

Demand and Supply, Offer Curves, and the Terms of Trade

LEARNING GOALS:

After reading this chapter, you should be able to:

- Show how the equilibrium price at which trade takes place is determined by demand and supply
- Show how the equilibrium price at which trade takes place is determined with offer curves
- Explain the meaning of the terms of trade and how they changed over time for the United States and other countries

4.1 Introduction

We saw in Chapter 3 that a difference in relative commodity prices between two nations in isolation is a reflection of their comparative advantage and forms the basis for mutually beneficial trade. The equilibrium-relative commodity price at which trade takes place was then found by trial and error at the level at which trade was balanced. In this chapter, we present a more rigorous theoretical way of determining the equilibrium-relative commodity price with trade. We will first do this with partial equilibrium analysis (i.e., by utilizing demand and supply curves) and then by the more complex general equilibrium analysis, which makes use of offer curves.

Section 4.2 shows how the equilibrium-relative commodity price with trade is determined with demand and supply curves (i.e., with partial equilibrium analysis). We then go on to general equilibrium analysis and derive the offer curves of Nation 1 and Nation 2 in Section 4.3. In Section 4.4, we examine how the interaction of the offer curves of the two nations defines the equilibrium-relative commodity price with trade. In Section 4.5, we look at the relationship between general and partial equilibrium analyses. Finally, Section 4.6 examines the meaning, measurement, and importance of the terms of trade. The appendix to this chapter presents the *formal* derivation of offer curves and examines the case of multiple and unstable equilibria.

4.2 The Equilibrium-Relative Commodity Price with Trade—Partial Equilibrium Analysis

Figure 4.1 shows how the equilibrium-relative commodity price with trade is determined by partial equilibrium analysis. Curves D_X and S_X in panels A and C of Figure 4.1 refer to the demand and supply curves for commodity X of Nation 1 and Nation 2, respectively. The vertical axes in all three panels of Figure 4.1 measure the relative price of commodity X (i.e., P_X/P_Y , or the amount of commodity Y that a nation must give up to produce one additional unit of X). The horizontal axes measure the quantities of commodity X.

Panel A of Figure 4.1 shows that in the absence of trade, Nation 1 produces and consumes at point A at the relative price of X of P_1 , while Nation 2 produces and consumes at point A' at P_3 . With the opening of trade, the relative price of X will be between P_1 and P_3 if both nations are large. At prices above P_1 , Nation 1 will supply (produce) more than it will demand (consume) of commodity X and will export the difference or excess supply (see panel A). Alternatively, at prices below P_3 , Nation 2 will demand a greater quantity of commodity X than it produces or supplies domestically and will import the difference or excess demand (see panel C).

Specifically, panel A shows that at P_1 , the quantity supplied of commodity X (QS_X) equals the quantity demanded of commodity X (QD_X) in Nation 1, and so Nation 1 exports nothing of commodity X. This gives point A* on curve S (Nation 1's supply curve of exports) in panel B. Panel A also shows that at P_2 , the excess of BE of QS_X over QD_X represents the quantity of commodity X that Nation 1 would export at P_2 . This is equal to B^*E^* in panel B and defines point E^* on Nation 1's S curve of exports of commodity X.

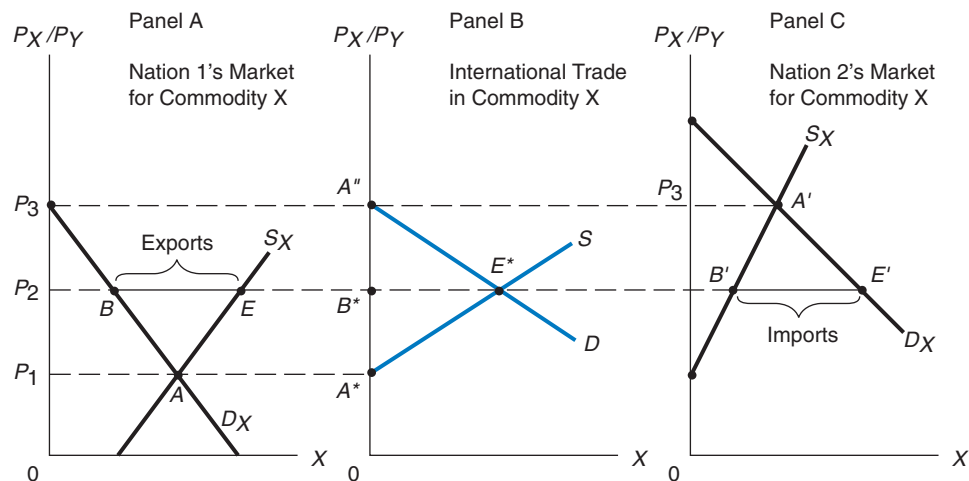


FIGURE 4.1. The Equilibrium-Relative Commodity Price with Trade with Partial Equilibrium Analysis. At P_X/P_Y larger than P_1 , Nation 1's excess supply of commodity X in panel A gives rise to Nation 1's supply curve of exports of commodity X (S) in panel B. On the other hand, at P_X/P_Y lower than P_3 , Nation 2's excess demand for commodity X in panel C gives rise to Nation 2's demand for imports of commodity X (D) in panel B. Panel B shows that only at P_2 does the quantity of imports of commodity X demanded by Nation 2 equal the quantity of exports supplied by Nation 1. Thus, P_2 is the equilibrium P_X/P_Y with trade. At $P_X/P_Y > P_2$, there will be an excess supply of exports of commodity X, and this will drive P_X/P_Y down to P_2 . At $P_X/P_Y < P_2$, there will be an excess demand for imports of X, and this will drive P_X/P_Y up to P_2 .

On the other hand, panel C shows that at P_3 , $QD_X = QS_X$ (point A'), so Nation 2 does not demand any *imports* of commodity X. This defines point A'' on Nation 2's demand curve for imports of commodity X (D) in panel B. Panel C also shows that at P_2 , the excess $B'E'$ of QD_X over QS_X represents the quantity of commodity X that Nation 2 would import at P_2 . This is equal to B^*E^* in panel B and defines point E^* on Nation 2's D curve of imports of commodity X.

At P_2 , the quantity of imports of commodity X demanded by Nation 2 ($B'E'$ in panel C) equals the quantity of exports of commodity X supplied by Nation 1 (BE in panel A). This is shown by the intersection of the D and S curves for trade in commodity X in panel B. Thus, P_2 is the equilibrium-relative price of commodity X with trade. From panel B we can also see that at $P_X/P_Y > P_2$ the quantity of exports of commodity X supplied exceeds the quantity of imports demanded, and so the relative price of X (P_X/P_Y) will fall to P_2 . On the contrary, at $P_X/P_Y < P_2$, the quantity of imports of commodity X demanded exceeds the quantity of exports supplied, and P_X/P_Y will rise to P_2 .

The same could be shown with commodity Y. Commodity Y is exported by Nation 2 and imported by Nation 1. At any relative price of Y higher than equilibrium, the quantity of

■ CASE STUDY 4-1 Demand, Supply, and the International Price of Petroleum

Table 4.1 shows that the price of petroleum fluctuated widely from 1972 to 2011. As a result of supply shocks during the Arab-Israeli War in fall 1973 and the Iranian revolution in 1979–1980, OPEC (Organization of Petroleum Exporting Countries) was able to increase the price of petroleum from an average of \$2.89 per barrel in 1972 to \$11.60 in 1974 and to \$36.68 per barrel in 1980. These increases stimulated energy conservation and expanded exploration and petroleum production by non-OPEC countries. In the face of excess supplies during the 1980s and 1990s, OPEC was unable to prevent the price of petroleum from falling to a low of

\$14.17 in 1986 and \$13.07 in 1998. The price of petroleum then rose to \$28.23 in 2000 and \$104.00 in 2011 (the all-time monthly high was \$132.60 in July 2008).

If we consider, however, that all prices have risen over time, we can see from Table 4.1 that the real (i.e., inflation-adjusted) price of petroleum rose from \$2.89 per barrel in 1972 to \$9.51 in 1974 and to \$17.14 in 1980; it then fell to \$4.69 in 1986 and \$2.90 in 1998, but it subsequently rose to \$5.73 in 2000 and \$14.83 in 2008, and it was \$15.80 in 2011. Thus, the real price of petroleum was 5.47 times higher ($15.80/2.89$) in 2011 than in 1972, rather than by 35.99 times in nominal prices.

■ TABLE 4.1. Nominal and Real Petroleum Prices, Selected Years, 1972–2011

Year	1972	1973	1974	1978	1979	1980	1985
Petroleum Prices (\$/barrel)	2.89	3.24	11.60	13.39	30.21	36.68	27.37
Real Petroleum Prices (\$/barrel)	2.89	3.00	9.51	7.70	15.82	17.14	9.34
Year	1986	1990	1998	2000	2005	2008	2011
Petroleum Prices (\$/barrel)	14.17	22.99	13.07	28.23	53.40	97.03	140.00
Real Petroleum Prices (\$/barrel)	4.69	6.51	2.90	5.73	8.99	14.83	15.80

Source: Elaborated from data in International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, various issues).

exports of Y supplied by Nation 2 would exceed the quantity of imports of Y demanded by Nation 1, and the relative price of Y would fall to the equilibrium level. On the other hand, at any P_Y/P_X below equilibrium, the quantity of imports of Y demanded would exceed the quantity of exports of Y supplied, and P_Y/P_X would rise to the equilibrium level. (You will be asked to show this graphically in Problem 1.) Case Study 4-1 shows the international price of petroleum in nominal and real (i.e., inflation-adjusted) terms from 1972 to 2010, while Case Study 4-2 shows the index of export to import prices for the United States over the same period.

■ CASE STUDY 4-2 The Index of Export to Import Prices for the United States

Figure 4.2 shows the index of U.S. export to import prices or terms of trade from 1972 to 2011. This index declined almost continuously from 1972 to 1980, it rose from 1980 to 1986, and then it remained in the 96–107 range (with 2000 = 100), except in 2008, when it fell to 92. The decline in the index was particularly large during the two “oil shocks” of 1973–74 and 1979–80, and from 2002 to 2008 when the price of petroleum and other

primary commodities imports rose sharply. From the figure, we see that the average *relative* price of U.S. exports declined from 127.1 in 1972 to 90.2 in 1980, and 91.8 in 2008, and it was 94.6 in 2011. This means that, on the average, the United States had to export 34 percent more of its goods and services in 1980, 32 percent more in 2008, and 29 percent more in 2011 to import the same quantity of goods and services that it did in 1972.

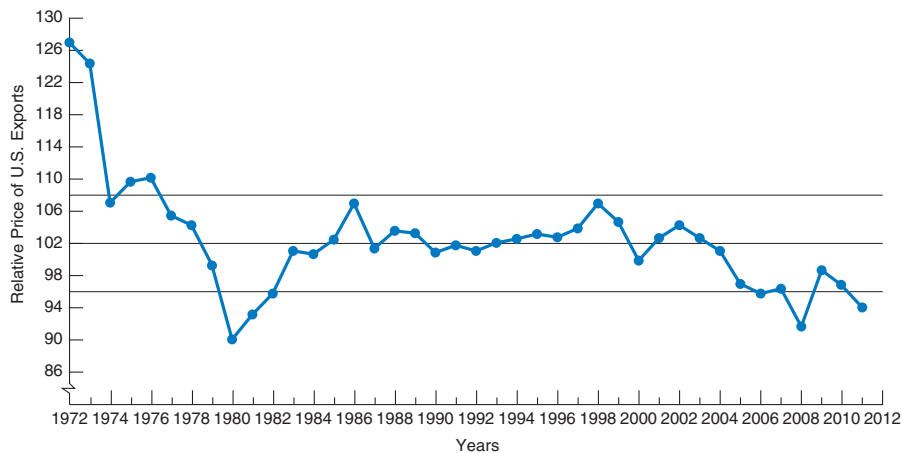


FIGURE 4.2. Index of Relative U.S. Export Prices, 1972–2011 (2000 = 100).

The index of U.S. export to import prices declined from 127.1 in 1972 to 107.2 in 1974 (due to the sharp increase in petroleum prices in 1973 and 1974) and to 90.2 in 1980, as a result of the second “oil shock.” The index then rose to 107.1 in 1986, but it fell to 91.8 in 2008 as a result of the sharp increase in the price of petroleum and other primary commodities imports. The index was 94.6 in 2011.

Source: Elaborated from data in International Monetary Fund, *International Financial Statistics* Washington, D.C.: IMF, various issues.

4.3 Offer Curves

In this section, we define offer curves and note their origin. We then derive the offer curves of the two nations and examine the reasons for their shape.

4.3A Origin and Definition of Offer Curves

Offer curves (sometimes referred to as **reciprocal demand curves**) were devised and introduced into international economics by *Alfred Marshall* and *Ysidro Edgeworth*, two British economists, at the turn of the twentieth century. Since then, offer curves have been used extensively in international economics, especially for pedagogical purposes.

The offer curve of a nation shows how much of its import commodity the nation demands for it to be willing to supply various amounts of its export commodity. As the definition indicates, offer curves incorporate elements of both demand and supply. Alternatively, we can say that the offer curve of a nation shows the nation's willingness to import and export at various relative commodity prices.

The offer curve of a nation can be derived rather easily and somewhat informally from the nation's production frontier, its indifference map, and the various hypothetical relative commodity prices at which trade could take place. The formal derivation of offer curves presented in the appendix is based on the work of *James Meade*, another British economist and Nobel Prize winner.

4.3B Derivation and Shape of the Offer Curve of Nation 1

In the left panel of Figure 4.3, Nation 1 starts at the no-trade (or autarky) point *A*, as in Figure 3.3. If trade takes place at $P_B = P_X/P_Y = 1$, Nation 1 moves to point *B* in production, trades 60X for 60Y with Nation 2, and reaches point *E* on its indifference curve III. (So far this is exactly the same as in Figure 3.4.) This gives point *E* in the right panel of Figure 4.3.

At $P_F = P_X/P_Y = 1/2$ (see the left panel of Figure 4.3), Nation 1 would move instead from point *A* to point *F* in production, exchange 40X for 20Y with Nation 2, and reach point *H* on its indifference curve II. This gives point *H* in the right panel. Joining the origin with points *H* and *E* and other points similarly obtained, we generate Nation 1's offer curve in the right panel. The offer curve of Nation 1 shows how many imports of commodity Y Nation 1 requires to be willing to export various quantities of commodity X.

To keep the left panel simple, we omitted the autarky price line $P_A = 1/4$ and indifference curve I tangent to the production frontier and P_A at point *A*. Note that P_A , P_F , and P_B in the right panel refer to the same P_X/P_Y as P_A , P_F , and P_B in the left panel because they refer to the same *absolute* slope.

The offer curve of Nation 1 in the right panel of Figure 4.3 lies above the autarky price line of $P_A = 1/4$ and bulges toward the X-axis, which measures the commodity of its comparative advantage and export. To induce Nation 1 to export more of commodity X, P_X/P_Y must rise. Thus, at $P_F = 1/2$, Nation 1 would export 40X, and at $P_B = 1$, it would export 60X. There are two reasons for this: (1) Nation 1 incurs increasing opportunity costs in producing more of commodity X (for export), and (2) the more of commodity Y and the less of commodity X that Nation 1 consumes with trade, the more valuable to the nation is a unit of X at the margin compared with a unit of Y.

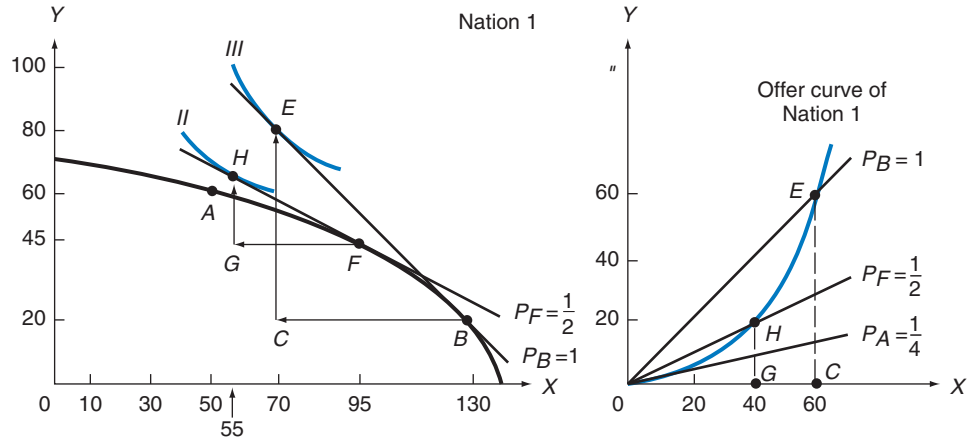


FIGURE 4.3. Derivation of the Offer Curve of Nation 1.

In the left panel, Nation 1 starts at pretrade-equilibrium point A. If trade takes place at $P_B = 1$, Nation 1 moves to point B in production, exchanges 60X for 60Y with Nation 2, and reaches point E. This gives point E in the right panel. At $P_F = \frac{1}{2}$ in the left panel, Nation 1 would move instead from point A to point F in production, exchange 40X for 20Y with Nation 2, and reach point H. This gives point H in the right panel. Joining the origin with points H and E in the right panel, we generate Nation 1's offer curve. This shows how many imports of commodity Y Nation 1 requires to be willing to export various quantities of commodity X.

4.3c Derivation and Shape of the Offer Curve of Nation 2

In the left panel of Figure 4.4, Nation 2 starts at the autarky equilibrium point A' , as in Figure 3.3. If trade takes place at $P_{B'} = P_X/P_Y = 1$, Nation 2 moves to point B' in production, exchanges 60Y for 60X with Nation 1, and reaches point E' on its indifference curve III'. (So far this is exactly the same as in Figure 3.4.) Trade triangle $B'C'E'$ in the left panel of Figure 4.4 corresponds to trade triangle $O'C'E'$ in the right panel, and we get point E' on Nation 2's offer curve.

At $P_{F'} = P_X/P_Y = 2$ in the left panel, Nation 2 would move instead to point F' in production, exchange 40Y for 20X with Nation 1, and reach point H' on its indifference curve II'. Trade triangle $F'G'H'$ in the left panel corresponds to trade triangle $O'G'H'$ in the right panel, and we get point H' on Nation 2's offer curve. Joining the origin with points H' and E' and other points similarly obtained, we generate Nation 2's offer curve in the right panel. The offer curve of Nation 2 shows how many imports of commodity X Nation 2 demands to be willing to export various quantities of commodity Y.

Once again, we omitted the autarky price line $P_{A'} = 4$ and indifference curve I' tangent to the production frontier and $P_{A'}$ at point A' . Note that $P_{A'}$, $P_{F'}$, and $P_{B'}$ in the right panel refer to the same P_X/P_Y as $P_{A'}$, $P_{F'}$, and $P_{B'}$ in the left panel because they refer to the same *absolute slope*.

The offer curve of Nation 2 in the right panel of Figure 4.4 lies *below* its autarky price line of $P_{A'} = 4$ and bulges toward the Y-axis, which measures the commodity of its comparative advantage and export. To induce Nation 2 to export more of commodity Y, the

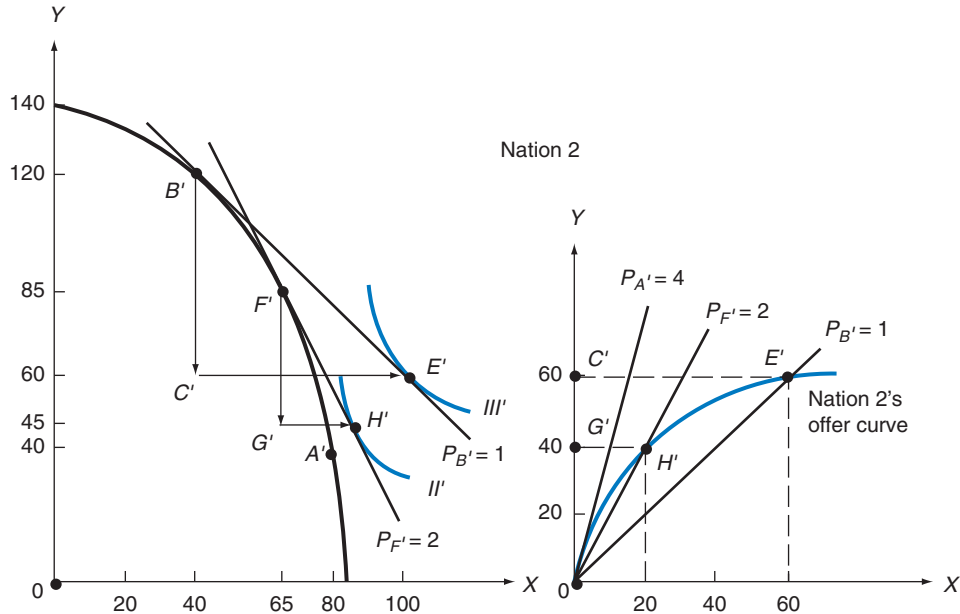


FIGURE 4.4. Derivation of the Offer Curve of Nation 2.

In the left panel, Nation 2 starts at pretrade equilibrium point A' . If trade takes place at $P_{B'} = 1$, Nation 2 moves to point B' in production, exchanges 60Y for 60X with Nation 1, and reaches point E' . This gives point E' in the right panel. At $P_{F'} = 2$ in the left panel, Nation 2 would move instead from A' to F' in production, exchange 40Y for 20X with Nation 1, and reach H' . This gives point H' in the right panel. Joining the origin with points H' and E' in the right panel, we generate Nation 2's offer curve. This shows how many imports of commodity X Nation 2 demands to be willing to supply various amounts of commodity Y for export.

relative price of Y must rise. This means that its reciprocal (i.e., P_X/P_Y) must fall. Thus, at $P_{F'} = 2$, Nation 2 would export 40Y, and at $P_{B'} = 1$, it would export 60Y. Nation 2 requires a higher relative price of Y to be induced to export more of Y because (1) Nation 2 incurs increasing opportunity costs in producing more of commodity Y (for export), and (2) the more of commodity X and the less of commodity Y that Nation 2 consumes with trade, the more valuable to the nation is a unit of Y at the margin compared with a unit of X.

4.4 The Equilibrium-Relative Commodity Price with Trade—General Equilibrium Analysis

The intersection of the offer curves of the two nations defines the equilibrium-relative commodity price at which trade takes place between them. Only at this equilibrium price will trade be balanced between the two nations. At any other relative commodity price, the *desired* quantities of imports and exports of the two commodities would not be equal. This would put pressure on the relative commodity price to move toward its equilibrium level. This is shown in Figure 4.5.

The offer curves of Nation 1 and Nation 2 in Figure 4.5 are those derived in Figures 4.3 and 4.4. These two offer curves intersect at point E , defining equilibrium $P_X/P_Y = P_B = P_{B'} = 1$. At P_B , Nation 1 offers 60X for 60Y (point E on Nation 1's offer curve), and Nation 2 offers exactly 60Y for 60X (point E' on Nation 2's offer curve). Thus, trade is in equilibrium at P_B .

At any other P_X/P_Y , trade would not be in equilibrium. For example, at $P_F = 1/2$, the 40X that Nation 1 would export (see point H in Figure 4.5) would fall short of the imports of commodity X demanded by Nation 2 at this relatively low price of X. (This is given by a point, not shown in Figure 4.5, where the extended price line P_F crosses the extended offer curve of Nation 2.)

The excess import demand for commodity X at $P_F = 1/2$ by Nation 2 tends to drive P_X/P_Y up. As this occurs, Nation 1 will supply more of commodity X for export (i.e., Nation 1 will move up its offer curve), while Nation 2 will reduce its import demand for commodity X (i.e., Nation 2 will move down its offer curve). This will continue until supply and demand become equal at P_B . The pressure for P_F to move toward P_B could also be explained in terms of commodity Y and arises at any other P_X/P_Y , such as $P_F \neq P_B$.

Note that the equilibrium-relative commodity price of $P_B = 1$ with trade (determined in Figure 4.5 by the intersection of the offer curves of Nation 1 and Nation 2) is identical to that found by trial and error in Figure 3.4. At $P_B = 1$, both nations happen to gain equally from trade (refer to Figure 3.4).

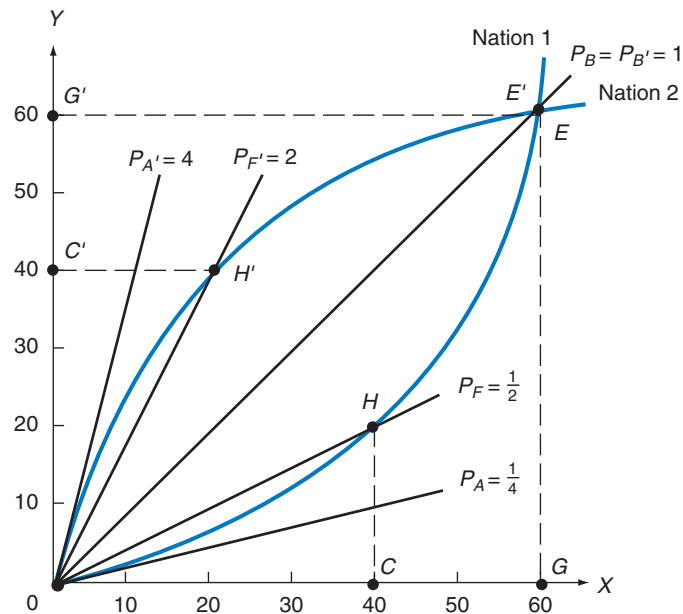


FIGURE 4.5. Equilibrium-Relative Commodity Price with Trade.

The offer curves of Nation 1 and Nation 2 are those of Figures 4.3 and 4.4. The offer curves intersect at point E , defining the equilibrium-relative commodity price $P_B = 1$. At P_B , trade is in equilibrium because Nation 1 offers to exchange 60X for 60Y and Nation 2 offers exactly 60Y for 60X. At any $P_X/P_Y < 1$, the quantity of exports of commodity X supplied by Nation 1 would fall short of the quantity of imports of commodity X demanded by Nation 2. This would drive the relative commodity price up to the equilibrium level. The opposite would be true at $P_X/P_Y > 1$.

4.5 Relationship between General and Partial Equilibrium Analyses

We can also illustrate equilibrium for our two nations with demand and supply curves and thus show the relationship between the general equilibrium analysis of Section 4.4 and the partial equilibrium analysis of Section 4.2. This is shown with Figure 4.6.

In Figure 4.6, S is Nation 1's supply curve of exports of commodity X and is derived from Nation 1's production frontier and indifference map in the left panel of Figure 4.3 (the same information from which Nation 1's offer curve in the right panel of Figure 4.3 is derived). Specifically, S shows that the quantity supplied of exports of commodity X by Nation 1 is zero (point A) at $P_X/P_Y = 1/4$, 40 (point H) at $P_X/P_Y = 1/2$, and 60 (point E) at $P_X/P_Y = 1$ (as indicated in the left panel of Figure 4.3 and on Nation 1's offer curve in the right panel of Figure 4.3). The export of 70X by Nation 1 at $P_X/P_Y = 1/2$ (point R on the S curve in Figure 4.6) can similarly be obtained from the left panel of Figure 4.3 and is shown as point R on Nation 1's offer curve in Figure 4.9 in Appendix A4.3.

On the other hand, D refers to Nation 2's demand for Nation 1's exports of commodity X and is derived from Nation 2's production frontier and indifference map in the left panel of Figure 4.4 (the same information from which Nation 2's offer curve in the right panel of Figure 4.4 is derived). Specifically, D in Figure 4.6 shows that the quantity demanded of Nation 1's exports of commodity X by Nation 2 is 60 (point E) at $P_X/P_Y = 1$ (as in the left panel of Figure 4.4), 120 (point H') at $P_X/P_Y = 1/2$, but 40 (point R') at $P_X/P_Y = 1/2$.

D and S intersect at point E in Figure 4.6, determining the equilibrium $P_X/P_Y = 1$ and the equilibrium quantity of exports of 60X (as in Figure 4.5). Figure 4.6 shows that at

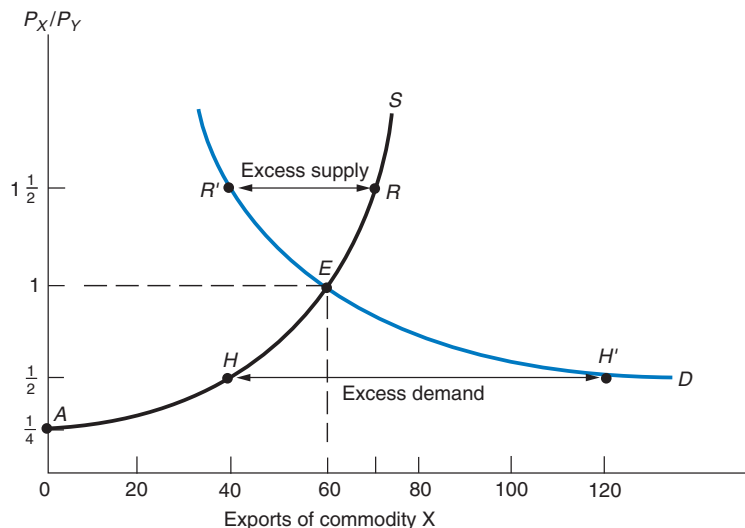


FIGURE 4.6. Equilibrium-Relative Commodity Price with Partial Equilibrium Analysis.

S refers to Nation 1's supply curve of exports of commodity X, while D refers to Nation 2's demand curve for Nation 1's exports of commodity X. S and D are derived from the left panel of Figures 4.3 and 4.4, and show the same basic information as Figure 4.5. D and S intersect at point E, determining the equilibrium $P_X/P_Y = 1$ and the equilibrium quantity of exports of 60X. At $P_X/P_Y = 1/2$, there is an excess supply of exports of $R'R = 30X$, and P_X/P_Y falls toward equilibrium $P_X/P_Y = 1$. At $P_X/P_Y = 1/2$, there is an excess demand of exports of $HH' = 80X$, and P_X/P_Y rises toward $P_X/P_Y = 1$.

$P_X/P_Y = 1/2$ there is an excess supply of exports of $R'R = 30X$, and P_X/P_Y falls toward equilibrium $P_X/P_Y = 1$. On the other hand, at $P_X/P_Y = 1/2$, there is an excess demand of exports of $HH' = 80X$, and P_X/P_Y rises toward $P_X/P_Y = 1$. Thus, the relative price of X gravitates toward the equilibrium price of $P_X/P_Y = 1$, given by point E in Figure 4.6 (the same as in Figure 4.5). The same conclusion would be reached in terms of Y (see Problem 8, with answer at www.wiley.com/college/salvatore).

If, on the other hand, Nation 2 were small, its demand curve for Nation 1's exports of commodity X would intersect the horizontal portion of Nation 1's supply curve of exports of commodity X (near the vertical axis). In that case, Nation 2 would trade at the pretrade price of $P_X/P_Y = 1/4$ in Nation 1, and Nation 2 would receive all of the gains from trade. (This could also be shown with offer curves; see Problem 10, with the answer on the Web.)

Going back to our Figure 4.6, we see that it shows the same basic information as Figure 4.5, and both are derived from the nations' production frontiers and indifference maps. There is a basic difference, however, between the two figures. Figure 4.5 refers to general equilibrium analysis and considers all markets together, not just the market for commodity X. This is important because changes in the market for commodity X affect other markets, and these may give rise to important repercussions on the market for commodity X itself. On the other hand, the partial equilibrium analysis of Figure 4.6, which utilizes D and S curves, does not consider these repercussions and the connections that exist between the market for commodity X and the market for all other commodities in the economy. Partial equilibrium analysis is often useful as a first approximation, but for the complete and full answer, the more difficult general equilibrium analysis is usually required.

4.6 The Terms of Trade

In this section, we define the terms of trade of each nation and illustrate their measurement. We also discuss the meaning of a change in a nation's terms of trade. Finally, we pause to take stock of what we have accomplished up to this point and examine the usefulness of our trade model.

4.6A Definition and Measurement of the Terms of Trade

The **terms of trade** of a nation are defined as the ratio of the price of its export commodity to the price of its import commodity. Since in a two-nation world, the exports of a nation are the imports of its trade partner, the terms of trade of the latter are equal to the inverse, or reciprocal, of the terms of trade of the former.

In a world of many (rather than just two) traded commodities, the terms of trade of a nation are given by the ratio of the price *index* of its exports to the price *index* of its imports. This ratio is usually multiplied by 100 in order to express the terms of trade in percentages. These terms of trade are often referred to as the **commodity or net barter terms of trade** to distinguish them from other measures of the terms of trade presented in Chapter 11 in connection with trade and development.

As supply and demand considerations change over time, offer curves will shift, changing the volume and the terms of trade. This matter will be examined in Chapter 7, which deals with growth and change, and international trade. An improvement in a nation's terms of trade is usually regarded as beneficial to the nation in the sense that the prices that the nation receives for its exports rise relative to the prices that it pays for imports.

4.6B Illustration of the Terms of Trade

Since Nation 1 exports commodity X and imports commodity Y, the terms of trade of Nation 1 are given by P_X/P_Y . From Figure 4.5, these are $P_X/P_Y = P_B = 1$ or 100 (in percentages). If Nation 1 exported and imported many commodities, P_X would be the *index* of its export prices, and P_Y would be the *index* of its import prices.

Since Nation 2 exports commodity Y and imports commodity X, the terms of trade of Nation 2 are given by P_Y/P_X . Note that this is the inverse, or reciprocal, of Nation 1's terms of trade and also equals 1 or 100 (in percentages) in this case.

If through time the terms of trade of Nation 1 rose, say, from 100 to 120, this would mean that Nation 1's export prices rose 20 percent in relation to its import prices. This would also mean that Nation 2's terms of trade have deteriorated from 100 to $(100/120)100 = 83$. Note that we can always set a nation's terms of trade equal to 100 in the base period, so that changes in its terms of trade over time can be measured in percentages.

Even if Nation 1's terms of trade improve over time, we cannot conclude that Nation 1 is *necessarily* better off because of this, or that Nation 2 is necessarily worse off because of the deterioration in its terms of trade. Changes in a nation's terms of trade are the result of many forces at work both in that nation and in the rest of the world, and we cannot determine their net effect on a nation's welfare by simply looking at the change in the nation's terms of trade. To answer this question, we need more information and analysis, and we will postpone that until Chapter 11. Case Study 4-3 shows the terms of trade of

■ CASE STUDY 4-3 The Terms of Trade of the G-7 Countries

Table 4.2 gives the terms of trade of the Group of 7 largest advanced countries (G-7) for selected years from 1972 to 2011. The terms of trade were measured by dividing the index of export unit value by the index of import unit value, taking 2000 as 100. Table 4.2 shows that the terms of trade of the G-7 countries fluctuated very widely over the years

and were much lower in 2011 than in 1972 for the United States, Germany, and especially Japan; a little lower for the United Kingdom, France, and Italy; and much higher in the past decade for Canada (primarily because of the sharp increase in the price of petroleum and of other primary commodities, of which Canada is a major exporter).

■ **TABLE 4.2.** The Terms of Trade of the G-7 Countries, Selected Years, 1972–2011 (Export Unit Value ÷ Import Unit Value; 2000 = 100)

	1972	1974	1980	1985	1990	1995	2000	2005	2010	2011	% Change 1972–2011
United States	127	107	90	103	101	103	100	97	97	95	–29
Canada	96	109	107	94	97	97	100	117	120	122	24
Japan	109	81	59	66	84	115	100	83	68	60	–58
Germany	118	105	98	94	110	108	100	105	103	99	–18
United Kingdom	107	82	103	102	101	100	100	105	103	103	–4
France	101	89	90	89	100	107	100	111	100*	100*	–1*
Italy	106	80	78	78	94	96	100	101	99	96	–10

* refers to 2008

Source: Elaborated from data in International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, various issues).

■ CASE STUDY 4-4 The Terms of Trade of Advanced and Developing Countries

Table 4.3 gives the terms of trade of advanced countries and developing countries as a whole, as well as for African, Asian, European, Middle Eastern, and Western Hemispheric developing countries for selected years from 1972 to 2010. The terms of trade were measured by dividing the index of export unit value by the index of import unit value, with 2000 as 100.

Table 4.3 shows that the terms of trade of advanced countries declined from 1972 to 1985 but then rose until 1995, and they were 98 in 2010, as compared with 110 in 1972. For developing countries, the terms of trade rose sharply from 1972 to 1980 primarily as a result of the very sharp increase in the terms of trade of Western Hemispheric countries, but they then declined until 1985 and they were 102 in 2010, as compared with 61 in 1972. The terms of trade of Africa increased from 85 in 1972 to 108 in 2005 (more recent data were not available). From 1972 to

2010, the terms of trade rose for Asia from 101 to 104 and declined for European developing countries from 112 to 95. The term of trade rose sharply for the Western Hemispheric countries from 39 in 1972 to 92 in 2010 and for the Middle East from 94 in 1972 to 167 in 2007 (more recent data were not available).

Although the terms of trade of industrial and developing countries reflected to a large extent the large fluctuations in the price of petroleum over the period examined, other forces were also clearly at work (note, for example, that the largest fluctuation was in the terms of trade of the Western Hemispheric countries, whose exports were mostly nonpetroleum and that the terms of trade of the Middle East as a whole declined between 1972 and 1974 because many Middle Eastern countries did not export petroleum). A detailed analysis and data of the forces that determine the terms of trade of developing countries are presented in Chapter 10.

■ **TABLE 4.3.** The Terms of Trade of Advanced and Developing Countries, Selected Years, 1972–2010 (Export Unit Value ÷ Import Unit Value; 2000 = 100)

	1972	1974	1980	1985	1990	1995	2000	2005	2010
Industrial countries	110	97	89	87	100	105	100	101	98
Developing countries	61	86	107	101	103	102	100	99	102
Africa	85	118	117	115	100	103	100	108	—
Asia	101	101	101	98	103	107	100	92	104
Europe	112	101	69	64	69	106	100	102	95
Middle East	94	75	90	80	109	68	100	140	167*
Western Hemisphere	39	110	194	189	130	107	100	104	92

* refers to 2007

Source: International Monetary Fund, *International Financial Statistics* (Washington, D.C.: IMF, various issues).

the G-7 countries, and Case Study 4-4 gives the terms of trade of advanced and developing countries for selected years over the 1972–2010 period.

4.6c Usefulness of the Model

The trade model presented thus far summarizes clearly and concisely a remarkable amount of useful information and analysis. It shows the conditions of production, or supply, in the two nations, the tastes, or demand preferences, the autarky point of production and