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PART I

Theory of Consumer
Behavior and Demand

Broadly speaking, there are three sets of economic agents: consumers, entrepreneurs, and resource owners. Resource owners furnish the inputs used to produce whatever bill of goods is dictated by market forces. In return for the use of their resources, the resource owners receive money income. This money income, in turn, enables them to function as consumers.

Entrepreneurs organize production and, ultimately, determine the supply of goods and services in free markets. Those entrepreneurs who organize production efficiently and are successful in anticipating consumer desires are rewarded with money income in the form of profit. They are thereby also able to enter the market as consumers.

Some people earn money income by selling resources or the use of resources. Others earn income by using their special resource (entrepreneurial skill) to organize production. All people who earn money income belong to the set of economic agents called consumers. There are, of course, other members of this group. Family members who are dependent upon the income earner participate in the household budget decisions and are, therefore, consumers. People who are not able to earn money income receive money by some type of transfer payment and are also in the consumer category.

For our present purpose, the *source* of money income is not material. Only the fact that money is received by households and spent on consumer goods is of importance. Each household determines how to allocate its money income among the vast array of consumer goods

available. In other words, each household decides upon its demand for every item (even though the quantity demanded at any price may be zero for many items). The aggregate of these demand decisions constitutes market demand, an expression of how society wants its resources allocated.

The fundamental purpose of Part I is to analyze the process by which market demand is formed—to find, in other words, the basic determinants of market demand. Part II is devoted to an analysis of physical production and how it establishes the cost conditions an entrepreneur faces. Demand and cost are brought together in Part III; the behavior of different classes of producers is analyzed and the formation of market prices is studied. In Part IV we go behind the demand for and supply of commodities to determine the prices received by resource owners for the use of their resources in the production process. Finally, the general welfare of an economic society is analyzed in Part V. We begin with various data: the wishes of consumers as expressed by market demand, the pool of resources available to a society, and the technological conditions of production. Given this information, we want to determine the conditions that must exist—the type of economic organization a society must have—if its pool of resources is to be allocated so as to maximize the economic well-being of its members.

Chapter 1

THEORY OF UTILITY AND PREFERENCE: A HISTORICAL APPROACH

1.1 INTRODUCTION

Each individual or household has a fairly accurate notion of what its money income will be for a reasonable planning period, say a year. It also has some notion—perhaps not too well defined—of the goods and services it wants to buy. The task confronting every household is to spend its limited money income so as to maximize its economic well-being. No individual or household, of course, actually succeeds in this task. To some extent this failure is attributable to the lack of accurate information; but there are other reasons as well, such as impulse buying. Yet in any event, the more or less conscious effort to attain maximum satisfaction from a limited money income determines individual demand for goods and services.

To analyze the formation of consumer demand more accurately, we use some simplifying assumptions that do not distort the relevant aspects of economic reality.

1.1.a—Full Knowledge

First, we assume each consumer or family unit has complete information on all matters pertaining to its consumption decisions. A consumer knows the full range of goods and services available in the market; he knows precisely the technical capacity of each good or service to satisfy a want. Furthermore, he knows the exact price of each good and service, and he knows these prices will not be changed by his actions in the market. Finally, the consumer knows precisely what his money income will be during the planning period.

1.1.b—The Preference Function

A consuming unit—either an individual or a household—derives *satisfaction* or *utility* from each good or service consumed during a given time period. In order to attain its objective—maximization of satisfaction or utility for a given level of money income—the consuming unit must be able to rank different bundles of commodities. That is,

the consumer must be able to compare alternative budgets or bundles of commodities and to determine his order of preference among them.

To this end we assume each consuming unit has a *preference function* defined by and possessing the following characteristics:

i) The preference function establishes a *rank ordering* for every conceivable budget (or bundle of commodities).

ii) For every two budgets *A* and *B*, the preference function indicates that *A* is preferred to *B*, that *B* is preferred to *A*, or that the consumer is *indifferent* between these two alternatives. Furthermore, if *A* is preferred to *B*, *B* cannot be preferred to *A*; and if *A* is indifferent or equivalent to *B*, *B* is indifferent to *A*.

iii) Consider any three budgets *A*, *B*, and *C*. If *A* is preferred to *B* and *B* is preferred to *C*, *A* must be preferred to *C*. Similarly, if *A* is indifferent to *B* and *B* is indifferent to *C*, *A* must be indifferent to *C*.

iv) A greater budget is always preferred to a smaller one. One budget is greater than another if it contains as many units of every commodity and more units of at least one commodity.

In summary, the preference function is characterized by two relations: preference and indifference. When two or more budgets are compared, the preference function indicates the rank order of preference (two bundles that are indifferent are tied in rank).¹ The greater the budget, the higher its rank in the ordering. An example will help to explain.

Suppose there are only two goods, *X* and *Y*. A portion of a preference function is shown in Table 1.1.1 and illustrated in Figure 1.1.1. Budget *A* is clearly preferred to all other budgets (by iv) since it contains more of both commodities. Budget *B* is also clearly inferior to *A* because it contains the same amount of *Y* and less *X*. Budgets *C* and *D* are, by assumption, indifferent to *B*. The consumer is willing to take less *Y* if he gets some more *X* in return. Budget *B*, however, must be preferred to *E* because the latter has less *Y* and the same quantity of *X*. Similarly, *E* must be preferred to *F* because the latter has less *X* and the

¹ Mathematically, one may write the preference function as $\Phi = \Phi(x_1, x_2, \dots, x_n)$, where x_i indicates the quantity of the *i*-th commodity. Any, and therefore every, set of quantities defines a budget and a value of Φ . For example, the set of quantities x_i^a defines

$$\Phi^a = \Phi(x_1^a, x_2^a, \dots, x_n^a),$$

or the budget *A*. The characteristics stated above require that Φ establish a *complete rank ordering* of the budgets in commodity space. The preference function indicates two types of relations: preference and indifference. The indifference relation (I) is reflexive, symmetric, and transitive. Thus for any three bundles *A*, *B*, and *C*, the following must hold: *AIA*; if *AIB*, then *BIA*; if *AIB* and *BIC*, then *AIC*. The preference relation (*P*) is antisymmetric and transitive. For any three bundles, *APB* implies *B not PA*; *APB* and *BPC* implies *APC*. Finally, condition (iv) is a nonsatiation assumption. This implies that Φ does not possess a maximum point.

TABLE 1.1.1
A RANK ORDERING OF COMMODITY BUNDLES OR BUDGETS

Budget	Amount of X	Amount of Y	Rank Order
A.....	5	5	1
B.....	3	5	2
C.....	4	3	2
D.....	5	2	2
E.....	3	4	3
F.....	1	4	4
G.....	2	2	4
H.....	3	1	4

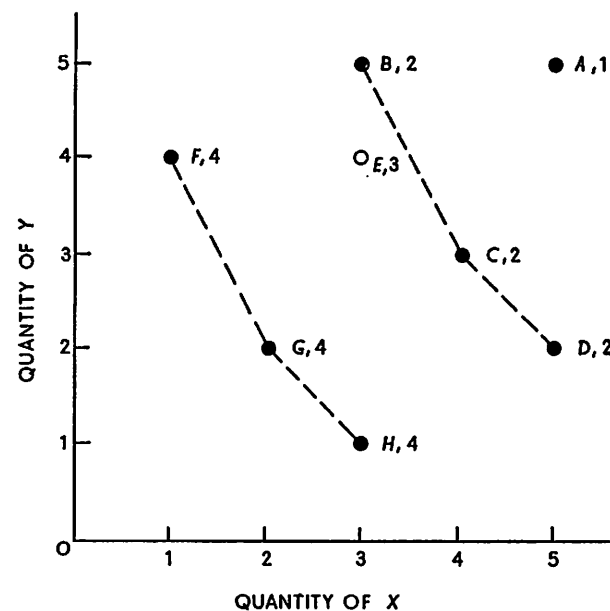


FIGURE 1.1.1
ORDERING OF BUDGETS IN TABLE 1.1.1

same quantity of *Y*. Finally, *G* and *H* are indifferent to *F*, the consumer being willing to substitute *X* for *Y* in his consumption pattern.

The assumptions necessary to analyze consumer behavior can be set out in the following compact form.

Assumptions: (a) Each consumer has exact and full knowledge of all information relevant to his consumption decisions—knowledge of the goods and services available and of their technical capacity to satisfy his wants, of market prices, and of his money income.

(b) Each consumer has a preference function that (i) establishes a rank

ordering among all budgets; (ii) for pairwise comparisons, indicates that A is preferred to B , B preferred to A , or that they are indifferent; (iii) for three-or-more-way comparisons, indicates that if A is preferred (indifferent) to B and B is preferred (indifferent) to C , A must be preferred (indifferent) to C ; (iv) states that a greater budget is always preferred to a smaller one.

Note: do the problem at the end of the chapter now.

1.2 UTILITY AND PREFERENCE

Economists define "utility" as that quality which inheres in a commodity to make it desired. This is, of course, a highly subjective phenomenon because each person's physiological and psychological makeup is different from another's. Yet if one sought a single criterion to distinguish modern microeconomic theory from its classical antecedents, he would probably decide it is to be found in the introduction of *subjective value theory* into economics.

Historically, the process was a long one. Our discussion will build up to the modern theory of consumer behavior by outlining some of its intellectual precursors.

1.2.a—The Original Approach

The modern theory of demand represents a psychological approach to the analysis of economic behavior. The first steps in this direction were hedonistic, based upon the notion of subjective utility. In the original approach—attributable to Gossen (1854), Jevons (1871), and Walras (1874)—utility was regarded as a *measurable* quality of any commodity. It was further assumed that utility is an *additive* quality.²

Any good or service consumed by a household provides utility; and the greater the rate of consumption, the greater the total utility associated with the consumption of that good. These early writers merely assumed that utility is cardinally measurable and that the utility obtained from one good is not affected by the rate of consumption of another. For example, one slice of bread per day might yield a measurable five "utils" of utility. Two slices per day might yield nine utils, three slices eleven utils, etc. Furthermore, the utility gained from bologna was assumed to be independent of the quantity of bread consumed. Thus one slice of bologna might yield twenty utils, two slices

² Alfred Marshall (1890) is also usually placed in the group of originators. In his *Principles* Marshall did indeed assume that utilities are independent and additive. However, it is not clear whether Marshall intended to be taken at his word or whether he regarded this as an approximation for small movements.

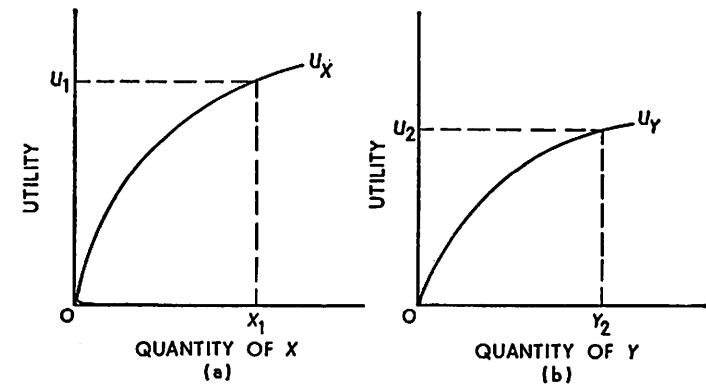


FIGURE 1.2.1
UTILITY FUNCTIONS WHEN UTILITIES ARE INDEPENDENT

thirty-seven utils, three slices fifty utils, etc. Total utility associated with consuming two slices of bread and two of bologna would therefore be forty-six utils.³

This approach is illustrated in Figure 1.2.1. We assume there are two commodities, X and Y . Panels a and b show hypothetical utility functions for an individual. The curve OU_X in panel a shows the level of utility associated with each rate of consumption of X . Thus if OX_1 units of X are consumed per period of time, the utility obtained is OU_1 utils. Similarly, OU_Y is the function relating utility to the consumption of Y . If OY_2 units are consumed per period, utility is OU_2 . Therefore, total utility is the measurable magnitude

$$U = OU_1 + OU_2.$$

There are two fundamental objections to this approach to the theory of consumer behavior. First, it is doubtful that the intensity of satisfaction (utility) can be measured *cardinally*—that is, measured as cardinal numbers such as 25, 56.5, and so on. Second, even if measurable, independent and additive utility is clearly an untenable assumption. The utility or satisfaction a person obtains from steak is related to his consumption of roast; the utility of tennis balls must be partially dependent upon the quantity of tennis rackets.

1.2.b—The Second Phase

The second objection to the earliest subjective value theory was soon removed. Edgeworth (1881), Antonelli (1886), and Irving

³ Let U represent utility and let goods 1, 2, . . . , n be consumed in the amounts x_1, x_2, \dots, x_n . $U_i(x_i)$ is the utility yielded by the i -th good, and total utility, according to this early approach, was simply given by

$$U = U_1(x_1) + U_2(x_2) + \dots + U_n(x_n).$$

Fisher (1892), among others, realized that utility theory in no way depended upon the additivity assumption. Hence these writers assumed that utility is a *measurable quality* that is generally nonadditive. Total utility depends upon the quantities of each good consumed per period of time, but it is not simply the *sum* of the independent utilities obtained separately from each good.⁴

Rather than constructing a utility function for *each* good, one must now construct a utility surface relating the level of utility to the rates of consumption of all goods simultaneously. Assuming there are two goods, X and Y, a utility surface is illustrated in Figure 1.2.2. The

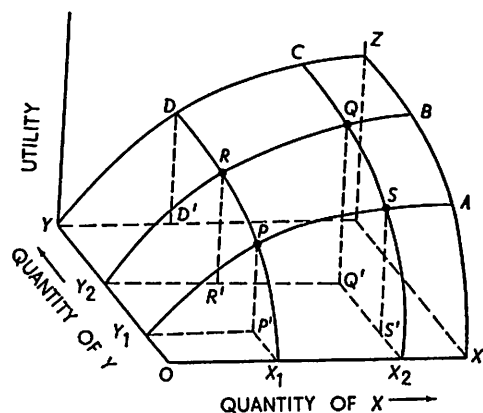


FIGURE 1.2.2
UTILITY SURFACE

utility surface is OXZY. Thus if OX_1 units of X and OY_1 units of Y are consumed per period of time, utility is the measurable magnitude PP' . Similarly, if OX_2 and OY_2 are consumed per period of time, total utility is QQ' .

Suppose the rate of consumption of X is fixed at OX_1 . The curve X_1PRD then shows the total utility associated with OX_1 units of X and variable amounts of Y. If consumption is OY_1 , utility is PP' ; if consumption is $OY_2 (>OY_1)$, utility is $RR' (>PP')$, etc. In like manner, if the consumption of X is held fixed at OX_2 units per period of time, the curve X_2SQC relates total utility to the rate of consumption of Y. The same analysis can be applied to a fixed rate of consumption of Y and a variable rate for X. If the consumption of Y is fixed at OY_1 , total utility is PP' if OX_1 units of X are consumed per period of time,

⁴ In the notation of footnote 3,
 $U = U(x_1, x_2, \dots, x_n)$.

$SS' (>PP')$ if the rate of consumption is $OX_2 (>OX_1)$, etc. Thus the curve Y_1PSA shows the level of total utility associated with OY_1 units of Y and various rates of consumption of X. Similarly, Y_2RQB shows the same thing when the rate of consumption of Y is fixed at OY_2 units per period of time.

The Edgeworth-Antonelli-Fisher approach removed one serious objection to the original form of subjective value theory, namely the assumption that utilities are independent and additive. Nonetheless, in this somewhat newer form the theory of consumer behavior rests upon the questionable assumption of cardinally measurable utility.

1.2.c—Pareto: The Final Step

The work of Vilfredo Pareto (1906) laid the foundation for removing this last objection, although Pareto himself did not exploit his discovery. Pareto's basic approach is formally the same as that of Edgeworth, Antonelli, and Fisher, as illustrated in Figure 1.2.2. There is only a change in interpretation; but this is very important because it enabled later writers to develop the theory of consumer behavior without resort to the assumption that utility is cardinally measurable.

Pareto's contribution may be explained by means of Figure 1.2.3. There are two goods, X and Y, and the total utility surface is OXZY, just as in Figure 1.2.2. If OX_1 units of X and OY units of Y are consumed per period of time, total utility is RR' . If the consumption of X is greater—at the rate OX_2 , for instance—the consumption of Y remaining unchanged, the level of utility is also greater, the amount BB' . But an essential feature of utility theory is that one commodity

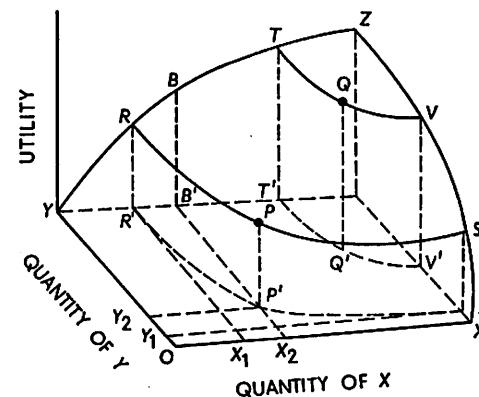


FIGURE 1.2.3
UTILITY SURFACE WITH CONSTANT UTILITY CONTOURS

may be *substituted* for another in consumption in such a way as to leave the level of total utility unchanged. For example, X_1X_2 units of X may be substituted for YY_2 units of Y without changing total utility. If the rates of consumption are OX_1 of X and OY of Y , total utility is RR' . If the rates are OX_2 of X and OY_2 of Y , total utility is $PP' = RR'$. Similarly, OX of X and OY_1 of Y yield total utility of $SS' = PP' = RR'$.

In other words, one may "slice" or intersect the utility surface at the level $RR' = PP' = SS'$ and determine all combinations of X and Y that will yield this constant level of utility. These combinations are shown by the dashed curve $R'P'S'$ in the X - Y plane. Since each combination of X and Y on $R'P'S'$ yields the same level of utility, a consumer would be indifferent to the particular combination he consumed. In like manner, all combinations of X and Y on the dashed curve $T'Q'V'$ yield the same total utility ($TT' = QQ' = VV'$). A consumer would thus be indifferent as to the particular combination consumed. But a consumer would *not* be indifferent between a combination of X and Y lying on $R'P'S'$ and a combination lying on $T'Q'V'$. Each combination on $T'Q'V'$ is preferred to any combination on $R'P'S'$ because the former yields a higher level of total utility (for example, $TT' > RR'$).

Curves such as $R'P'S'$ and $T'Q'V'$ are called *indifference curves*.

Definition: An indifference curve is a locus of points—or particular budgets or combinations of goods—each of which yields the same level of total utility.

A partial set of indifference curves is shown in Figure 1.2.4.⁵ Graphs such as this are called *indifference maps*.

The curve labeled I in Figure 1.2.4 might represent all combinations of X and Y that yield ten utils of utility to a certain person. Similarly II, III, and IV represent all combinations yielding nineteen, twenty-six, and thirty utils respectively. Now, the important contribution of Pareto lay in recognizing that the specific utility numbers attached to I, II, III and IV are immaterial—the numbers could be 10, 19, 26, and 30, or 100, 190, 270, and 340, or any other set of numbers that *increase*. The salient point is that for the theory of consumer behavior, only the shape of the indifference map matters—the underlying

⁵Using the utility function in footnote 4, an indifference curve is given by the equation

$$U(x_1, x_2, \dots, x_n) = c,$$

where c is a constant. An indifference map is generated by allowing c to assume every possible value.

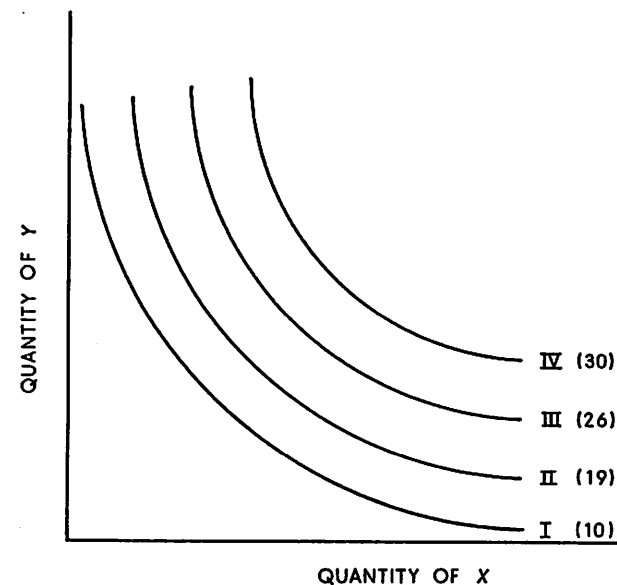


FIGURE 1.2.4
INDIFFERENCE CURVES

ing utility surface is immaterial. The indifference map can be defined on a psychological-behavioristic basis without making use of the concept of measurable utility. The indifference curves and the concept of preference are all that is required—all budgets situated on the same indifference curve are equivalent; all budgets lying on a higher curve are preferred.

Relationships: a consumer regards all budgets yielding the same level of utility as equivalent. The locus of such budgets is called an indifference curve because the consumer is indifferent as to the particular budget he consumes. The higher, or further to the right, an indifference curve, the greater is the underlying level of utility (compare $R'P'S'$ and $T'Q'V'$ in Figure 1.2.3). Therefore, the higher the indifference curve, the more preferred is each budget situated on the curve.

1.2.d—Summary

We have now passed from the original concept of measurable, additive utility and the associated utility surface to the concept of preference and indifference as defined by the indifference map. The essential difference between the two lies in the nature of the measurement scale involved. In the older approaches, utility was assumed to be *cardinally measurable* in some units such as utils. The contribution of Pareto was to show that only *ordinal* measurement is required.

The cardinal measure of utility associated with each indifference curve is immaterial. The only requirement is that indifference curves rank budgets according to preference. Thus in Figure 1.2.4, all combinations on IV are most preferred; all budgets on III are preferred to those on II and I and are less desirable than those on IV, and so on. To repeat, cardinal measurement is not required. Ordinal measurement—ranking budgets first, second, third, etc.—is all that is required.

1.3 CHARACTERISTICS OF INDIFFERENCE CURVES

Indifference curves have three characteristics important in our discussion of the modern theory of consumer behavior in Chapter 2. The first property is actually an assumed one; the second is a logical necessity; and the third is required by the condition (discussed in Chapter 2) that a consumer behave so as to maximize the satisfaction obtainable from a given money income.

For simplicity of discussion, assume there are only two goods, X and Y. The X-Y plane is called *commodity space*. The first property results from the following assumption: an indifference curve passes through *each* point in commodity space. In the language of mathematics, indifference curves are “everywhere dense.” For example, draw any two indifference curves. An infinite number of indifference curves lie between the two you have drawn. This property is very similar to a property possessed by rational numbers: there are an infinite number of rational numbers lying between $\frac{1}{100}$ and $\frac{1}{1000}$ (or any other pair of rational numbers).

Second, indifference curves cannot intersect. This property is a logical necessity, as illustrated in Figure 1.3.1. In this graph I and II are indifference curves, and the points P, Q, and R represent three different budgets (or combinations of X and Y). R must clearly be preferred to Q because it contains more of both goods (characteristic iv in subsection 1.1.b above). R and P are equivalent because they are situated on the same indifference curve. In like manner, P and Q are indifferent. By characteristic iii, subsection 1.1.b, indifference is a “transitive” relation—that is, if A is indifferent to B and B is indifferent to C, A must be indifferent to C. In our present case, R is indifferent to P and P is indifferent to Q, hence R must be indifferent to Q. But as previously mentioned, R is preferred to Q because it contains more of both goods. Hence intersecting indifference curves, such as those shown in Figure 1.3.1, are logically impossible.

The third property of indifference curves is required in order for a

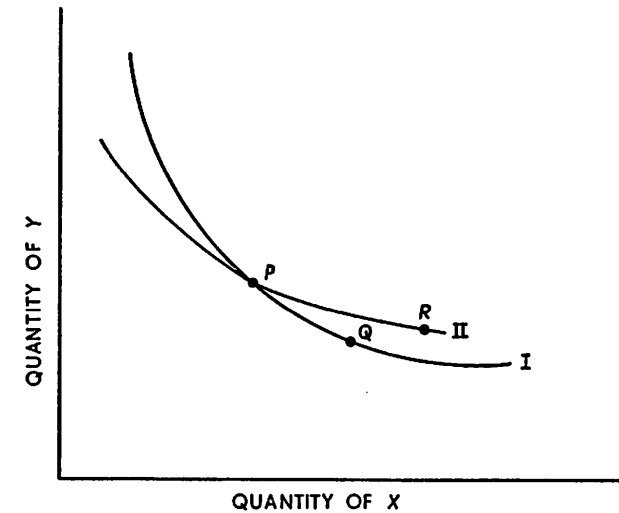


FIGURE 1.3.1
INDIFFERENCE CURVES CANNOT INTERSECT

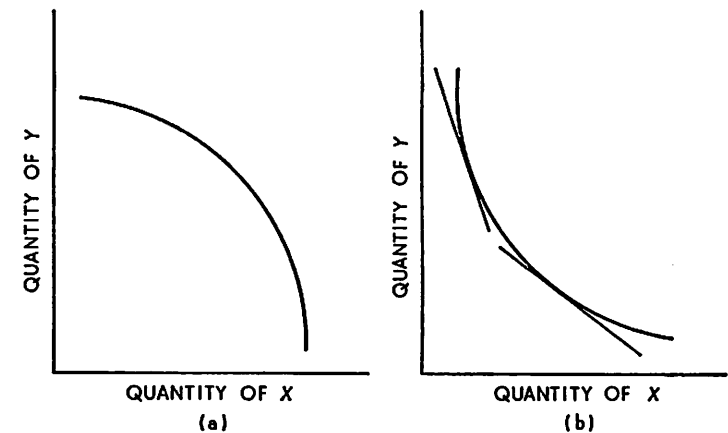


FIGURE 1.3.2
INDIFFERENCE CURVES ARE CONCAVE FROM ABOVE

consumer to maximize satisfaction for a given expenditure of money income.⁶ The property is that indifference curves are *concave from above*—that is, an indifference curve must lie above its tangent at each point, as illustrated by panel b, Figure 1.3.2. This implies that indifference curves cannot look like the curve constructed in panel a of that figure.

Properties: indifference curves possess the following characteristics:
(a) an indifference curve passes through each point in commodity space;

⁶ This proposition is proved in footnote 4, Chapter 2.

(b) indifference curves cannot intersect; and (c) indifference curves are concave from above.

1.4 MARGINAL RATE OF SUBSTITUTION

As previously mentioned, one essential feature of the subjective theory of value is that different combinations of commodities can give rise to the same level of utility. In other words, the consumer is indifferent as to the particular combination he obtains. Therefore, as market prices might dictate, one commodity can be substituted for another in the right amount so the consumer remains just as well off as before. He will, in other words, remain on the same indifference curve. It is of considerable interest to know the rate at which a consumer is *willing* to substitute one commodity for another in his consumption pattern.

Consider Figure 1.4.1. An indifference curve is given by the curve labeled *I*. The consumer is indifferent between the budget *R*, containing OX_1 units of *X* and OY_1 units of *Y*, and the budget *P* containing $OX_2 > OX_1$ units of *X* and $OY_2 < OY_1$ units of *Y*. The consumer is willing to substitute X_1X_2 units of *X* for Y_1Y_2 units of *Y*. The rate at which he is willing to substitute *X* for *Y*, therefore, is

$$\frac{OY_1 - OY_2}{OX_2 - OX_1} = \frac{RS}{SP}$$

This ratio measures the average number of units of *Y* the consumer is willing to forego in order to obtain one additional unit of *X* (over the

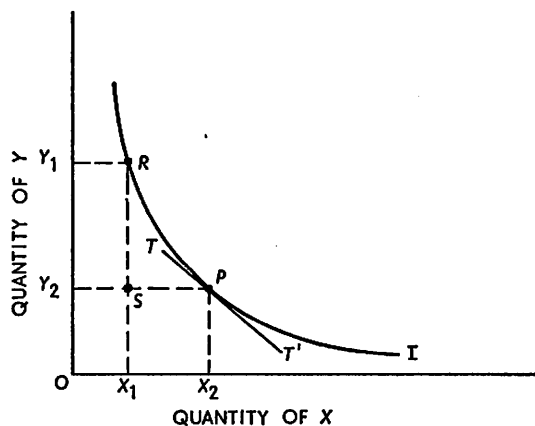


FIGURE 1.4.1
THE MARGINAL RATE OF SUBSTITUTION

range of consumption pairs under consideration). Stated alternatively, the ratio measures the amount of *Y* that must be sacrificed per unit of *X* gained if the consumer is to remain at precisely the same level of satisfaction.

The rate of substitution is given by the ratio stated above. But as the point *R* moves along *I* toward *P*, the ratio RS/SP approaches closer and closer to the slope of the tangent TT' at point *P*. In the limit, for very small movements in the neighborhood of *P*, the slope of *I* or of its tangent at *P* is called the *marginal rate of substitution of X for Y*.

Definition: the marginal rate of substitution of *X* for *Y* measures the number of units of *Y* that must be sacrificed per unit of *X* gained so as to maintain a constant level of satisfaction. The marginal rate of substitution is given by the slope of an indifference curve at a point. It is defined only for movements along an indifference curve, never for movements among curves.⁷

The requirement that indifference curves be concave from above implies that the marginal rate of substitution of *X* for *Y* diminishes as *X* is substituted for *Y* along an indifference curve. This is illustrated in Figure 1.4.2.

I is an indifference curve, and *P*, *Q*, and *R* are three budgets situated on this curve. The horizontal axis is measured so that $OX_1 = X_1X_2 = X_2X_3$. Consider first the movement from *P* to *Q*. If *P* is very close to *Q*, or the amount X_1X_2 is very small, the marginal rate of substitution of *X* for *Y* at *Q* is

$$\frac{OY_1 - OY_2}{OX_2 - OX_1} = \frac{Y_1Y_2}{X_1X_2}$$

Similarly, for a movement from *Q* to *R*, the marginal rate of substitution at *R* is

$$\frac{OY_2 - OY_3}{OX_3 - OX_2} = \frac{Y_2Y_3}{X_2X_3}$$

⁷ Let the utility function be $U(x, y)$, so an indifference curve is given by $U(x, y) = c$, where c is a constant. Taking the total derivative, one obtains

$$\frac{\partial U}{\partial x} dx + \frac{\partial U}{\partial y} dy = 0$$

Solving for dy/dx , the slope of the indifference curve, we find that

$$-\frac{dy}{dx} = MRS_{xy} \text{ for } y = \frac{\frac{\partial U}{\partial x}}{\frac{\partial U}{\partial y}}$$

In older terminology, $\partial U/\partial x$ was called the marginal utility of x , $\partial U/\partial y$ the marginal utility of y . Thus the marginal rate of substitution of x for y is the ratio of the marginal utilities of x and y .

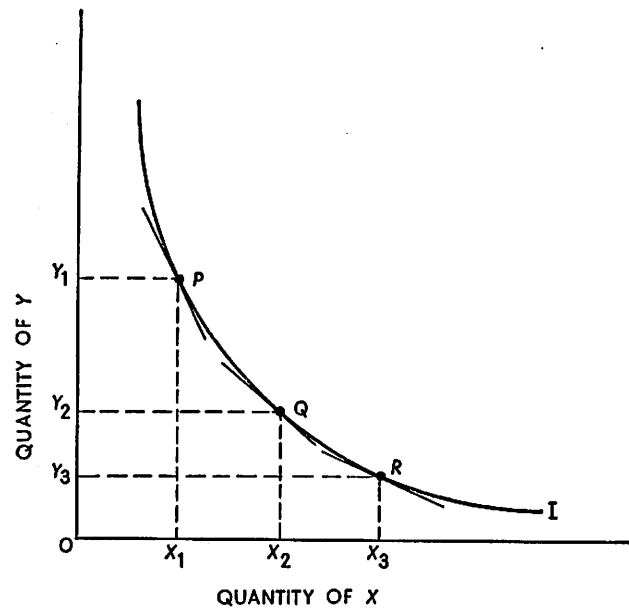


FIGURE 1.4.2
THE DIMINISHING MARGINAL RATE OF SUBSTITUTION

By construction $X_1X_2 = X_2X_3$; but very obviously, $Y_1Y_2 > Y_2Y_3$. Hence the marginal rate of substitution is less at R than at Q. This is also shown by the decreasing slopes of the tangents at P, Q, and R.

Principle: As X is substituted for Y so as to leave the consumer on the same indifference curve, the marginal rate of substitution of X for Y diminishes.

1.5 CONCLUSION

Historically, economists have turned from a theory of utility to a theory of preference to explain consumer behavior and demand. Instead of using the entire utility surface, only indifference curves are required. These curves pass through every point in commodity space, never intersect, and are concave from above. The last mentioned property implies that the marginal rate of substitution of X for Y diminishes as X is substituted for Y so as to maintain the same level of satisfaction.

These concepts and relationships are used in Chapter 2 to develop the modern theory of consumer behavior and to determine the shape of individual demand curves.

PROBLEM

There are three commodities X, Y, and Z. The table contains a list of budgets composed of different combinations of these three goods. Determine the rank order of the budgets (in this problem, there are no budgets among which the consumer is indifferent).

Budget	Amount of X	Amount of Y	Amount of Z	Rank Order
A.....	86	88	77	
B.....	86	87	76	
C.....	100	90	80	
D.....	79	80	69	
E.....	85	87	76	
F.....	79	79	68	
G.....	95	89	79	
H.....	80	80	70	
I.....	79	79	69	
J.....	86	87	77	

SUGGESTED READINGS

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