When the quantity demanded changes faster than the price, the elasticity of demand is higher than unity, and we say that demand is **elastic.** Finally, when the quantity demanded changes more slowly than the price, the elasticity of demand is lower than unity, and we say that demand is **inelastic.**

There is an important relationship between the elasticity of demand and the total expenditure (price × quantity) on the commodity under consideration. Suppose that the price falls by 1 percent. If the quantity demanded increases by more than 1 percent (that is, if demand is elastic), then the total expenditure on the commodity will increase. If the quantity demanded increases by less than 1 percent (that is, if demand is inelastic), then total expenditure will fall. In the limiting case of unit elastic demand, total expenditure remains the same.

The above ideas are directly applicable to the demand for imports. For instance, the **elasticity of demand for imports** of food is given by the ratio of the percentage change in the quantity of food imported to the percentage change in the relative price of food. The same relationship that exists between the ordinary elasticity of demand and changes in total expenditure also exists between the elasticity of demand for imports and total expenditure on imports. This observation is very important, because we can use it to predict from the mere shape of the offer curve whether the demand for imports is elastic or inelastic at a certain point.

Return to Figure 3-9. What is the total expenditure on the imports of food at point K^*? By definition, we have:

$$\text{Total expenditure on imports of food} = \text{relative price of food} \times \text{imports of food}$$
$$= \text{exports of clothing}$$

Accordingly, the total expenditure on imports of food equals the amount of clothing that the country must export to pay for the imports of food. Remember that a country pays for its imports by means of its exports. For instance, at K^* the total expenditure for the imports of O^*L^* units of food is represented by the amount of L^*K^* units of clothing.

Suppose now that the relative price of food is given by the slope of terms-of-trade line TOT_3^* and the economy trades at K^*. Is the demand for imports elastic or inelastic at K^*? Consider a very small reduction in the relative price of food. This price reduction can be represented by a small clockwise rotation of line TOT_3^* as implied by line OW^* (not drawn). At this lower price, the economy will be willing to trade at W^*. What has happened to the total expenditure on imports? Note that point K^* happens to be on an upward-sloping region of the offer curve. Accordingly, as food becomes cheaper and the country moves from K^* to W^*, the total exports of clothing (that is, total expenditure on imports) increase. From this, we immediately infer that the demand for imports is elastic at K^*.

Following this analysis, we conclude that Britain's demand for imports is elastic at all points (such as S^* and K^*) which lie in upward-sloping region OZ^*

downward-sloping region Z^*U^*; and it is unit elastic at point Z^*, at which Britain's offer curve is momentarily horizontal.

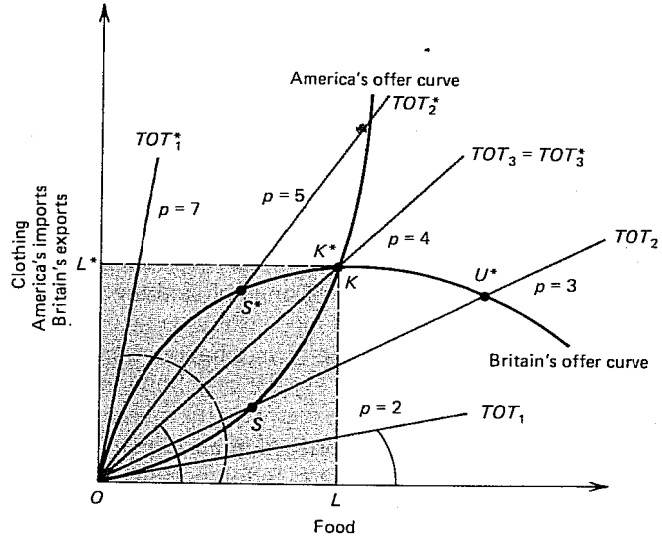
Referring to Figure 3-8, we can also conclude that America's demand for imports (of clothing) is elastic over upward-sloping region OZ of the offer curve; it is inelastic over backward-bending region ZU; and it is unit elastic at point Z (where America's offer curve is vertical).

3-7 INTERNATIONAL EQUILIBRIUM

International equilibrium occurs when the terms of trade are such that trade is balanced. At that point world supply equals world demand in each and every market. All producers sell all they wish to sell, and all consumers buy all they wish to buy. All are satisfied, and they have no incentive to change their behavior. How is international equilibrium attained? How do we bring world supply and demand together to determine the equilibrium terms of trade? We can use our new tools, the offer curves, to provide a systematic answer to this important problem.

International equilibrium occurs at the intersection of the two offer curves. Only at the terms of trade implied by that intersection will the desired trade flows of the two nations be balanced. This is shown in Figure 3-10, which brings together the offer curves of America and Britain derived in Figures 3-8 and 3-9. The equilibrium terms of trade ($p = 4$) are given by terms-of-trade line

FIGURE 3-10 **International equilibrium.** International equilibrium occurs at K, where the offer curves intersect. America exports OL units of food to Britain and imports OL^* units of clothing from Britain. The slope of terms-of-trade line TOT_3 gives equilibrium terms of trade OL^*/OL.



TOT_3, which now coincides with TOT_3*. At $p = 4$, America exports OL units of ood to Britain in exchange for OL* units of British clothing, as shown by point on America's offer curve. Britain's offer, given by K*, matches America's offer, s evidenced by the fact that points K and K* coincide. Thus, at the equilibrium erms of trade ($p = 4$), all markets clear and international equilibrium prevails.

The equilibrium terms of trade (that is, the relative price of food) lie between he autarkic prices of America and Britain. This is illustrated by the fact that erms-of-trade line $TOT_3 = TOT_3$* lies between terms-of-trade lines TOT_1 (giving America's autarkic price ratio) and TOT_1* (giving Britain's autarkic price ratio).

The intersection of the two offer curves (point K or K*) is the only point at vhich each country's desired imports are exactly matched by the other country's desired exports. For instance, at terms of trade $p = 3$, indicated by erms-of-trade line TOT_2, America's offer (S) is much smaller than Britain's offer U*). In this case, there will be an excess demand for food (because America is iot willing to export as much food as Britain is willing to import), putting an ipward pressure on the price of food. At the same time, there will be an excess supply of clothing (because America is not willing to import as much clothing as Britain is willing to export), putting a downward pressure on the price of clothing. Both of these pressures will cause the relative price of food to rise until international equilibrium is attained at K.

TRADE

The preceding analysis sheds much light on the significance of the concept of terms of trade in international equilibrium. The domestic employment of factors; the techniques of production; the distribution of income; the production, consumption, exporting, and importing of commodities—all depend on the terms of trade. No wonder, then, that economists as well as statisticians, policymakers, and politicians pay so much attention to this concept.

So far we have used the phrase "terms of trade" to mean the relative price of the exported commodity. For instance, in our earlier discussion, in which America imported clothing and exported food, America's terms of trade were defined as the relative price of food—that is, the ratio of the price of food to the price of clothing. As we have seen, the relative price of food (or America's terms of trade) shows the number of units of clothing that exchange in the international market for one unit of food. These terms of trade are often referred to as **commodity terms of trade** or **net barter terms of trade.**

In practice, each country exports and imports many commodities, not just one. For this reason, the price of exports is calculated as an index number of export prices. Similarly, the price of imports is calculated as an index number of import prices. Such export price and import price indices are regularly reported by the International Monetary Fund in its monthly *International Financial Statistics*. The net barter terms of trade are then equal to the ratio of the two indices:

$$\text{Terms of trade} = \frac{\text{index of export prices}}{\text{index of import prices}}$$

Table 3-1 presents data on the terms of trade of various countries for the years 1982–1985.

A rise in the statistical measure of the terms of trade of, say, America, is usually referred to as an "improvement" (or "favorable" movement) in its terms of trade. Similarly, a fall in America's terms of trade is referred to as a "deterioration" (or "unfavorable" movement) in its terms of trade. The idea, of course, is that America's terms of trade represent the number of units of imports that the nation can obtain per unit of exports. A rise in America's terms of trade, then, means that the nation can obtain more units of imports per unit of exports, and for this reason it is thought that America is better off. Similarly, a fall in America's terms of trade means that the nation gets fewer imports per unit of exports, and its welfare allegedly deteriorates. Such feelings are usually reinforced by a diagram, such as Figure 3-4, in which a terms-of-trade improvement apparently results in an increase in social welfare, and a terms-of-trade

TABLE 3-1 TERMS OF TRADE, 1982–1985
(1980 = 100)

	1982	1983	1984	1985
Argentina	89	96	97	88
Australia	98	97	95	90
Belgium	95	95	94	95
Brazil	95	87	103	87
Canada	95	97	94	92
France	97	99	100	103
Germany, Federal Republic of	97	99	96	98
Ghana	84	88	99	91
Greece	95	96	97	91
Hong Kong	110	109	109	110
India	104	111	107	115
Israel	93	94	84	95
Italy	95	98	96	97
Ivory Coast	91	92	101	94
Japan	103	106	109	113
Korea, Republic of	100	101	100	105
Malaysia	85	88	93	85
Mexico	110	98	100	98
Netherlands	102	101	102	104
Philippines	89	99	101	96
South Africa	87	86	86	85
Turkey	88	94	90	92
United Kingdom	100	100	99	100
United States	106	112	112	114

Source: The World Bank, *World Development Report 1986*, Oxford University Press, New York, 1986; ibid., *1987*, 1987.

and their continued use is justified only by the fact that they give rise to results that are qualitatively similar to those derived by more rigorous methods.

7 In a closed economy, general equilibrium occurs at the point where the production-possibilities frontier becomes tangent to the highest possible social indifference curve. The equilibrium commodity price ratio is equal to both the marginal rate of transformation (that is, the slope of the production frontier) and the marginal rate of substitution in consumption (that is, the slope of the social indifference curve) at the equilibrium point.

8 As in the Ricardian model, comparative advantage is decided on the basis of the opportunity costs that prevail in each trading country before trade. However, with increasing opportunity costs, pretrade costs cannot be inferred from the production-possibilities frontier without full information about demand.

9 The opportunity to trade enables an open economy to separate its domestic consumption from its domestic production. In particular, an open economy (a) maximizes its national income by producing at the point where its marginal rate of transformation equals the international price ratio and (b) maximizes its welfare by consuming at the point of tangency between its consumption-possibilities frontier (that is, the community budget line passing through the optimal production point) and the highest social indifference curve, a point that normally lies beyond the production frontier.

10 The total gain from trade is divided into a consumption gain (or gain from international exchange), which is normally positive, and a production gain (or gain from specialization), which could be zero (but never negative) in a backward economy that lacks the capacity to transform its autarkic production bundle into a more profitable bundle.

11 The offer curve is an ingenious device (developed by Alfred Marshall) that summarizes the offers of a country at alternative terms of trade. When the offer curve slopes upward, the country's demand for imports is elastic; when it slopes downward (or bends backward, as happens when imports are measured along the vertical axis), the demand for imports is inelastic. The slope of the offer curve at the origin gives the country's autarkic price ratio.

12 International equilibrium occurs when world supply equals world demand in every market, or alternatively when each country's desired imports match exactly the other country's desired exports (balanced trade). Graphically, international equilibrium occurs at the intersection of the offer curves of the trading countries, with the slope of the terms-of-trade line (which connects the origin with the equilibrium point) giving the equilibrium terms of trade.

13 Because countries export and import many commodities, economists and statisticians measure a country's terms of trade by the ratio of an index of the country's export prices to an index of the country's import prices.

14 An improvement (deterioration) in a country's terms of trade is unambiguously equivalent to an increase (decrease) in that country's welfare only when the change in the terms of trade is due to a change in foreign behavior (such as a change in foreign tastes or technology). When the change in the terms of trade is

due to a change in domestic conditions, its effect on domestic welfare cannot ways be inferred from the direction of change in the terms of trade.

PROBLEMS[1]

1 The production possibilities of America are summarized in the following table:

	Output combinations			
	A	B	C	D
Commodity X	0	20	40	60
Commodity Y	100	90	70	40

- **a** Draw the production-possibilities frontier of America. (Note: Plot points *A* throu *E* and connect them by means of straight-line segments. The implicit assumptio that opportunity costs remain constant between any pair of adjacent points.)
- **b** Determine America's optimum production point for each of the following wo price ratios (p_x/p_y): 0.2, 0.8, 1.1, 1.75, and 30.
- **c** Suppose that America consumes commodities in the fixed proportion $1X:1Y$ i spective of prices. If the world price ratio (p_x/p_y) is 0.6, what will America produ consume, export, and import? Give precise quantities.

2 Germany and France produce wine and cloth under increasing opportunity costs. their respective autarkic equilibriums, the marginal costs of production are given the following table:

	Germany	France
Wine	2 marks	4 franc
Cloth	6 marks	24 franc

- **a** Which country has a comparative advantage in the production of wine? In the p duction of cloth?
- **b** Under free-trade equilibrium, Germany exports 100 units of cloth in exchange 500 units of French wine. Assuming that the marginal cost of German cloth rises 7.5 marks and that 1 mark exchanges for 3 francs, determine the equilibrium pri of wine and cloth in France (in francs).

3 Canada and Italy produce typewriters and wheat under increasing opportunity co Both countries share the same production-possibilities frontier. However, Italy co sumes more bushels of wheat per typewriter than Canada at all conceivable price tios.

- **a** In which country are typewriters relatively cheaper under autarky?
- **b** Under free trade, what is the relationship between Italy's and Canada's structure production?
- **c** Which country exports wheat?
- **d** Illustrate your conclusions graphically.

[1]Problems that appear with asterisks are more difficult.

of such artificial prices, nor can domestic residents buy and sell freely abroad. If such trade were allowed, it would be inefficient; it would also frustrate the main goals of the planners. For this reason, eastern-bloc countries conduct their international trade through foreign-trade organizations. Nevertheless, the function of these organizations is greatly hampered, among other things, by the fact that they cannot compare foreign prices to domestic prices, because the latter are not equal to opportunity costs.

Because of their emphasis on central planning, the leaders of eastern-bloc countries view foreign trade as an economic disturbance that interferes with the planning process. Thus their tendency is to leave no room for international trade in the long run. The foreign-trade organizations are apparently used as emergency devices by means of which the planners expect to correct through imports any deficiencies that may arise in some sectors, or to get rid of any occasional surpluses through exports. However, the full benefits of international trade can be attained only if it is allowed to become an integral part of planning instead of being used as a residuum.

The planning procedures of eastern-bloc countries render their currencies **inconvertible.** This means that foreigners cannot legally hold, for example, rubles and hence are not allowed to spend rubles freely; and similarly, Soviets are not free to use their rubles to buy foreign currencies. Such currency restrictions rule out **multilateral trade,** at least among eastern-bloc countries (East-East trade). For instance, if Czechoslovakia sells tractors to the USSR, it cannot use the rubles it receives to pay for imports from Romania. Instead, the Czechs must use their rubles to purchase whatever commodities the Soviet foreign-trade organization has to sell. The restriction of multilateral trade reduces the scope of potential benefits from East-East trade. However, multilateral exchanges are still possible in East-West trade because the latter can be conducted with convertible western currencies. For instance, the USSR may export natural gas to France in exchange for French francs, and later use the francs to purchase machinery from West Germany.

Another obstacle to East-West trade is the difficulty the East European economies face in expanding their exports fast enough to keep pace with their import needs. This problem is primarily due to the low quality of Eastern exports, particularly consumer goods.

The Soviet-U.S. Wheat Deals

The USSR is the world's largest wheat producer. For instance, in 1980 the USSR produced about 98 million metric tons of wheat, while the United States produced a little over 64 million metric tons. Historically, the USSR has been a major exporter of wheat, but since the early 1970s, the country has turned into a net grain importer due to increased domestic consumption.

Soviet grain imports are particularly heavy whenever the weather causes the Soviet crop to be bad. This was the case in 1972 when the Soviets purchased about one-fourth of the U.S. wheat crop. This unprecedented Soviet-U.S. wheat deal disrupted the U.S. economy, and it was later suspected that the Soviets had taken advantage of their monopoly of information about Soviet crop conditions. The feeling was that the Soviets, knowing that their own harvest would be very poor, quietly purchased large amounts of grain at low prices. This charge was not justified, however, because the Soviet purchases actually unfolded over several months and their intended magnitude was known to the U.S. Department of Agriculture and major grain dealers when most contracts

What actually permitted the Soviets to enjoy a continuing bargain on U.S. grain was the perverse and obsolete U.S. policy. To support farm incomes, U.S. agricultural policy restricted the number of acres of land that farmers could use to plant wheat, and this **acreage control** was allowed to continue even after it became known to be no longer necessary. In addition, the U.S. Department of Agriculture failed to remove its obsolete subsidy on the export of "surplus" grain even when a surplus no longer existed. As a result, U.S. taxpayers' money was used to assist the Soviets to purchase U.S. grain at prices that were much lower than those paid by U.S. consumers.

A few years later, the United States and the USSR negotiated a five-year bilateral grain trade agreement (1977–1981) according to which the USSR was to purchase at least 6 million metric tons of wheat and corn each year and the United States was to permit purchases of up to 8 million metric tons a year, with larger purchases requiring new negotiations.

Following the invasion of Afghanistan, however, the United States on January 5, 1980, imposed an embargo on exports of grain and high technology to the USSR. In addition, the United States tried to persuade other friendly nations to avoid supplying the Soviets with the needed grain. But the Soviets were able after all to find grain from other sources, such as Argentina, Canada, and France. U.S. farmers also recouped part of their lost Soviet sales by exporting wheat to those countries that had increased their sales to the USSR. Indeed, there is evidence that some U.S. grain was shipped to third-party countries and re-exported to the USSR. So the U.S. embargo did not really work. President Ronald Reagan lifted the embargo in 1981 and renewed the five-year grain trade agreement in 1983.

3-10 SUMMARY

1 The fundamental concepts of opportunity cost and social indifferenc form the basis for the neoclassical theory of international values.

2 Linear production-possibilities frontiers imply *constant* opportunity cost *Increasing* opportunity costs, illustrated by production-possibilities frontiers tha are concave to the origin, offer a better description of reality. In addition to th fact that many industries operate under increasing (not constant) costs, increa ing opportunity costs do not lead to the unrealistic situation of complete sp cialization (whereas constant opportunity costs do).

3 Increasing opportunity costs can be explained in one of two ways: (a) b invoking the product specificity of factors or (b) by observing that technology such that different commodities use homogeneous factors in different propo tions.

4 The production-possibilities frontier shows the maximal combinations outputs that the economy can produce. It depends on two fundamental data: factor supplies (or endowments) and (b) technology (or production functions).

5 The neoclassical theory of international trade makes two simplifying sumptions: (a) that society's tastes can be summarized by a well-behaved soc indifference map and (b) that society tries to reach the highest social indiff ence curve.

6 There are only a few special cases in which the use of social indiffere curves can be made rigorous. In general, social indifference curves do not ex

deterioration gives rise to a reduction in social welfare. Unfortunately, the terms-of-trade measure is not a good index of social welfare. Any statements made on the basis of historical changes in a country's terms of trade, if not rejected offhand, must be scrutinized thoroughly before they are actually accepted.

A change in a country's terms of trade may reflect a change in either domestic or foreign economic behavior. When the terms of trade change as a result of foreign behavior (that is, a change in foreign tastes, technology, or factor endowments), then we must conclude on the basis of our earlier analysis (Section 3-3) that an improvement in the terms of trade is equivalent to an increase in American welfare and that a deterioration is equivalent to a reduction in social welfare.

Suppose, however, that the change in America's terms of trade is the result of a change in American economic conditions. In particular, suppose that as a result of tremendous advances in American technology, America can produce large amounts of food very cheaply. As a result, the American production-possibilities frontier shifts outward. Suppose further that this overabundance of food forces a reduction in the relative price of food in world markets. Such a reduction in the relative price of food is not unreasonable but should be expected from the normal operation of the **law of supply and demand.** Nevertheless, the reduction in the relative price of food will be registered by statisticians as an "unfavorable" change in America's terms of trade. Is America worse off because of the mere deterioration of its terms of trade? Such a hasty conclusion is not warranted. The outward shift in the American production-possibilities frontier must also be taken into consideration before a conclusion is reached. The outcome could go either way, as our analysis in Chapter 6 will show.

Conversely, suppose that a hard frost destroys a substantial percentage of the Brazilian coffee crop, as indeed was the case in 1963, 1969, 1972, and especially in 1975, when about half of the 1976 Brazilian coffee crop was destroyed. Because Brazil produces approximately one-third of the world's output, such crop destruction may lead to a substantial increase in the price of coffee. For instance, the 1975 frost led to a quadrupling of the price of coffee within a short period of time. Such an increase in the price of coffee will be registered by statisticians as a "favorable" change in Brazilian terms of trade. But whether Brazilian welfare improves or deteriorates depends not only on the rise of the terms of trade but also on the destruction of the Brazilian crop. Again the outcome could go either way.

3-9 EAST-WEST TRADE

It is generally agreed that international trade between the market-oriented economies of the West and the centrally planned economies of the Soviet bloc is mutually beneficial because such trade bargains are entered into voluntarily on both sides. Yet East-West trade faces many political and economic obstacles. In this section we discuss the difficulties that surround East-West trade; we also give a brief account of the recent Soviet-U.S. wheat deals.

Political Obstacles to East-West Trade

On balance, the East exports raw materials to the West in exchange for new technology and manufactured goods (such as machinery, consumer goods, chemical and building materials, and food). Relative to total world trade, however, East-West trade is much more important to the East than it is to the West.

The political obstacles to East-West trade are deeply rooted in the ideological differences between the two blocs and fluctuate with the general state of international relations. After long, unsuccessful efforts at détente (interrupted by the escalation of the Vietnam war), the visits of President Nixon to China and the USSR in 1972 generated an atmosphere of hope and optimism for improved trade relations between the East and the West. Subsequent developments, however, showed how elusive is the goal of peaceful cooperation between the two superpowers of the world. Concern about Soviet policy toward Jewish emigration, and about human rights generally, has led to U.S. restrictions (such as the 1978 cancellation of a computer sale, which the Soviets eventually replaced by a French one) and the continued denial of most-favored-nation status to the USSR and other East European countries. Soviet-U.S. relations worsened further following the Soviet invasion of Afghanistan, which prompted the American embargo on exports of grain and high-technology goods.

Some political observers are fearful of any serious dependence on, say, Soviet trade. They point to the USSR's sudden cutting of purchases of Icelandic fish in 1948 and of sales of oil to Israel in 1956. (Note, however, that the United States also abruptly reduced the Cuban sugar quota in 1960.)

In addition, many observers on both sides feel that any transaction benefiting the other side, the Enemy, is harmful to their side. Their recommendation is to further restrict East-West trade even if such trade brings direct economic benefits to their own side.

The political obstacles are formidable, but the potential mutual benefits of East-West trade are also high. One wonders if the world will ever be smart enough to throw away the guns and concentrate on peaceful cooperation and free international trade in the pursuit of economic welfare. Surely, the hope to abolish poverty and disease lies in peaceful cooperation, not in mistrust, treachery, hostility, and guns. The 1987 pact banning intermediate-range missiles is a hopeful sign of Soviet-U.S. cooperation as opposed to confrontation. Not unexpectedly, the Soviets are asking for the lifting of the U.S. ban on imports of Russian furs in exchange for U.S. exports of machinery to the Soviet Union.

Economic Obstacles to East-West Trade

We now turn to the economic obstacles to East-West trade, which are no less formidable than the political obstacles. In centrally planned economies, prices—the basis on which one shops—are primarily accounting devices. Unlike the prices that exist in market economies, the prices in the eastern bloc do not reflect opportunity costs; and only to a very limited extent do they serve as signaling devices in the allocation of resources. The latter is instead integrated with the planning mechanism, which seeks to achieve material balances.

For instance, for their own internal purposes, the USSR and other eastern-bloc countries have kept the prices of consumer goods artificially high and the prices of capital goods artificially low. As a result, foreigners are not allowed to trade freely on the basis