
CHAPTER 3

Comparative Advantage (Revised)

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. Indeed motorcycles have been all the rage in Vietnam. Originally, the most desirable motorcycle was the Honda Dream, but subsequently attention turned to the Honda Wave. These brands are so popular that copies of them are made in China and exported to 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. 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.

In order to understand comparative advantage, we will draw on the analytical elements of countries, sectors and factors of production. These elements will be embedded in 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 for a brief introduction.

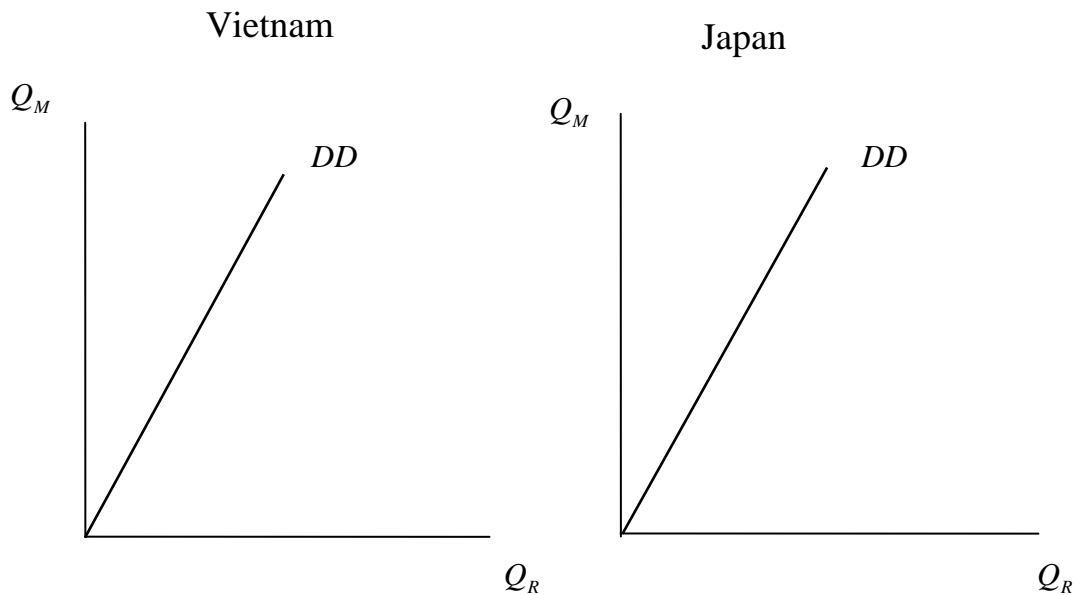
Autarky and Comparative Advantage

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 are such that these two goods are consumed in the *same, fixed proportions*.¹ This assumption is depicted in Figure 3.1. In the diagrams for Vietnam and Japan, the quantity of rice (Q_R)

¹ 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 in trade theory such as Markusen et al. (1995).

is measured on the horizontal axes, and the quantity of motorcycles (Q_M) is measured on the vertical axes. Since 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.² As we will see below, movements up and down a demand diagonal can also be viewed as changes in economic welfare.

Figure 3.1. Demand Diagonals in Vietnam and Japan



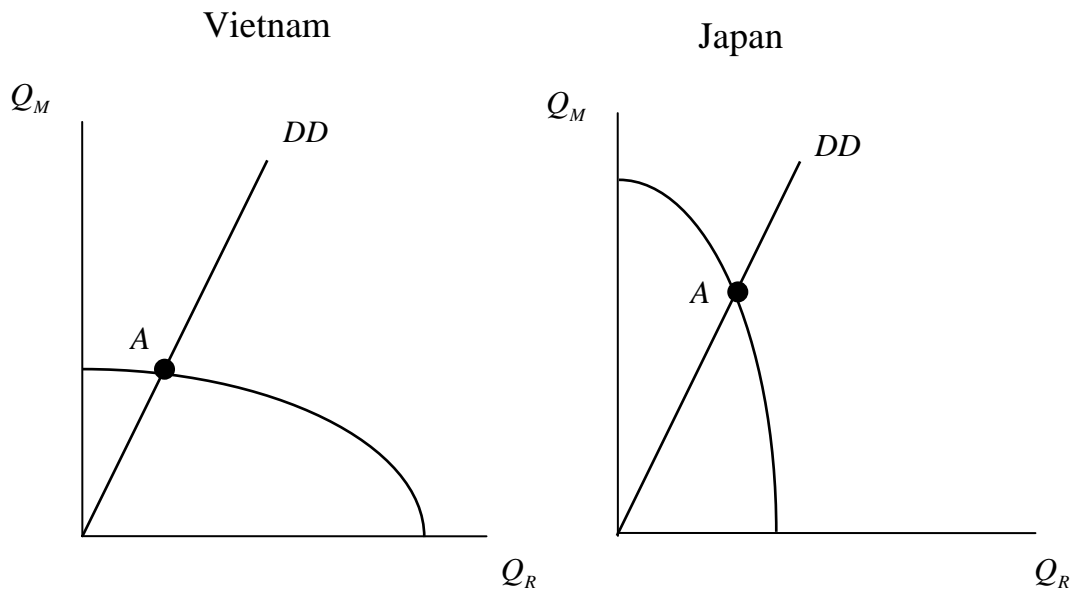
As we said in Chapter 2, trade often arises due to differences in supply conditions. Therefore, we once again allow supply conditions to differ between Vietnam and Japan. In particular, we assume that resource or technology conditions in Vietnam give it a **production possibilities frontier** (PPF) that 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

² 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. We take the DD approach here to avoid using indifference curves, with which many students are not familiar. The results we obtain are the same as those derived with the more advanced indifference curve concept.

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 or not produced because resources have switched to rice.

Figure 3.2 Demand and Production Possibility Frontiers in Vietnam and Japan



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 PPFs where the demand diagonal crosses it is the relative price of rice, $\left(\frac{P_R}{P_M}\right)$. We represent this in Figure 3.3 by drawing in the *tangent* lines to the PPFs at the point where

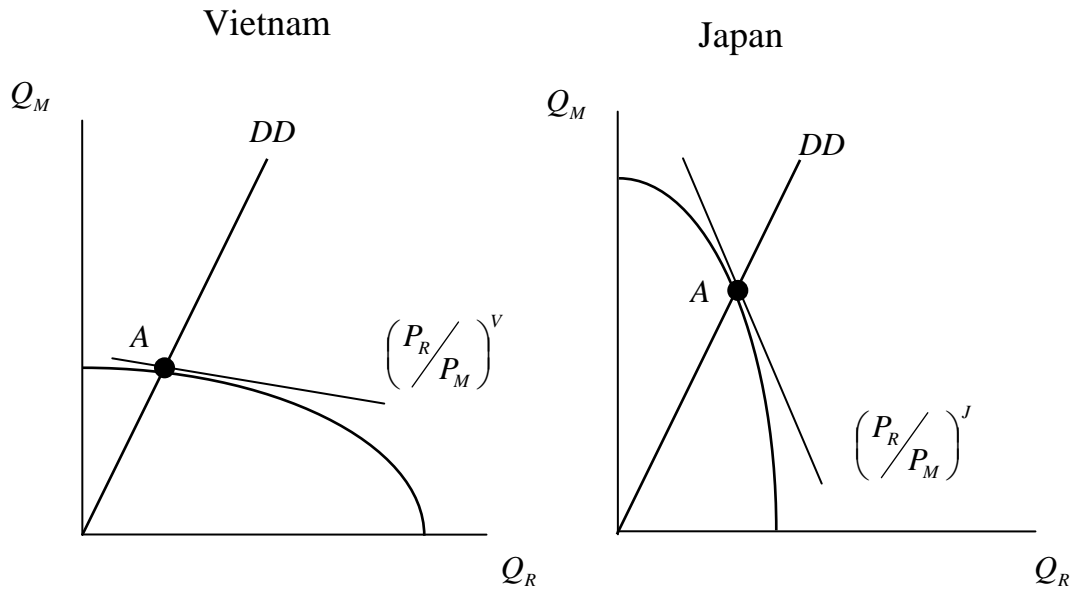
the demand lines cross them at points A .³ Points A in the two PPFs of Figure 3.2 represent the two countries under **autarky** in isolation from the rest of the world economy.

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:

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

This equation says that the relative price of rice is lower in Vietnam than in Japan. Since 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.

Figure 3.3. Relative Prices in Vietnam and Japan under Autarky



We need to note one very important thing about Equation 3.1. This comparative advantage inequality involves *four prices* rather than *two prices* as in the advantage inequality of Equation 2.1. This difference has an immediate and important implication: a

³ We discuss this further in the appendix to this chapter.

country can have a *comparative advantage* in a good in which it has an *absolute disadvantage*.⁴ This is one reason why the comparative advantage concept is more powerful than the absolute advantage concept.

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, given its *comparative* advantage in motorcycles, Japan can import rice even if it has an *absolute* advantage in rice production.

International Trade

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

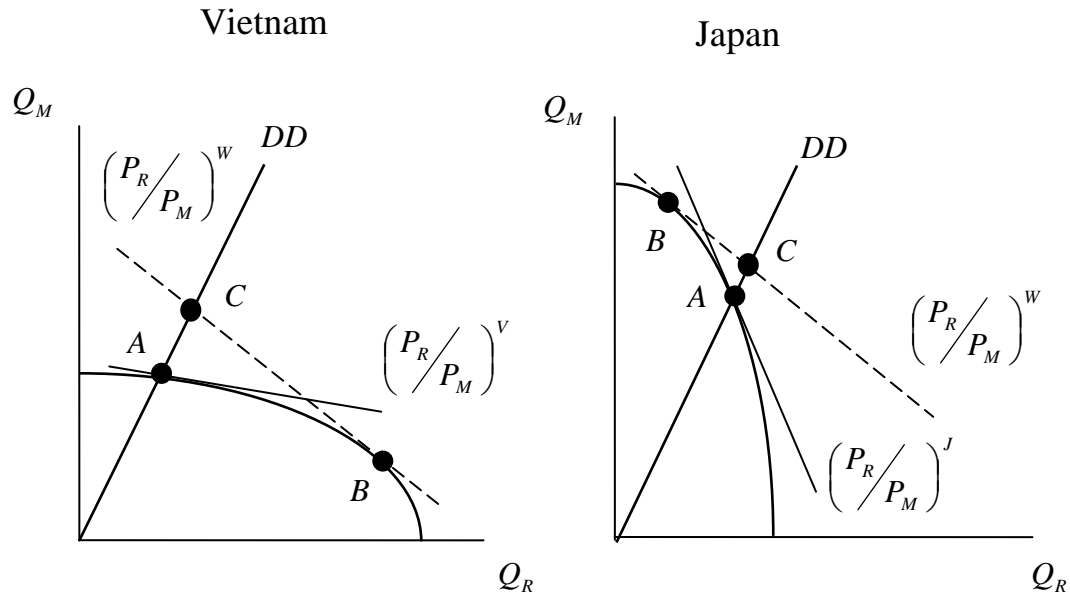
$$\left(\frac{P_R}{P_M}\right)^V < \left(\frac{P_R}{P_M}\right)^W < \left(\frac{P_R}{P_M}\right)^J \quad (3.2)$$

This situation is depicted in Figure 3.4. The world price ratio here is depicted with dashed lines that have the slope $\left(\frac{P_R}{P_M}\right)^W$. 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, while 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 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

⁴ 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.

and other resources must be moved from one sector of the economy to another in the process.⁵

Figure 3.4. Autarky and Comparative Advantage in Vietnam and Japan



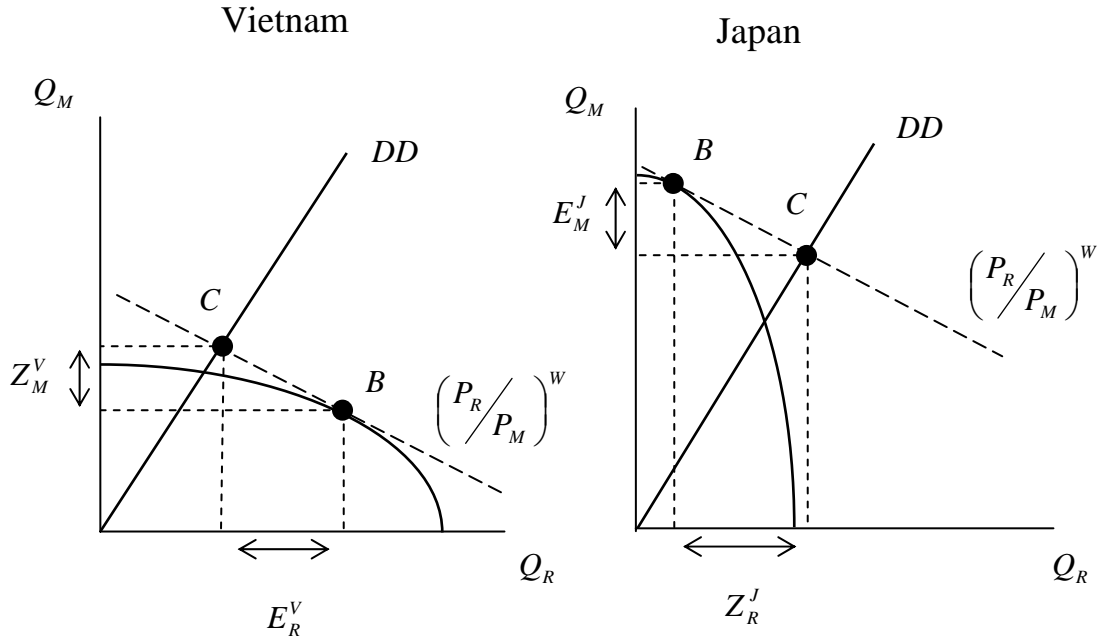
Consumption points for Vietnam and Japan must be along our diagonal demand lines. These points, labeled *C* in Figure 3.4, occur where the dashed world price lines intersect the demand lines. Why is this? Both consumption and production must respect world prices. That is, *both* points *B* and *C* must 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. 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).⁶ 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.

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

⁶ As in Chapter 2, we use *Z* to denote imports, since the symbols *I* and *M* are taken up by investment and money, respectively.

Figure 3.5. Trade between Vietnam and Japan



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. The empirical application of the concept in the form of *revealed comparative advantage* is discussed in the accompanying box.

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

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.

Revealed Comparative Advantage

How is the notion of comparative advantage applied in practice? Beginning with Belassa (1965), the standard practice is to examine actual trade flows of a country to understand what is known as *revealed comparative advantage*. This is done in relative terms to a set of comparison countries or to a single comparison country. What has come to be known as the *Belassa index (BI)* is calculated for country *i* in sector *j* as follows:

$$BI_j^i = \frac{\text{share of sector } j \text{ in country } i\text{'s exports}}{\text{share of sector } j \text{ in reference country exports}}$$

Comparative advantage is said to be “revealed” when *BI* is greater than one. As is evident in this formula, however, a key question is what country or countries to use as a point of reference in the denominator. Another issue is how to handle *intra*-industry trade, a topic discussed in Chapter 4. Despite these problems, revealed comparative advantage has been used for a long time by a number of researchers to understand evolving patterns of comparative advantage in the world economy.

Sources: Belassa (1965) and Van Marrewijk (2002)

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 *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.⁷

⁷ Our implicit assumption here is the standard one in economics, namely that welfare is determined by consumption levels. For a well-known challenge to this assumption, see Sen (1987).

As in Chapter 2, 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. To foreshadow our discussion in Chapter 5, for example, rice producers in Japan have a long history of opposing imports of rice.

Second, in recent years, there has also 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. 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 approach the trade and environment issue on a case-by-case basis. This issue is discussed in the accompanying box.

Comparative Advantage and the Environment

Given the steady advance of the volume of trade discussed in Chapter 1 and the growing concern about environmental issues worldwide, it is natural to ask what role trade and comparative advantage play in levels of pollution and other forms of environmental degradation. While this issue is largely empirical, trade and environmental economists have identified three means through which trade can have positive or negative environmental impacts: a scale or growth effect, an activity composition effect, and a technique effect.

The *scale or growth effect* refers to the possibility that trade can stimulate the overall level of economic activity that can, in turn, have environmental repercussions. This effect holds constant the composition of economic activity and production technology. For example, trade might stimulate the overall use of scarce natural resources or the overall level of pollution. It is here that we encounter the “inverted U” hypothesis that environmental degradation first increases and then decreases with the level of economic activity or gross domestic product (GDP). This inverted U relationship is sometimes also known as the environmental Kuznets curve or EKC.

The *activity composition effect* refers to something that we have seen in this chapter, namely that trade changes the location of countries on the PPF. This effect holds constant the overall level of economic activity and the production technology. Depending on the pattern of comparative advantage, pollution intensive sectors such as chemicals and metals can either increase or decrease their share in the total output of a country. López and Islam (2009) state a general rule of thumb that physical capital and natural resource intensive sectors tend to be more polluting than human capital intensive sectors.

The *technique effect* holds constant both the overall level of economic activity and the sectoral composition of that activity. It refers to the possibility that the pollutant

intensity of a given level of output in a sector can change, sometimes for the better. López and Islam (2009) note that “The technique effect of trade has been found to reduce certain pollutants, particularly air pollutants, but the effects on other environmental factors (are) less significant.” The technique effect also becomes applicable in the spread of green or environmentally-friendly technologies on which much hope has been placed in recent years.

The *net effect* of trade on the environment is, as we stated above, an empirical issue, and the case of NAFTA and the environment is discussed in a box in Chapter 8. But in principle, this net effect would reflect the combined impacts of the scale or growth effect, the activity composition effect, and the technique effect. These are the lenses through which economists view the trade and environment issue.

Sources: Beghin and Potier (1997) and López and Islam (2009)

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.⁸

Conclusion

Differences in technology and/or factor endowments among the countries of the world can generate patterns of comparative advantage. While patterns of comparative advantage can be *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. This is the issue of the political economy of trade that we take up in Chapter 5.

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.

⁸ See, for example, Reinert (2004).

- 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 concise introduction to comparative advantage can be found in Maneschi (2009) and a historical perspective can be found in Maneschi (1998). A more advanced treatment can be found in Chapter 5 of Markusen et al. (1995). Krugman (1998) has also written an interesting essay on comparative advantage entitled “Ricardo’s Difficult Idea” that is very much worth reading. *The Economist* maintains a set of research tools on its website, including a set of terms at: <http://www.economist.com/research/economics>. You can read their entry on comparative advantage using their search facility. On motorcycle use in Vietnam, see Truitt (2008).

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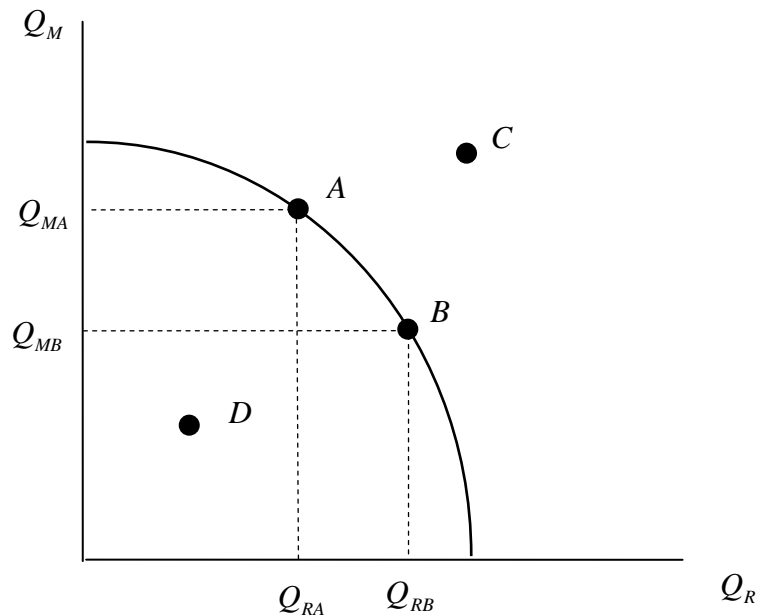
Appendix: The Production Possibilities Frontier

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 3.6. The PPF is depicted as *concave* with respect to the origin 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 motorcycles 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 chooses 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 3.6. 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*.⁹

⁹ Recall that the concept of efficiency in economics refers to *allocative efficiency*, not technological efficiency.

Figure 3.6. The Production Possibilities Frontier



How are the relative prices we use in this chapter determined in a PPF? We consider this in Figure 3.7 using the following steps:

Step 1. The slope of the PPF $\left(\frac{\Delta Q_M}{\Delta Q_R}\right)$ 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.

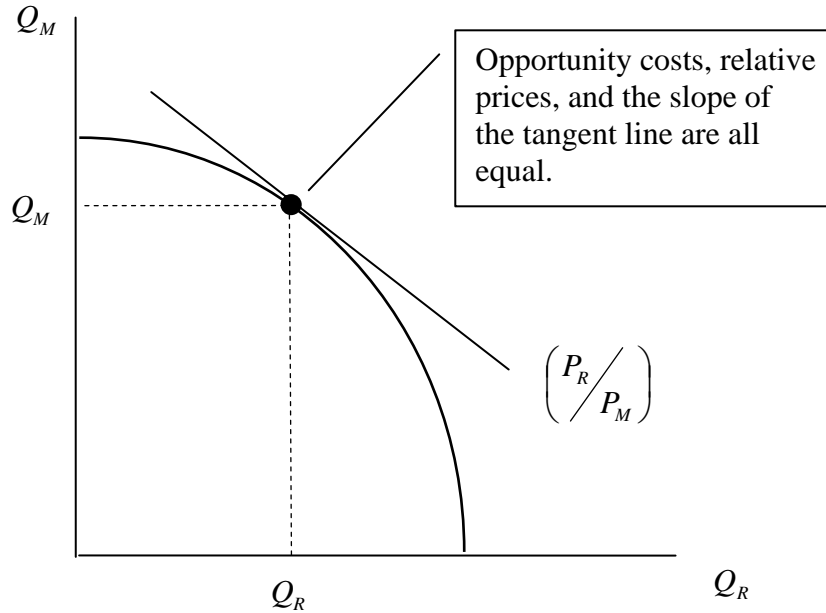
Step 2. In a perfectly competitive, market system, when resources are fully employed, the opportunity costs are fully reflected in relative prices. The relative price of rice, the good on the horizontal axis, is $\left(\frac{P_R}{P_M}\right)$.

Step 3. A tangent line to the PPF shares the same slope of the PPF, namely $\left(\frac{\Delta Q_M}{\Delta Q_R}\right)$.

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, $\left(\frac{P_R}{P_M}\right)$.

This is the result we use in this chapter and indicated in Figure 3.7.

Figure 3.7. Relative Prices and the Production Possibilities Frontier



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 look at this a bit further in Figure 3.8. Suppose that, from point A , we want to *increase* the output of rice from Q_{RA} to Q_{RB} . Since 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 $\left(\frac{P_R}{P_M}\right)_A$ to the steeper $\left(\frac{P_R}{P_M}\right)_B$. This supply relationship, equivalent to the upward-sloping rice supply curve of Chapter 2, indeed makes economic sense.

Figure 3.8. An Increase in Rice Output

