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Useful Notes on Consumer’s Equilibrium in Both One and Two Commodity World

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Suppose the consumer is in one commodity world where commodity price is fixed. Suppose further that consumption is indivisible (i.e., all the units of the commodity are to be consumed in one go), and hence subject to the law of diminishing marginal utility. Let the commodity in question be bananas available at a fixed price of Rs 2 each.

As shown in Table 2.5, suppose that marginal utility of bananas is measurable in money units and our consumer is hungry having nothing else available except bananas. The marginal utility of successive units of bananas, starting from the first, diminishes suppose by one rupee each time the consumer has an additional banana, given his estimate of the marginal utility for the first banana at Rs 8.

It is quite obvious that the consumer would consume only seven bananas because the marginal utility of each of these seven bananas is either greater than or equal to the price of a banana which is fixed at Rs 2.

Table 2.5:

No. of bananas had :	1	2	3	4	5	6	7	8	9	10	1
Marginal utility (Rs) :	8	7	6	5	4	3	2	1	0	-1	-
Price (Rs) :	2	2	2	2	2	2	2	2	2	2	2

The equilibrium level of consumption is seven bananas. For the seventh banana, the marginal utility is Rs 2 which is equal to its price, Rs 2 (Figure 2.28; x = 7). For subsequent units of bananas, the marginal utility is less than the price to be paid for each.

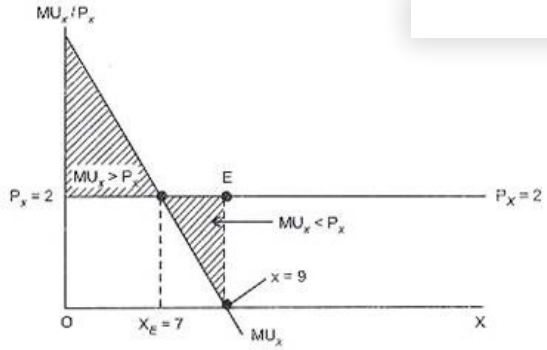


Fig. 2.28: *Equilibrium of the consumer takes place at the point where MUx = P_x. The MU curve slopes downward from left to right demonstrating the law of diminishing marginal utility. Price of the product being fixed, the horizontal price line cuts the MU curve at point E, the point of equilibrium.*

The illustration explains Marshall's cardinal utility approach which is based on subjectivity and numerical measurability of utility. A consumer attempts maximisation of the excess of utility derived over the sacrifice of purchasing power made.

Let this excess be denoted by Φ so that

$$\Phi = U - xP_x \quad \ldots(2.11)$$

Where, U = utility derived, x = quantity of X purchased at price P_x

With the help of differential calculus, it can be shown that O would be maximised when marginal utility (MU) is equal to the price of the product and the slope of the MU curve is negative. For multiproduct markets, the condition can be generalised as

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \frac{MU_z}{P_z} \quad \ldots(2.12)$$

Let us now turn to the consumer's equilibrium through the Hicks-Allen indifference curve approach of ordinal utility.

Consumer's Equilibrium in a Two-Commodity World:

Suppose the consumer is in a two-commodity world. He consumes quantities x and y of goods X and Y respectively. Prices of the two goods are given as P_x and P_y. Total utility derived by the consumer from these quantities is U. Thus

U = f (x, y)

Here, U is a function of x and y. It shows depends on the quantities of the two goods consumed. To derive a fixed level of utility, U a consumer may have more of X with less of Y or more of Y with less of X. Level of utility derived from each being the same, our consumer will be indifferent between the two combinations.

In other words, it would not matter whether he has more of X with less of Y or more of Y with less of X so long as he has the same level of utility from each of the two combinations. To demonstrate, let the two commodities be oranges (X) and apples (Y) (Refer Figure 2.29).

Then, so long as the utility derived by the consumer from 10 oranges with 50 apples is the same as that derived from 50 oranges with 10 apples, or from 20 oranges with 30 apples, the consumer in question will be indifferent in between these combinations. For him, one bundle is as good as another.

Plotting the combinations (10, 50), (20, 30) and (50, 10) of the two fruits with oranges on the x-axis and apples on y-axis and joining the points by means of a smooth curve, we get a curve called the 'indifference curve'.

The nomenclature is deliberate. One can use 'fixed utility curve' as an alternative but use of indifference curve' is to emphasize consumer's indifference in between the bundles as each of them offers him the same utility. Here, the 'curve is convex to the origin' (Fig.2.29). Consumer's preferences that lead to an indifference curve such as this are called 'convex preferences.

An indifference curve can thus be defined as the locus of various combinations of quantities of two goods each of which offers the same level of satisfaction (utility, U) to the consumer to the extent that the consumer turns indifferent in between any two of them. Utility derived by the consumer being fixed, the utility function of equation 2.13 transforms to

U =f(x, y)

Where, U is fixed level of utility derived fr

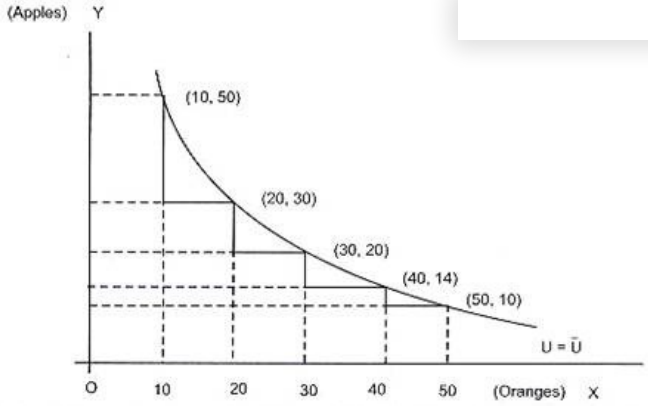


Fig. 2.29: *Each of the combinations (10. 50), (20, 30), (30, 20), (40, 14) and (50, 10) in the figure stands for the same utility, $\bar{U}$, with the result that the consumer turns indifferent in between any two of them. The combinations here lead to an indifference curve that is convex to the origin, and hence, they are known as convex preferences. Note how the rate of sacrifice of apples each time 10 additional oranges are had by the consumer varies along the curve. The rate, also called the Marginal Rate of Substitution of X for Y and written as $MRS_{x,y}$, depicts a diminishing trend from left to right along the curve. $MRS_{x,y}$ can be defined as the rate at which commodity Y is sacrificed by the consumer per additional unit of commodity X had.*

As we go down the curve from left to right (Figure 2.29), we observe that the slope ($\Delta y/\Delta x$) of the curve increases while the numerical value of the slope ($|\ \Delta y/\Delta x\ |$) decreases. The latter, known as the Marginal Rate of Substitution of X for Y, written as $MRS_{x, y}$, is defined as the rate at which units of Y are sacrificed each time an additional unit of X is had by the consumer. Thus,

$MRS_{x, y}$ = Quantity of Y foregone (Δy) / Quantity of X gained (Δx)

= Change in quantity of Y / Change in quantity of X

$$= \frac{-\Delta y}{+\Delta x} = -\frac{\Delta y}{\Delta x}$$

$$= \left|\frac{\Delta y}{\Delta x}\right| \qquad \ldots(2.15)$$

Expression in (2.15) represents the numerical value of the slope of the curve. Note that $\Delta y/\Delta x$ is the slope, which is negative. Its numerical value can be represented as modulus of $\Delta y/\Delta x$ or as $(-\Delta y/\Delta x)$.

For small changes in y and x, the rate can also be represented as (-dy/dx) or as modulus of (dy/dx). Table 2.6 demonstrates the mechanism of determi
as the $MRS_{x, y}$.

As quantity of X increases, that of Y decr
changes in y are negative while those in x, positive. The ratio $\Delta y/\Delta x$ is negative. It increases from (-2.00) to (-0.40) from left to right along the Indifference Curve (IC).

The numerical value (modulus) of the slope, defined as $MRS_{x,y}$ decreases from 2.00 to 0.40 as we go down the curve. The fact is known as the law of diminishing marginal rate of substitution of X for Y.

Table 2.6

Oranges (X)	Apples (Y)	Changes		Slope of IC ($\Delta y/\Delta x$)	$MRS_{x,y}$ $\lvert\Delta y/\Delta x\rvert$
		Δy	Δx		
10	50	–	–	–	–
20	30	–20	+10	–2.00	2.00
30	20	–10	+10	–1.00	1.00
40	14	–06	+10	–0.60	0.60
50	10	–04	+10	–0.40	0.40

Consumer preferences such as these that lead to an indifference curve convex to the origin, or to the diminishing marginal rate of commodity substitution, are known as the convex preferences, as stated earlier. Consumer preferences that lead to negative slope of the indifference curve are called monotonic preferences.

To provide an illustrative definition, if (x_1 y_1) is a bundle (combination) of two goods and if (x_2, y_2) is a bundle of two goods with at least as much of both the goods and more of one, then consumer's preference to (x_2, y_2) over (x_1 , y_1), written as (x_2, y_2) > (x_1; y_1), is known as the monotonic preference.

How could such preferences lead to a negative slope? To understand, see Figure 2.30. Such preferences imply 'more is better' which is abbreviated as MIB. As the saying goes, excess of everything is bad. The assumption of MIB holds only to a certain point in consumption. If goods are consumed beyond this point, called the point of satiation, 'more is no longer better'.

Preference to bundle (3, 3) over bundles
(0, 3), (1, 0), (1, 1), (1, 2), (1, 3), (2, 0), (2
0), (3, 1) and (3, 2) is a monotonic prefer

are ranked as in Table 2.7). It implies at l
the goods as each of the rejected bundles offer and more of at least one of the two goods.

The indifference curve that serves as the lowest boundary of the preferred zone of the consumer can be checked to have bundles (1, 2) and (2, 1) while a higher boundary would comprise bundles (1, 3), (2, 2), (3, 1) and a still higher one would comprise bundles (2, 3) and (3, 2). Of the three, the last one yields the highest IC, raising the preferred zone up while the first one yields the lowest IC, lowering the preferred zone down.

In all the three cases, ICs would have the negative slope. The reader can make a note of the fact that bundles with zero quantity of any one of the two goods cannot fall on an IC due to the implicit assumption that the consumer has to consume both the goods, implying non-zero quantities of both. Of the three, a consumer with monotonic preferences would prefer the IC having bundles (2, 3) and (3, 2).

Next in order of his preference would be the IC having bundles (1, 3), (2, 2), (3, 1), and the last one in order of preference would be the IC having bundles (1, 2) and (2, 1). Each of the bundles (3, 3) and (1, 1) is an isolated bundle.

The former would fall on the highest IC and the latter, on the lowest one, provided such ICs exist. Existence or non-existence of an IC for an isolated bundle would depend on whether the nature of the consumer's preferences is known or not.

Given that consumer's preferences are linear, each of the two isolated bundles would fall on a linear IC and given that consumer's preferences are convex, each of the isolated bundles would fall on a convex IC. Assuming that the consumer's preferences are linear in this illustration, we can draw ICs at least for the bundles ranked 1 to 5 in Table 2.7.

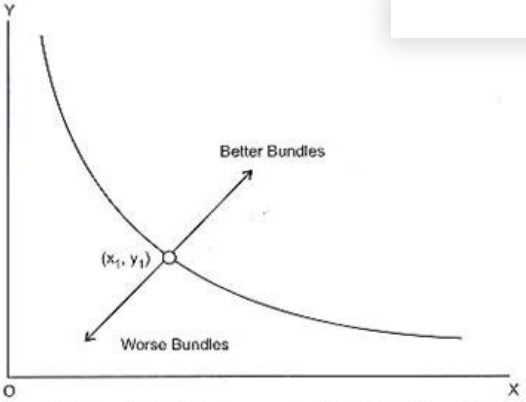
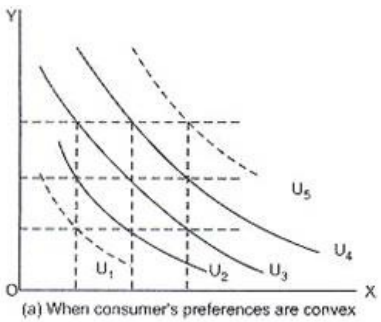


Fig. 2.30: *Bundle (x_1, y_1) lies on the indifference curve. Bundles with at least as much of both the goods and more of one, if preferred by a consumer, imply his monotonic preferences. Starting from bundle (x_1, y_1) and moving anywhere up and to the right is moving to the preferred zone while moving down and to the left is moving to the non-preferred zone. All the better bundles in the preferred zone imply at least as much of two goods as offered by any bundle on the IC and more of one. The IC, therefore, serves as the lower boundary of the preferred zone. This is possible only when the IC is negatively sloped.*

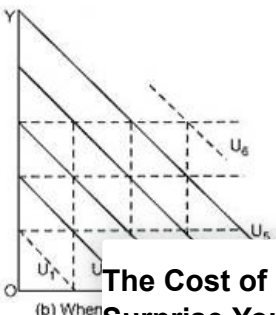
Table 2.7: Given convex preferences, bundles in bold figures would not fall on an IC as the consumer is implicitly assumed to consume bundles with non-zero quantities of both the goods. The rest, with ranks 1, 2, 3, 4 and 5 would yield five convex ICs [panel (a)] with one above the other. When consumer's preferences are given as linear bundles ranked from 1 to 6 can all be portrayed through linear ICs as shown in panel (b) of Figure 2.31 ICs, one above the other comprise indifference map.

Table 2.7

Ranks	Bundles
1	(3. 3)
2	(2, 3), (3, 2)
3	(1, 3), (2, 2), (3, 1)
4	(1, 2), (2, 1), **(0, 3)**, **(3, 0)**
5	**(0, 2)**, (1, 1), **(2, 0)**
6	**(0, 1)**, **(1, 0)**
7	**(0, 0)**



(a) When consumer's preferences are convex



(b) When

Fig. 2.31: Given consumer's preferences (a)], bundles with non-zero quantities of the two goods in the first five ranks are portrayed through convex ICs. The lowest and the highest ICs, though having isolated bundles, assume convex shapes and so do the other three ICs. Lowest boundary of the preferred zone is U_l and highest one is U_5. In order of preference, $U_5 > U_4 > U_3 > U_2 > U_1$. Given consumer's preferences as linear [panel (b)], all the bundles including those with zero quantities of one or the other or of both the goods can be portrayed through linear ICs. They are six in number and each one of them extends to the two axes. The lowest one having zero quantities of both is not portrayed because it offers no utility to the consumer. In order of preference, $U_6 > U_5 > U_4 > U_3 > U_2 > U_1$ the lowest and the highest boundaries of the preferred zones are U_1 and U_6. Each one has a negative slope, confirming the fact that the preferences represented by it are monotonic preferences. When consumer's preferences are linear, the locus of f(x, y) = U is a straight line with a downward slope and may be given by ax + by = c, where, a, b and c are all constants. ICs are linear when the two goods in question are perfect substitutes of each other. As discussed later in this section, prefect substitutes are rare in real world. What we often come across are close substitutes like pepsi and coke, tea and coffee, etc. Note that $MRS_{X,Y}$ = constant for each IC.

Besides monotonic and convex preferences, consumers are known to have linear preferences as seen in above illustration, quasi-linear preferences, discrete preferences, Cobb Douglas preferences, and homothetic preferences. You will study about them in higher classes.

Similarly commodities can be classified as normal goods, neutral goods and bad goods (economic bads). Utility contributed by a unit of normal good is positive, that by a unit of neutral good is zero, and by a unit of economic bad is negative. Cigarettes and alcohol are both economic bads as both are injurious to human health. For a economics, a book on biology is a neutra economics is a normal good.

Changes in the shapes of the ICs caused by changes in consumer preferences, and the nature of one or both of the two goods consumed are quite interesting. You will study them in higher classes.

Indifference curves possess a few interesting features. Here, we cannot resist the temptation of outlining them.

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