

PART IV

**REGIONAL SPECIALIZATION
AND TRADE**

SHORT-RUN TRADE FLOWS

For ease in exposition, we have postponed our discussion of multiple products until the treatment of single-product market models could be extended to include spatial, form, and temporal dimensions of market price. In Chapter 5, we warned that the benefits from trade could be shown only by simultaneous consideration of two or more products. The reason for this is clear. It is that some of the resources devoted to product A in the no-trade case must be shifted by *producers* to other products when trade results in a lowering of the price of product A in region X. Also, *consumers* of product A may shift some of their expenditures in the no-trade case away from other products and will purchase more of product A when its price falls as a consequence of the opening of trade with region Y.

To introduce the analysis of regional specialization and trade, we first consider a two-region situation in which the supply of the two products is taken as given. In later chapters, we modify these stock models and allow output of the two products to vary with price. Eventually, we treat models in which inputs and product outputs in multiple regions are all treated as variables, thus, approaching a general equilibrium analytical framework.

14.1 THE CONCEPT OF UTILITY

The analytical apparatus used to demonstrate the effects of trade in the short-run case of fixed product supplies will be familiar to most readers but will be reviewed here very briefly. We have observed that the individual's demand schedule reflects his particular tastes and preferences—or the ability of the commodity to satisfy his particular wants. The satisfaction of wants necessarily is a subjective matter for the individual and, as such, is difficult to measure. The characteristics of commodities (and services) that satisfy wants we label *utility*, and this is an important concept even though we cannot measure utility in objective terms. In spite of this, we can think of an individual receiving a certain amount of utility from the possession or consumption of a particular set of commodities. Let us consider a simple illustration: A person obtains certain utility or satisfaction from the combination of four apples and three oranges. His utility is increased (so long as both apples and oranges yield positive rather than negative utility) if he is given an additional apple, an additional orange, or one of each. Contrariwise, his total satisfaction will be decreased if we take away an apple, an orange, or one of each. Since each of these commodities bears a positive relation to the consumer's total utility, it follows that a decrease in the amount of one can be offset by an increase in the other.

This is illustrated in Figure 14.1. The original combination of four apples and three oranges is represented by *A*. Points *B*, *C*, and *D* show increases in either or both commodities and, hence, represent points of greater total utility. Points *E*, *F*, and *G*, on the other hand, represent

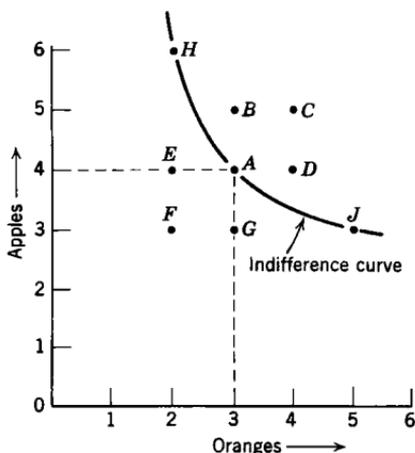


FIGURE 14.1 An indifference curve between apples and oranges.

smaller amounts of one or both commodities and so lower total utility. This person indicates, however, that his utility would be unchanged if he were given six apples and two oranges or three apples and five oranges. Thus, *H* and *J* represent combinations equivalent to *A* in terms of total utility. A curve joining these points, and many other similarly determined points, represents a constant utility curve or contour. If the consumer actually receives the same total satisfaction or utility from any combination represented by points on this curve, then his particular position on the curve will be a matter of complete indifference. For this reason, such isoutility curves are called *indifference* curves.

As long as the possession of more of the commodities in question yields positive utility, then indifference curves must be negatively inclined; a gain in the quantity of one commodity must be offset by a reduction in the quantity of the other to hold constant the total utility. In addition, indifference curves can be expected to be convex to the origin, as shown in Figure 14.1. This property is a reflection of the principle of diminishing marginal utility—that added units of a commodity will normally add less and less to total utility. The slope at any point on an indifference curve represents the inverse ratio of marginal utilities. In the present example, this means that the slope at any point on curve *HAI* represents the marginal utility of oranges divided by the marginal utility of apples. When we move toward *J*, the marginal utility of oranges decreases, the marginal utility of apples increases, the ratio of marginal utilities thus decreases and, hence, the slope of the curve becomes less and less steep. This slope is also called the *personal rate of substitution*.¹

Since we could start with any combination of apples and oranges (for instance, *B*, *C*, or *F*) and trace out indifference curves, it is apparent that our diagram might be filled with these curves and that every point on the diagram falls on one and only one curve. This family of indifference curves is called an indifference or preference map. The curves themselves will all be negatively inclined and convex to the origin; they will not cross or intersect for this would require that greater quantities have less utility than lesser quantities of the commodities in question. Each curve will represent a constant total level of utility or satisfaction. Each higher curve (up and to the right) represents greater total utility. For this reason, we can order the curves from lower to higher total utility even though we cannot measure the amount of utility in objective terms. Stated another way, we can rank combinations of commodities in terms of their total utility to the individual, indicating that some are preferable

¹Commonly referred to as marginal rate of substitution—a phrase which fails to distinguish between personal and technical rates of substitution.

to others even though we cannot say by how much more they are preferred.

The particular shape of indifference curves will reflect the tastes and preferences of the individual consumer. If he is very fond of apples and not especially fond of oranges, it will take a large number of oranges to offset the loss in utility from a single apple; and so the indifference curves would be relatively flat. On the other hand, a consumer greatly addicted to oranges would have relatively steep indifference curves. If the two products are nearly perfect substitutes over a wide range, then the indifference curves will approximate negatively inclined straight lines. At the other extreme, products that are very poor substitutes will be characterized by quite convex indifference curves.

14.2 CONSUMER EQUILIBRIUM

Let us now consider what this indifference curve apparatus can add to our understanding of the nature of consumer choice and of demand. Every consumer evaluates a large number of alternative commodities and, thus, we would need indifference surfaces with as many dimensions as commodities. The essential nature of the process may be revealed, however, by aggregating all commodities in money terms and by considering indifference curves between money and a particular commodity. In this case, it is understood that the marginal utility of money does not represent utility of the monetary unit itself but instead the utility of alternative commodities that can be purchased with the money. Figure 14.2 shows a hypothetical indifference map between income and a given commodity

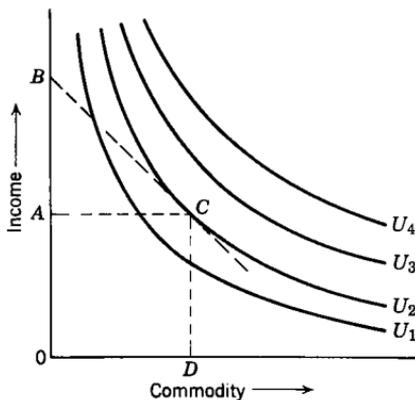


FIGURE 14.2 The indifference curves between income and quantity of a particular commodity.

for an individual consumer. A few of the indifference curves are shown: U_1, \dots, U_4 where the subscripts refer not to the absolute level of utility or satisfaction but to the rank from lower to higher total satisfaction.

Suppose that the individual has an income represented by OB and that he is confronted by a price P for the commodity. As long as this price remains fixed, the individual can exchange dollars of income for units of the commodity in a fixed proportion. More specifically, the individual can buy $1/P$ units of the commodity for \$1.00; and within the limits of his income, he can elect to buy as much or as little of the commodity as he chooses at this fixed exchange rate. In the diagram, we represent these exchange possibilities—income for commodity—by the line BC . Notice that the line starts from B representing the consumer's income, that it is a straight line corresponding to the fixed exchange rate P , and that the slope AB/AC equals the exchange rate P . In this diagram, then, we are representing (1) the consumer's tastes and preferences—the indifference map, (2) the consumer's income, and (3) the price of the product relative to other prices—money.

In this situation, the consumer will maximize his satisfactions by exchanging money for the commodity until he reaches the highest possible indifference curve. Starting at B , he moves along the price line toward C . At first, each move in this direction brings him to higher indifference curves; but, finally, at C he has reached the highest curve available with his given income and the given price. If he moves beyond C , he finds himself on lower indifference curves. Point C must then represent the best possible solution to the consumer's purchase problem: his satisfaction is as large as possible if he gives up AB of income in order to obtain AC of the commodity. Notice that the price line BC intersects all lower indifference curves but is tangent to curve U_2 . From this we can conclude that the consumer's equilibrium position requires that price ratios must be equated to the marginal rates of substitution. If the marginal utility or satisfaction obtained from expenditure of an added dollar on commodity X is greater than from the last dollar spent on commodity Y , then the consumer can improve his position by reallocating his expenditures until the marginal satisfactions per dollar spent on each and every commodity are equal.

14.3 BARTER BETWEEN INDIVIDUALS

We can now improve our analysis of the interdependent and reciprocal flow or exchange of commodities by using the indifference curve apparatus discussed above. Let us consider two individuals with present stocks

284 REGIONAL SPECIALIZATION AND TRADE

of two commodities. For simplicity, assume that Mr. Green has a stock or supply of commodity A and that Mr. Brown has a stock of commodity B. This is indicated graphically in Figure 14.3 where Green's stock is oc of commodity A and where some of Green's indifference curves for commodities A and B are represented by curve ceh and others like it which are convex to the origin O . Brown's stock of B and his indifference curves are also represented, but in this case we have rotated the diagram 180° so that the origin is located at O' with the quantities of B measured to the left of his origin and the quantities of A measured vertically below O' . This "Edgeworth-Bowley box" diagram is so constructed, in other words, that the sides measure the total stock oc of A that Green possesses and the total stock $o'c$ of B in Brown's possession. Any point within this box is attainable, in that it involves only the available quantities of the two commodities; and any such point will represent a distribution of the two commodities between the two individuals. Point O , for example, indicates that Green would have zero quantities of both commodities, while Brown would have the entire supplies.

Assume that these are the only two commodities involved; this simplifies the graphic presentation, but it should be emphasized that the general conclusions that we are able to obtain will hold true for multiproduct cases. With this construction, both Green and Brown start at position c . Will it be possible to exchange commodities to the benefit of both persons? Notice that in the absence of exchange, Green finds himself on his indifference curve ceh while Brown is on his curve cgh . Any position above and to the right of ceh would place Green on a higher indifference curve,

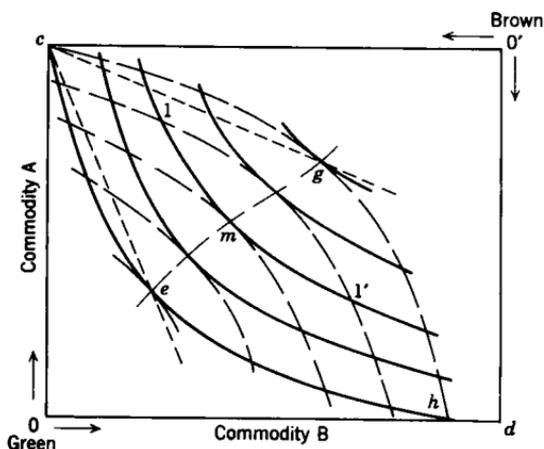


FIGURE 14.3 The superimposed indifference maps for two individuals.

just as any position below and to the left of cg would improve Brown's satisfactions. It is apparent, therefore, that any movement from point c into the concave area $cehgc$ would permit both Green and Brown to better their positions as compared to the situation at c in the absence of trade. Suppose that they start to barter, Green offering to exchange some of his A for B and Brown offering to give up some B in order to obtain some A. By this process, they arrive at point l where both have increased their satisfaction or total utility.

But this movement from c to l does not exhaust the possibilities of exchange with mutual benefit, since now any move from point l into the smaller concave area between l and l' will again permit each individual to move to a higher indifference curve. This will continue until some position, such as m , is reached on the *contract line* emg , which consists of all combinations where the two sets of indifference curves are tangent—where Green's personal rate of substitution is exactly equal to Brown's personal rate of substitution. An inspection of the diagram will indicate that any change from m to some point not on the contract line must involve decreased satisfactions for one or both individuals, although moves from m up or down the contract line will improve one person's position only by reducing the satisfactions for the other individual (Figure 14.4). As pointed out above, the final position in equilibrium must lie within the concave area formed by the indifference curves ceh and cg ; in fact, stable equilibrium will not be obtained until a position is reached somewhere on the contract line between e and g . The diagram also indicates

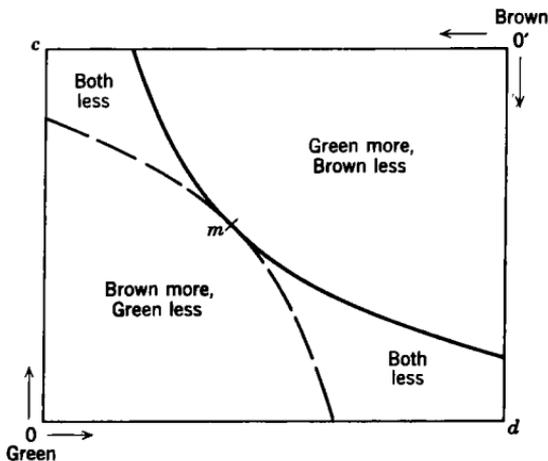


FIGURE 14.4 The changes in satisfactions for two individuals, compared to situation at some point m on contract line.

the extreme limits for the barter terms of trade—the quantities of A that will be exchanged for a unit of B. If Green is the more skillful bargainer, the barter terms of trade will approach the slope of the straight line cg while, if Brown is more adept, the terms of trade will approach the slope of line ce .

14.4 INDIVIDUAL "OFFER" CURVES

As long as we remain in a barter economy with two individuals, the final solution will be indeterminate, falling between e and g at some point, reflecting the relative bargaining abilities of the two. But let us introduce a simple rule in this game of exchange—that terms of trade will be "announced" and that each person will then adjust his offers to buy and to sell to these terms of trade. This is equivalent to saying that prices exist in a market economy with individuals buying and/or selling at these prices. And observe that the barter terms of trade of so many units of A per unit of B are equivalent to the inverse ratio of prices P_b/P_a in a price economy. With this rule, a low price for B relative to the price of A, equivalent to a relatively flat terms-of-trade line, would induce Green to demand a large quantity of B in exchange for a moderate amount of A. But this price ratio would be disadvantageous to Brown, and we observe that he would be willing to give up only a small amount of B. This discrepancy would represent a disequilibrium position, and the excess of the amount of B demanded over the amount offered for exchange would force an upward revision in the price of B. Eventually, a price ratio would be discovered that would equate the offers of the two individuals, and this would represent the final and determinate equilibrium.

All of these adjustments can be indicated readily by an elaboration of the diagram just presented. In Figure 14.5 we show the box diagram with indifference maps for Green and Brown. In addition, we show curves cfk and cfj , summarizing the offers of Green and Brown to exchange goods at various price ratios or terms of trade. Suppose the P_b/P_a ratio is represented by the slope of line cr . At these relative prices, Brown would offer to exchange B for A so as to reach point n , since this combination would place him on his highest attainable indifference curve. Green's best position would be at r , however, involving larger quantities of both commodities. Since the quantities demanded do not equal the quantities supplied, they cannot represent equilibrium prices.

Under the conditions stated, the equilibrium position is found at the intersection f of the two *offer* or *supply-demand* curves. At this point, Green's offer to supply cs of A is just equal to Brown's demand ft , while

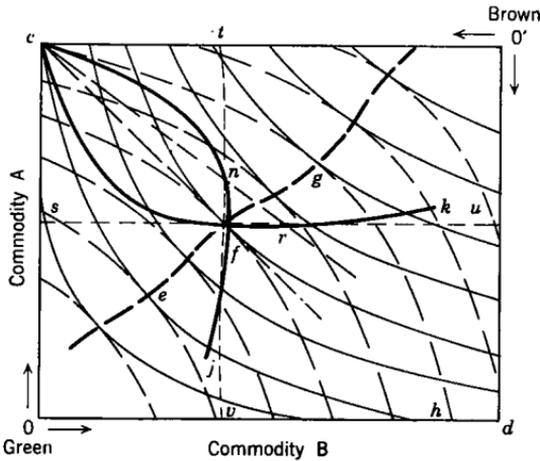


FIGURE 14.5 The superimposed indifference curves and offer curves for two individuals.

Brown's offer ct of B coincides with the quantity fs demanded by Green. Exchange takes place at the equilibrium price ratio represented by the slope of the straight line from c to f ; and observe that at f , this line is tangent to an indifference curve for Green and also an indifference curve for Brown. From this we deduce the general conditions for equilibrium: that the personal rates of substitution (or the inverse ratio of marginal utilities) must be equal for all individuals and equal to the inverse ratio of product prices.

Notice that exchange or trade opportunities are measured from point c , the original position for each individual before trade. The final consumption pattern is indicated by point f . Green consumes os of A and ov of B, Brown consumes $o't$ of B and $o'u$ of A, and these quantities exactly exhaust the total available supplies. This solution in no way depends on our original assumption that each individual had a stock of one commodity only. Figure 14.6 shows the situation for an individual who starts with some of both commodities—point c' . This places him on indifference curve $dc'e$; and at an exchange rate tangent to this curve at c' , he would find it impossible to better his position through trade. In short, with terms of trade indicated by the slope of line hk , this person would be forced to lower indifference curves if he moved from point c' . At any other price ratio, however, he could engage in trade to his benefit. With higher prices of B relative to A, he could move into the area bounded on the left by the segment $c'd$ of the indifference curve and on the right by the vertical line through c' (representing an infinitely high value for P_b relative to P_a). His

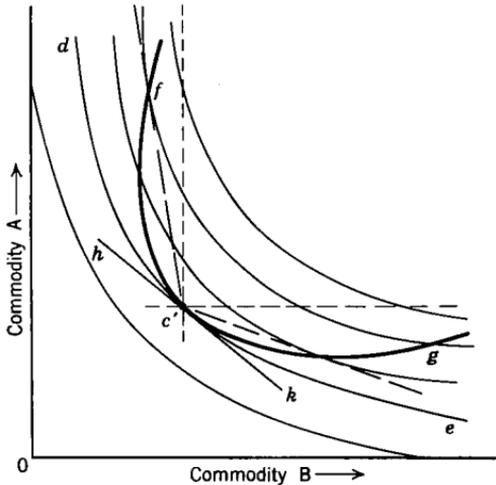


FIGURE 14.6 The offer curve for an individual who possesses stocks of two commodities.

offer curve in this range is indicated by the curved line $c'f$. With lower prices for B, the reverse would be true, and his offer curve would be $c'g$. His total offer curve then is $fc'g$, reflecting the fact that in certain price ranges he will sell A and buy B while in others he will buy A and sell B.

This simple model has brought out the fact that trade is basically concerned with the exchange of *goods for goods* instead of *goods for money*. Of course, with many commodities involved for every individual, direct barter of goods would be quite cumbersome and difficult. Here, the introduction of money as a medium of exchange is most useful. Goods are then traded for money and vice versa, but it must be emphasized that money merely represents a claim on goods and, as such, is only a facilitating device.²

14.5 SHORT-RUN REGIONAL OFFER CURVES

If we redefine our original problem to represent two regions rather than two individuals, the above analysis might be considered appropriate for interregional trade. In a strict sense, however, regional indifference curves cannot be used, since it is not possible to add together the preference maps of individuals. This stems from the subjective character of

²Money and monetary policies have a more active role in international trade than this suggests, but these aspects may be neglected in our presentation of the theory of interregional trade.

utility and the fact that the individual's indifference curves can only be ranked from lower to higher without specific measurement of the total utility or satisfaction involved. We might proceed on the heroic assumption that all individuals in a region had exactly the same tastes and preferences since, in this case, the regional preference map would merely be an individual preference map scaled upward in direct proportion to the number of individuals in the region.

A more useful approach, however, is based on the fact that we can add together individual offer curves because they are defined entirely in objective and measurable quantities. For any selected price ratio, we can sum together the quantities of A that all individuals offer to sell, the quantities of A that all offer to buy (and at any price some will be buyers and others sellers), the quantities of B offered for sale, and the quantities of B that all individuals offer to buy. With these four sets of quantity data for any assigned price ratio, it is a straightforward matter to construct regional offer curves similar to the individual offer curves. If we are concerned with trade between and among regions, however, these offer curves will be "gross" in that the indicated supply and demand conditions will be balanced off, at least in part, by trade *within* each region. If we consider a region in isolation, the aggregate offer curves just described will intersect to determine regional prices; and, at these prices, the buying and selling operations within the region will be in balance for each commodity. This means that at these prices the region would trade entirely on an internal or domestic basis without the export or import of any commodities. If we subtract the quantities that would be sold from the quantities that would be bought within the region at any specified price ratio, however, we can obtain "net" or *external* offer curves for the region.

This is illustrated in Figure 14.7 where we have assumed that our friends Brown and Green form the total inhabitants of a region. Our previous analysis then shows the internal trade equilibrium for this region, and the equilibrium ratio P_b/P_a is now shown by the slope of line *od*. At this price ratio the region would not find it profitable to trade with other regions. If the price of B increases relative to A, the price line becomes steeper than *od* with the result that there would be "surpluses" of selling offers for B and buying offers for A. These surpluses provide the opportunity for external trade and are summarized for various price ratios by the external offer curve *oc*. In a similar way, lower values for P_b/P_a are represented by price lines flatter than *od* and would result in net regional offers to sell A and buy B and external offer curve *oe*. To summarize, each region will have two external offer curves. One will fall *above* the internal equilibrium price ratio and will summarize offers to export B in exchange for A imports, and the other will fall *below* the

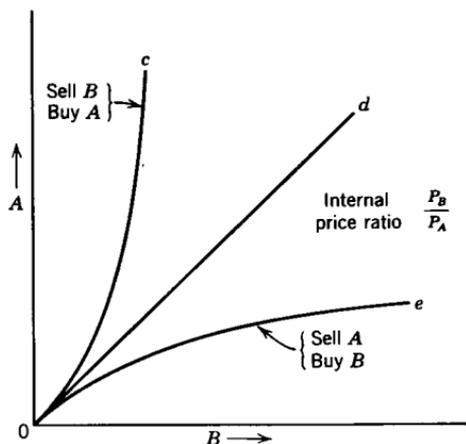


FIGURE 14.7 The net or external offer curves for a region, showing quantities of commodities offered for export and demanded for import. (Source. Derived from Figure 14.5.)

internal equilibrium price ratio and will show the region's offers to export A in exchange for B imports.

With this tool of external regional offer curves, we can complete our analysis of short-term interregional trade. Consider two regions, X and Y, for each of which we have the internal equilibrium price ratio and the pair of external offer curves. This is illustrated in Figure 14.8 where region X is represented by the internal price ratio od and the associated pair of offer curves and where region Y is similarly represented by oe and its

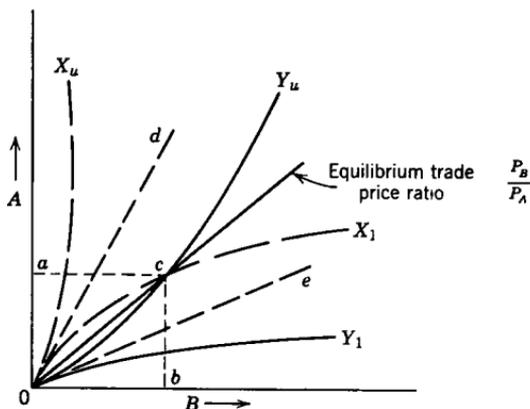


FIGURE 14.8 The external offer curves for two regions and the interregional trade equilibrium.

associated pair of external offer curves. Now if trade is to occur between these two regions, the product price ratio with trade will fall somewhere between the price ratios in isolation so that trade possibilities lie between the limits *od* and *oe*. This means that only one offer curve is now pertinent for each region: the *lower* offer curve for region X where the region exports A and imports B and the *upper* offer curve for region Y showing imports of A and exports of B.

The intersection of these two curves at *c* then defines the interregional trade equilibrium. The terms-of-trade or price ratio is shown by the slope of line *oc*. At this price, region X will ship *oa* of A to region Y, and this will be "paid for" by the shipment *ob* of B from region Y to X.

SELECTED READINGS

Short-Run Trade Flows

Braff, Allan, *op. cit.*, pp. 241–252.

Lloyd, Cliff, *op. cit.*, Chapter 2, "The Theory of Exchange and Pareto Optimality," pp. 80–97.

Newman, Peter, *The Theory of Exchange*. Prentice-Hall, Inc., Englewood Cliffs (1965). pp. 50–125.

Schneider, Erich, *op. cit.*, pp. 299–313.

Waugh, Frederick V., "A Partial Indifference Surface for Beef and Pork," *Journal of Farm Economics*. Vol. 38, No. 1 (February 1956). pp. 102–112.