Figure 3.1.

Figure 3.1 Demand Diagonals in Vietnam and Japan



As we saw in Chapter 2, trade often arises due to differences in supply conditions. Therefore, we once again allow supply conditions to differ between Vietnam and Japan. In particular, we assume that resource or technology conditions in Vietnam give it a **production possibilities frontier (PPF)** that is biased towards rice, while resource or technology conditions in Japan give it a PPF that is biased towards motorcycles. Why might this pattern arise? Vietnam might have superior technology in rice production, and Japan might have superior technology in motorcycle production. Alternatively, Vietnam might be better endowed in rice production factors (land and labor), and Japan might be better endowed in motorcycles production factors (physical capital). Whatever the reason, the PPFs take on complementary shapes as depicted in Figure 3.2. We label the intersection of the PPFs with our demand lines with the letter A.

In our discussion of absolute advantage in Chapter 2, we were able to determine the price of rice by the intersections of supply and demand curves in Vietnam and Japan. What do we do when we have two goods as in Figures 3.1 and 3.2? The *DD* lines represent the demand sides of the two economies, and the PPFs represent the supply sides of the two economies. How do we determine prices, though? The slope of the PPFs shows how many motorcycles must be given up to produce additional rice. Recall from introductory microeconomics that this slope measures the **opportunity cost** of producing the item on the horizontal axis, rice, expressed in terms of how many units of the item on the vertical axis, motorcycles, must be given up, that is, not produced because resources have switched to rice.

In a system of freely operating markets and full employment of production factors, opportunity costs are fully reflected in *relative* prices. Therefore, the slope of a PPF where the demand diagonal crosses it is the relative price of rice, (P_R/P_M) . We represent this in Figure 3.3 by drawing in the *tangent* lines to the PPFs at the point where the demand lines cross

Production possibilities frontier (PPF)

A diagram that illustrates the constraints on production in general equilibrium imposed by scarce resources and technology. It shows all the combinations of two goods that a country can produce given its resources and technology.

Opportunity cost

What has to be given up to gain something. Along a production possibilities frontier, there is an opportunity cost of increasing the output of one good in the form of less production of another good.

Figure 3.2 Demand and Production Possibility Frontiers in Vietnam and Japan

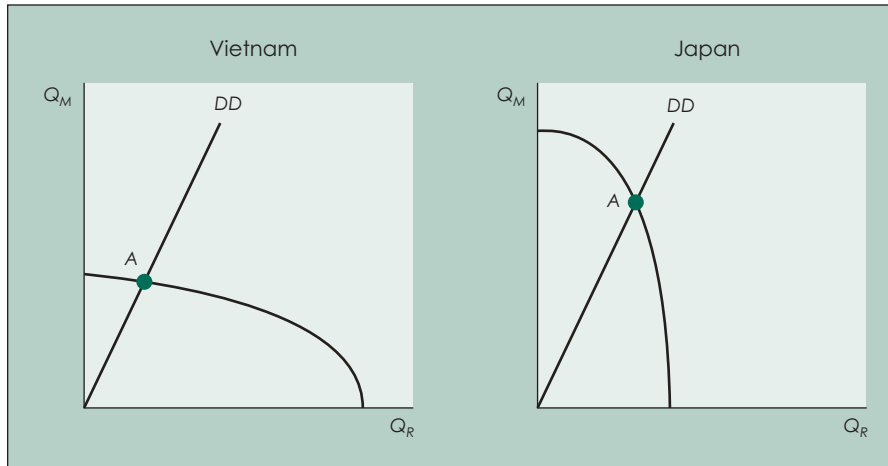
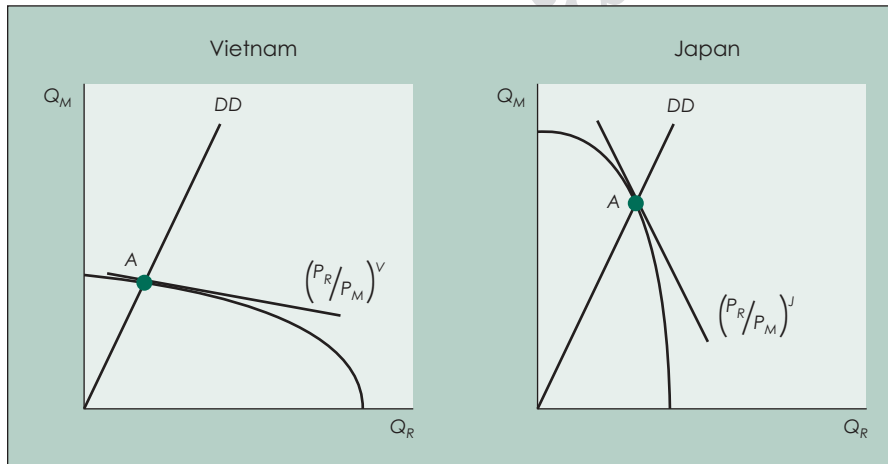


Figure 3.3 Relative Prices in Vietnam and Japan Under Autarky



them, points A.⁴ Points A in the two PPFs of Figure 3.2 represent the two countries under autarky.

Looking at points A in Figure 3.3, you can see that the tangency line giving relative prices is flatter in Vietnam than in Japan. That is, the opportunity cost of rice is lower in Vietnam than in Japan. In other words, under autarky:

$$\left(\frac{P_R}{P_M}\right)^V < \left(\frac{P_R}{P_M}\right)^J \quad (3.1)$$

⁴ We discuss this further in the appendix to this chapter.

Comparative advantage

A situation where a country's relative autarkic price ratio of one good in terms of another is lower than that of other countries in the world economy.

This equation says that the relative price of rice is lower in Vietnam than in Japan. Because Vietnam is the country that has a supply advantage in producing rice, Equation 3.1 makes sense. This inequality is an expression of a pattern of **comparative advantage**. Differences in economy-wide supply conditions cause differences in relative autarky prices and hence a pattern of comparative advantage.

Note one very important thing. The comparative advantage inequality illustrated by Equation 3.1 involves *four prices*. This is in sharp contrast to the absolute advantage inequality illustrated by Equation 2.1, which only involved two prices. This difference has an immediate and important implication: A country can have a *comparative advantage* in a good in which it has an *absolute disadvantage*.⁵

The concept of comparative advantage was first introduced in 1817 by David Ricardo in his *Principles of Political Economy and Taxation* (Ricardo, 1951). In a footnote in Chapter 7 of that book, Ricardo stated: “It will appear . . . that a country possessing very considerable advantages in machinery and skill, and which may therefore be enabled to manufacture commodities with much less labour than her neighbors, may, in return for such commodities, import a portion of its corn required for its consumption, even if its land were more fertile, and corn could be grown with less labour than in the country from which it was imported.” This country, in our example, is Japan, whose endowments of “machinery and skill” perhaps give it an absolute advantage in producing motorcycles. Corn in Ricardo’s time was the word for “grain,” and in our example, this is rice. Ricardo therefore suggests that Japan can import rice, even if it has an absolute advantage in rice production, given its comparative advantage in motorcycles.

International Trade

If Vietnam and Japan abandon autarky in favor of trade, the world relative price of rice $(P_R/P_M)^W$ will lie somewhere between the two autarky price ratios:

$$\left(\frac{P_R}{P_M}\right)^V < \left(\frac{P_R}{P_M}\right)^W < \left(\frac{P_R}{P_M}\right)^J \quad (3.2)$$

This situation is depicted in Figure 3.4. The world price ratio here is depicted with dashed lines that have the slope $(P_R/P_M)^W$. These lines are steeper than the autarky price line in Vietnam and flatter than the autarky price line in Japan, as is indicated in Equation 3.2. The tangencies of these world price lines with the PPFs determine the new production points in Vietnam and Japan. These points are labeled *B*. In Vietnam, the movement along the PPF from *A* to *B* involves an increase in the production of rice; in Japan, this movement involves an increase in the production of motorcycles. The important lesson you should understand here is that moving from autarky to trade restructures an economy’s production

⁵ The reader who is not convinced of this can work with the following example: $P_R^V = 2$, $P_R^J = 1$, $P_M^V = 4$, $P_M^J = 1$. Here, you will see that Japan has an *absolute advantage* in producing both goods ($P_R^J < P_R^V$ and $P_M^J < P_M^V$), but Vietnam has a *comparative advantage* in producing rice.

towards the good in which the country has a comparative advantage. This is one reason why opening economies up to trading relations with the rest of the world can be difficult for the countries involved. Workers and other resources must be moved from one sector of the economy to another in the process.⁶

Consumption points for Vietnam and Japan must be along our diagonal demand lines. These points, labeled *C* in Figure 3.4, occur where the dashed world price lines intersect the demand lines. Why is this? Both consumption and production must respect world prices. That is, *both* points *B* and *C* must be on the world price lines. In contrast to autarky, consumption and production points are now different. How can this be so? Through trade. Look ahead to Figure 3.5, which removes the autarky points and autarky price lines.

Figure 3.4 Autarky and Comparative Advantage in Vietnam and Japan

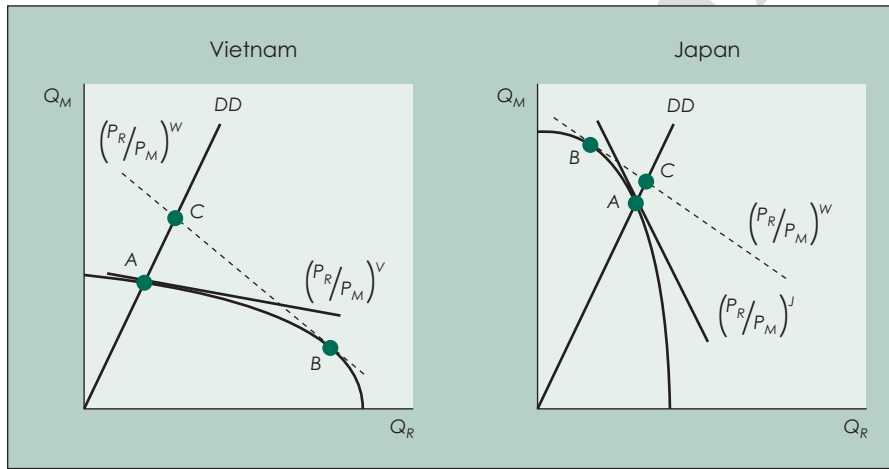
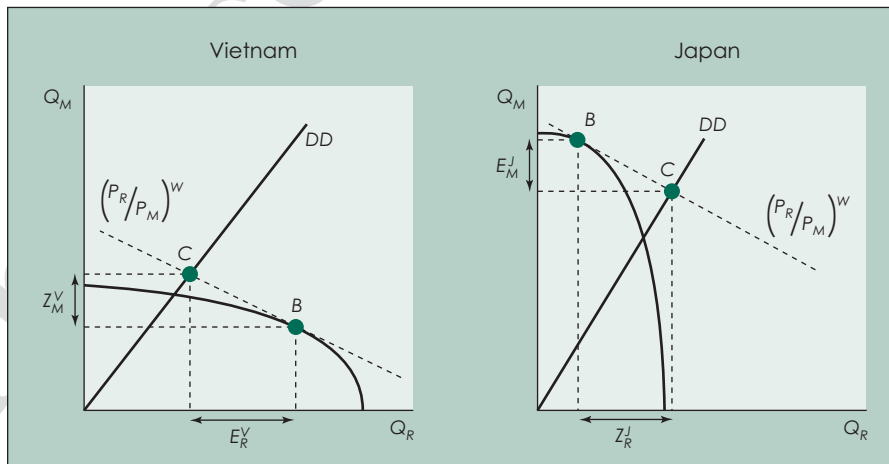


Figure 3.5 Trade Between Vietnam and Japan



⁶ We take up the political implications of these resource movements in Chapter 5.

In Vietnam, production of rice exceeds consumption of rice, and the difference is exported (E_R^V). Production of motorcycles, however, falls short of consumption of motorcycles, and this shortfall is imported (Z_M^V).⁷ In Japan, production of motorcycles exceeds consumption of motorcycles, and the difference is exported (E_M^J). Production of rice, however, falls short of production, and this shortfall is imported (Z_R^J). What we see in Figure 3.5 is that a pattern of comparative advantage, based on differences in supply conditions between two countries, gives rise to a complementary pattern of trade.

What ensures that the quantities imported and exported in Figure 3.5 balance? Suppose that E_R^V were smaller than Z_R^J . If this were the case, there would be excess demand for (or a shortage of) rice in the world market. As we saw in our absolute advantage model of Chapter 2, excess demand for rice would cause P_R^W to rise. Therefore, the $(P_R/P_M)^W$ lines in Figure 3.5 would become steeper. This would direct production in both countries along the PPFs toward rice, alleviating the excess demand.

We mentioned in Chapter 2 that the absolute advantage concept can leave the impression that a country could lack an advantage in anything, and therefore have nothing to export. The concept of comparative advantage clears up this problem. Having an *absolute* disadvantage in a product does not preclude having a *comparative* advantage in that product. Vietnam could have an absolute disadvantage in rice, but still export this product because of its comparative advantage. This is why comparative advantage is a more powerful concept than absolute advantage. Indeed, comparative advantage is perhaps the most central concept in international economics.

Before moving on to discuss the gains from trade, another key concept in international economics, let's summarize what we have shown this far:

Differences in supply conditions among the countries of the world give rise to complementary patterns of comparative advantage. These patterns of comparative advantage, in turn, make possible complementary patterns of international trade.

Gains from Trade

To this point, we have seen that, given a pattern of comparative advantage, it is possible for a country to give up autarky in favor of importing and exporting. But should a country actually do this? We can answer this question by examining Figure 3.4 once again. Notice that the post-trade consumption points C are up and to the right of the autarky consumption points A . This directional relationship between points A and C means that the movement from autarky to trade increases consumption of both rice

⁷ As in Chapter 2, we use Z to denote imports, because the symbols I and M are taken up by investment and money, respectively.

Comparative Advantage and the Environment

An increasing amount of attention is being given to the environmental impacts of trade, and trade between developed and developing countries has received particular scrutiny in this regard. Hiro Lee and David Roland-Holst have examined trade between Japan and Indonesia during the years 1965 to 1990. Lee and Roland-Holst introduce a concept they call *embodied effluent trade (EET)* “to capture the idea that traded commodities embody an environmental service: the amount of pollution emitted domestically when goods are produced for export” (p. 523). They find that, with respect to the bilateral trade between these two countries, Indonesia has developed a comparative advantage in pollution-intensive industries relative to Japan. More specifically, they conclude that “Indonesia’s net embodied effluents per unit exported to Japan are over six times the reverse flow and 29 percent higher than for its exports to the rest of the world. For Japan’s part, imports from Indonesia have about twice the embodied effluent content per unit of its imports from elsewhere. This trend has remained relatively stable over the 1965–90 period, and the result is a sustained and significant transfer of environmental costs between the two countries” (p. 523). Indonesia is experiencing the bulk of environmental damage in its trading relationship with Japan.

Lee and Roland-Holst do not conclude that Indonesia should move away from its trading relationship with Japan. Instead, they recommend the use of *effluent taxes* as a way of reducing the environmental consequences of trade and specialization. In their words, “it is possible to abate industrial pollution while maintaining or even increasing real output when . . . (effluent) taxation is combined with trade” (p. 542). Thus, the environmental impacts of trade require intelligent policy responses.

Source: Lee and Roland-Holst (1997).

and motorcycles. Increased consumption of both goods, in turn, implies that economic welfare has increased. Vietnam and Japan have experienced mutual **gains from trade** based on comparative advantage.⁸

A few caveats are in order. First, the gains from trade occur for the country as a whole. The fact that a country as a whole benefits in the aggregate from trade does not mean that every individual or group within the country benefits. Indeed, as you will see in Chapter 5, there are good reasons to expect that there will be groups that lose from increased trade. These groups will oppose increased trade despite the overall gains to their country. For example, rice producers in Japan have a long history of opposing imports of rice.

Second, in recent years, there has been a great deal of discussion of the impacts of trade based on comparative advantage on the environment. It is sometimes alleged that international trade is almost always detrimental to the environment.⁹ However, the situation is not always this straightforward. Both theoretical and empirical results demonstrate that increased trade can be either good or bad for the environment, and that we need to

Gains from trade

Advantages that accrue to a country from engaging in importing and exporting relationships. In an absolute advantage framework, gains from trade are identified as a net gain between consumer and producer surplus effects. In a comparative advantage framework, gains from trade are identified as an increase in consumption of all goods.

⁸ Our implicit assumption here is the standard one in economics, namely that welfare is determined by consumption levels. For a challenge to this assumption, see Sen (1989).

⁹ See, for example, Daly (1993).

approach the trade and environment issue on a case-by-case basis.¹⁰ A case in which trade based on comparative advantage has detrimental environmental impacts on a country is given in the box.¹¹

Third, some goods are traded that do not contribute to increased welfare. Land mines, heroin, and prostitution services are all traded internationally, but their consumption significantly reduces welfare rather than increases it. For this reason, you need to be careful not to generalize the gains from trade concept too far.¹²

¹⁰See, for example, Runge's *Freer Trade, Protected Environment* (1994), as well as the article by Beghin and Potier (1997).

¹¹We return to the issue of trade and the environment in the context of the World Trade Organization in Chapter 7.

¹²See, for example, Flowers (2001).

Conclusion



Differences in technology and/or factor endowments among the countries of the world can generate patterns of comparative advantage. Although patterns of comparative advantage are *influenced* by patterns of absolute advantage, they are not *determined* by patterns of absolute advantage. Indeed, a country can have a comparative advantage in a good in which it has an absolute disadvantage. Patterns of comparative advantage determine patterns of trade in the world economy and generate mutual gains from trade.

As with our analysis of absolute advantage in Chapter 2, it is important to remember that the gains from trade arising from comparative advantage are for countries as a whole, and not for all individuals and groups within a country. Within any country, there can be both winners and losers from international trade.

Review Exercises



1. What is the difference between *absolute* and *comparative* advantage?
2. Create an example of a comparative advantage model by choosing two countries and two products.
 - a. Draw a diagram describing *autarky* and a *pattern of comparative advantage* for your example.
 - b. Show the transition from autarky to trade in your diagram, label the trade flows, and demonstrate the *gains from trade*.
3. Can you think of any patterns of comparative advantage and trade in the world economy that might have some significant environmental impacts? What are they?

Further Reading and Web Resources



A relatively accessible discussion of some of the material of this chapter can be found in Chapter 2 of Williamson and Milner (1991). A more advanced treatment can be found in Chapter 5 of Markusen et al. (1995). MIT economist Paul Krugman has written an interesting essay on comparative advantage entitled "Ricardo's Difficult Idea." This essay can be found on his Web site at <http://web.mit.edu/krugman/www/ricardo.htm>. Business students will find a relevant discussion of dynamic comparative advantage in Chapter 2 of Meier (1998).

If this chapter has inspired you to travel in Vietnam on a motorcycle, you should first consult Peter M. Geiser's Asian travel guide. Its Web site address is <http://www.pmgeiser.ch/vietnam/transport/motorcycle.htm>. A cautionary view of the role of motorcycles in Vietnam's urban development is found on the International Institute for Sustainable Development's Web site at <http://iisd1.iisd.ca/didigest/special/urban.htm>. IISD also has an interesting statement on the trade and environment issue that can be found at <http://iisd1.iisd.ca/trade/statement.htm>.

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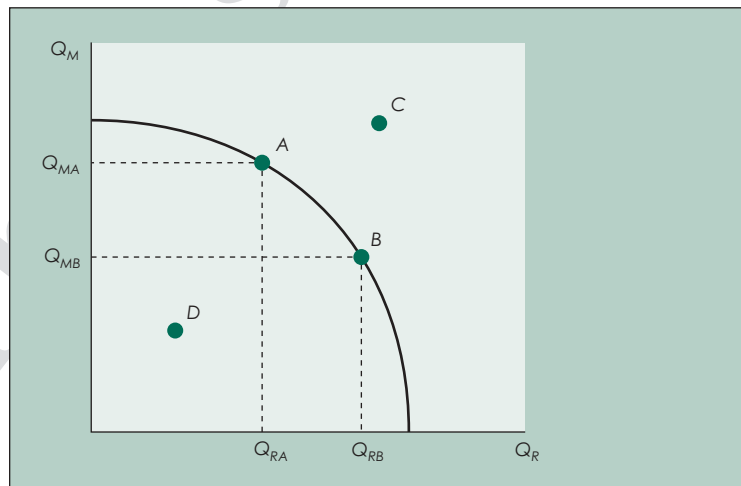


Appendix

The Production Possibilities Frontier

Consider an economy that produces two goods, rice and motorcycles. The quantities in these two sectors we will call Q_R and Q_M , respectively. We will depict the supply side of this economy using a production possibilities frontier (PPF) diagram. The PPF depicts the combinations of output of rice and motorcycles that the economy can produce given its available resources and technology. The PPF is depicted in Figure 3.A1. The PPF is depicted as the *concave* line in this figure. Given the available resources and technology, the economy can produce anywhere on or inside the PPF. Point A, on the PPF itself, is one such point. If the economy were at point A on the PPF, it would be producing Q_{RA} of rice and Q_{MA} of motorcycles. If the economy were to move from point A to point B, the output of rice would increase from Q_{RA} to Q_{RB} . However, the output of motorcycles would *fall* from Q_{MA} to Q_{MB} . The fall in motorcycle output is an example of a very general and very important concept in economics: *opportunity cost*. Opportunity cost is what must be forgone when a particular decision is made. If this economy choos-

Figure 3.A1 The Production Possibilities Frontier



es to move from point A to point B , the decreased production of motorcycles is the opportunity cost of the increased production of rice.

Point C is another production point in Figure 3.A1. It is more desirable than either points A or B , since point C provides more of both rice and motorcycles compared to A and B . Point C , however, is infeasible given the resources and technology of the economy. Point D , inside the PPF, is feasible. However, in comparison to points A and B , it offers less of both rice and motorcycles. Points A and B are said to be *efficient* in that at these points the economy is getting all it can from its scarce resources. This is not true at point D , and consequently, point D is *inefficient*.

How are the relative prices we use in this chapter determined in a PPF? We consider this in Figure 3.A2, using the following steps:

Step 1. The slope of the PPF ($\Delta Q_M / \Delta Q_R$) is the opportunity cost of the good on the horizontal axis, rice. It indicates how many motorcycles must be given up to produce an additional unit of rice.

Step 2. In a perfectly competitive market system, when resources are fully employed, the opportunity costs are fully reflected in relative prices. The relative price of rice, the good on the horizontal axis, is (P_R / P_M) .

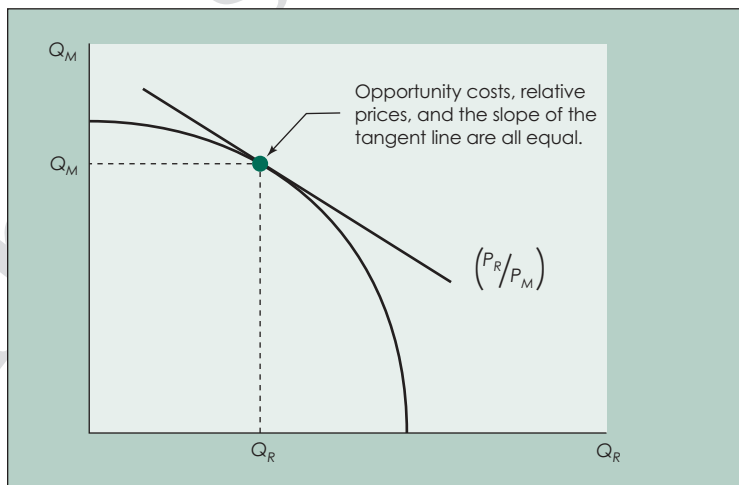
Step 3. A tangent line to the PPF shares the same slope of the PPF, namely $(\Delta Q_M / \Delta Q_R)$.

Step 4. Given Steps 1, 2, and 3, we can see that a tangent line to the PPF has a slope equal to the relative price of the good on the horizontal axis, (P_R / P_M) .

This is the result we use in this chapter and indicated in Figure 3.A2.

Does the result of step 4 that the slope of a tangent line represents the relative price of rice, the good on the horizontal axis, make any sense? Let's

Figure 3.A2 Relative Prices and the Production Possibilities Frontier



look at this a bit further in Figure 3.A3. Suppose that, from point A , we want to *increase* the output of rice from Q_{RA} to Q_{RB} . Because there are opportunity costs of production represented by the PPF, this implies a *decrease* in the output of motorcycles from Q_{MA} to Q_{MB} . As production moves from point A to point B , the slope of the PPF increases, reflecting increasing opportunity costs of rice production. To offset these increasing opportunity costs, the relative price of rice must rise. Therefore, increasing the output of rice requires increasing its relative price from $(P_R/P_M)_A$ to the steeper $(P_R/P_M)_B$. This supply relationship, equivalent to the upward-sloping rice supply curve of Chapter 2, indeed makes economic sense.

Figure 3.A3 An Increase in Rice Output

