UNIT –III

ORDINAL UTILITYANALYSIS

The Ordinal Utility Theory

The ordinal utility approach is a school of thought that believes that utility cannot be measured quantitatively, that is, utility is not additive rather it could only be ranked according to preference. The consumer must be able to determine the order of preference when faced with different bundles of goods by ranking the various 'baskets of goods' according to the satisfaction that each bundle gives. For instance, if a consumer derives 3 utils from the consumption of one unit of commodity X and 12 utils from the consumption of commodity Y, this means that the consumer derives more satisfaction from consuming commodity Y than from commodity X. Though to the cardinals, the consumer derives four times more utility from one unit of Y than from X. The ordinal utility theory explains consumer behaviour by the use of indifference curve.

4.1 Assumptions of Ordinal Utility Approach

(i) Rationality: - The consumer is assumed to be rational meaning that he aims at maximizing total utility given his limited income and the prices of goods and services.

(ii) Utility is Ordinal: - According to this assumption, utility is assumed not to be measurable but can only be ranked according to the order of preference for different kinds of goods.

(iii) Transitivity and Consistency of Choice: - By transitivity of choice, it means that if a consumer prefers bundle A to B and bundle B to C, then invariably, the consumer must prefer bundle A to C. Symbolically, it is written as:

If $A > B$ and $B > C$; then $A > C$.

By consistency of choice, it is assumed that the consumer is consistent in his choice making. If two bundles A and B are available to the consumer, if the consumer prefers bundle A to B in one period, he cannot choose bundle B over A nor treat them as equal. Symbolically:

If $A > B$, then $B > A$ and $A \neq B$ |

(iv) Diminishing Marginal Rate of Substitution (MRS):- MRS is the rate at which the consumer can exchange between two goods and still be at the same level of satisfaction. This assumption is based on the fact that the preferences are ranked in terms of indifference curves which are assumed to be convex to the origin.

(v) The Total Utility of the consumer depends on the quantities of the commodities consumed. That is, the total utility is the addition of the different utilities. u = f(q1, q2 ----- qn)

(vi) Non Satiation: - it is assumed that the consumer would always prefer a larger bundle of goods to a smaller bundle of the same good. He is never over supplied with goods within the normal range of consumption.

4.2 Indifference Curve Analysis

Situations can arise when a consumer consumes a large number of goods, the consumer may substitute one commodity for another and still be on the same level of satisfaction. As the consumer increases the consumption of one of the commodities, he must reduce the consumption of the second commodity and vice versa, to maintain the same level of satisfaction. When plotted graphically, it gives rise to what is known as an indifference curve. An indifference curve is defined as the locus of points representing different combination of two goods which yield equal utility to the consumer so that the consumer is indifferent to the combination consumed. When the preferences are plot graphically, it gives an indifference curve (Figure 4.1a). An indifference curve is also called iso-utility curve or equal utility curve. It is assumed that the goods may not be perfect substitutes but if the commodities are perfect substitutes, the indifference curve becomes a straight line with a negative slope (Figure 4.1b). And if the commodities are complements the curve assumes the shape of a right angle (Figure 4.1c).

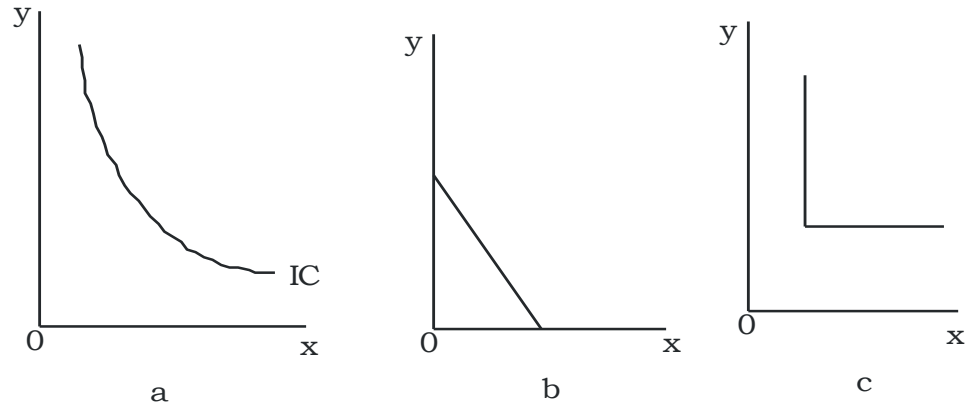


Figure 4.1: Different shapes of Indifference Curve

Let us illustrate the indifference curve using a consumer consuming two goods X and Y and makes six combinations which yield the same level of satisfaction. If we assume a hypothetical table with the different combinations of goods X and Y, the table could be regarded as an indifference schedule.

Table 4.1 A Hypothetical Indifference Schedule

Combination	Units of commodity X	Units of commodity Y	Utility
a	3	28	u
b	6	23	u
c	10	16	u
d	18	12	u
e	26	8	u
f	30	5	u

When the combinations a, b, c, d, e, f are plotted on a graph, the resulting curve is known as indifference curve. The indifference curve slopes downward from left to right showing that it is convex to the origin.

Different sets of indifference curves give an indifference map. An indifference map (Figure 4.2b) contains different number of indifference curves to show that the consumer may also choose other combinations of goods X and Y. The combinations of goods on a higher indifference curve yield higher level of satisfaction and are preferred. From Figure 4.2b, combination of goods X and Y on IC_3 is higher than the combination on IC_2, while the combination on IC_2 is higher than the combination on IC_1.

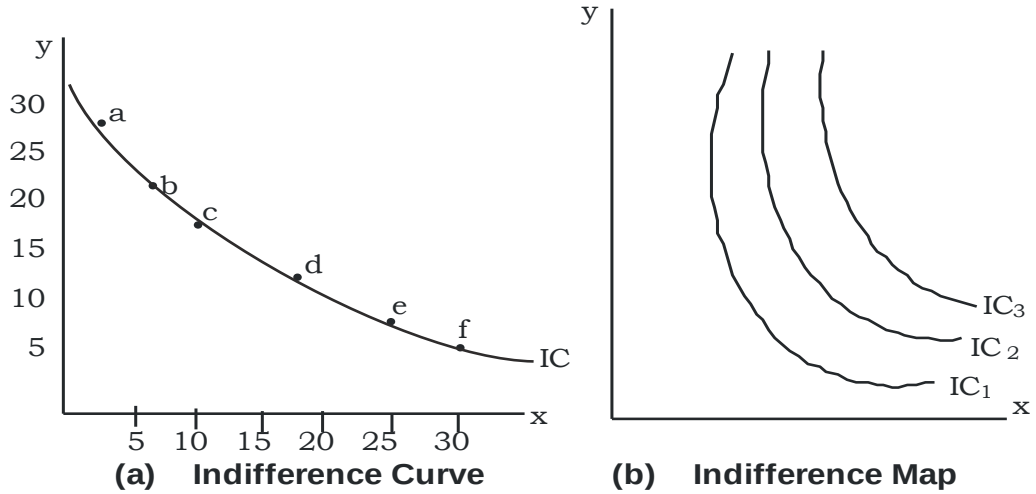


Figure 4.2: A Graph showing an Indifference Curve and Map

4.2.1 Properties of an Indifference Curve

(1) Indifference curves are negatively sloped: - This negative slope shows that for a consumer to stay on the same level of satisfaction, as the consumption of one commodity (X) increases, the quantity of the other commodity (Y) must decrease. This reflects the marginal rate of substitution. Marginal rate of substitution describes the rate of exchange between two

commodities. For our two commodities X and Y, the marginal rate of substitution of commodity X for commodity Y denoted as MRSx,y is the rate at which commodity X can be substituted for commodity Y, leaving the consumer at the same level of satisfaction. It is also known as the negative slope of an indifference curve at any one point.

$$\text{Slope of IC} = -\frac{dX}{dY} = MRS_{Y,X} \qquad 4.1$$

(2) Indifference curves must not Intersect: - If two indifferent curves intersect, it means two different levels of satisfaction at the point of intersection. This situation is impossible because it implies inconsistency in consumer's choices. In other words, it nullifies the consistency and transitivity of choice assumption.

(3) Upper indifference curve indicates a higher level of satisfaction: - An upper indifference curve contains a larger combination of both commodities than a lower one and gives the consumer a higher level of satisfaction.

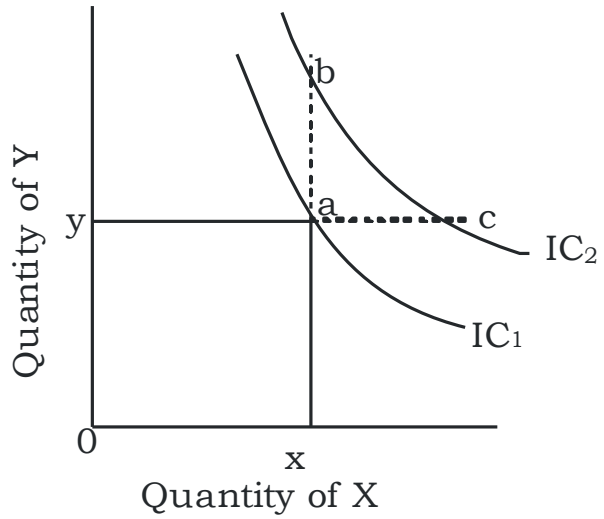


Figure 4.3: Higher and Lower Indifference Curve.

Let us assume two commodities X and Y with different combinations. From Figure 4.3, there are two indifference curves IC_1, and IC_2. A movement from point 'a' on IC_1 to point 'b' on IC_2 indicates an increase in the quantity of commodity Y, while a horizontal movement from point 'a' to point 'c' on IC_2 indicates an increase in the quantity of commodity X with the quantity of commodity Y remaining constant. The combinations on point 'b' and 'c' on IC_2 yield higher utility and will be preferred by the consumer.

(4) Indifference curve must be convex to the origin: - This shows that the slope of the indifference curve decreases as we move along the curve from left to the right.

4.3 The Budget Constraint of the Consumer

The main objective of a rational consumer is to maximize his total utility by assigning his limited resources (income). The consumer's ability to allocate these commodity bundles depends on the prices of the commodities. The income and prices of the concerned commodities act as a constraint to the consumer's ability to consume the desired commodities. Jointly they form a budget constraint and when graphed, it gives the budget line. Assuming our two commodities X and Y with prices Px and Py respectively, if the consumer spends all the income on the two commodities alone, the budget equation may be written as follows:

$$I = XPx + YPy \qquad 4.2$$

Where,

I = the income constraint of the consumer. X and Y quantities of commodities X and Y respectively while Px and Py are the respective prices of commodities X and Y.

If the consumer decides not to buy commodity X and spend the whole income in consuming commodity Y, then the quantity of Y demanded by the consumer will be:

$$QY = I/Py. \qquad 4.3$$

Similarly, If the consumer decides to spend the entire income in buying commodity X, then the quantity of X demanded will be:

$$QX = I/Px \qquad 4.4$$

Therefore, equation 4.3 and 4.4 explains the points of intersection of the budget line at the respective X and Y axis. The income constraint can be represented graphically with the budget line as shown in Figure 4.3

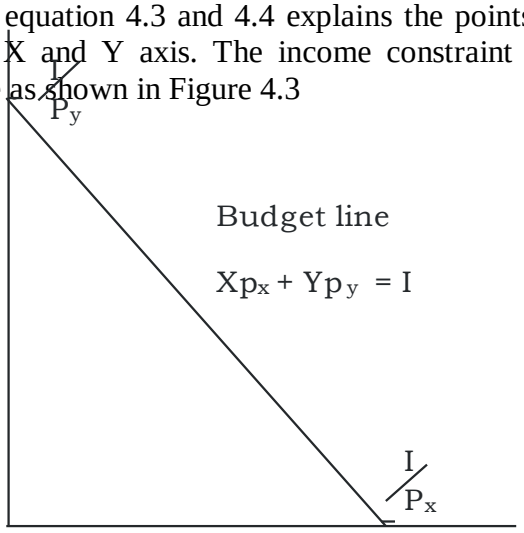


Figure 4.4: The Consumer's Budget Line

Figure 4.4 show the budget line which places a constraint on the utility maximizing behaviour of the consumer. The budget line shows the various combinations of goods that the consumer can purchase with his limited income. The budget line is negatively slope showing that for the consumer to have more of a commodity, he needs to have less of the other commodity. The slope of the budget line is the ratio of the prices of the two commodities, that is: $\frac{Px}{Py}$

4.4 Equilibrium Maximization of the Consumer

A rational consumer tries to attain equilibrium when he maximizes total utility given the price of the goods and his income (budget constraint). This can be achieved simultaneously under two conditions: The necessary (first order) condition and the sufficient (second order) condition.

(1) The first order condition is that the marginal rate of substitution must be equal to the ratio of commodity prices. That is,

$$MRSx,y = \frac{Mux}{Muy} = \frac{Px}{Py} \qquad 4.5$$

(2) The second order condition is that the indifference curve be convex to the origin. That is the slope of the indifference curve decreases from left to right as we move along the curve which is consistent with the axiom of diminishing marginal rate of substitution.

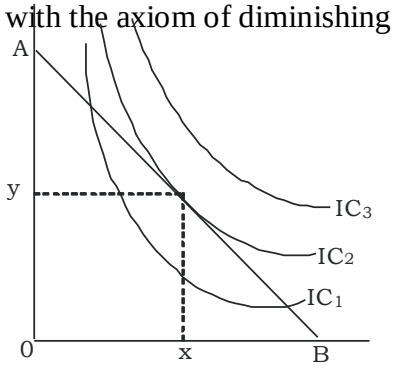


Figure 4.5: Equilibrium of the Consumer

Figure 4.5 represents the indifference map of a consumer for various combinations of commodities X and Y with the budget line AB. The consumer can afford to buy any of the combinations within the budget line, but, cannot afford the combination outside the budget line. The consumer will be in equilibrium by fulfilling both the first and second order conditions. The first condition is that point of tangency of the curves and the budget line while the second order condition is convex shape of the indifference curve. That is at the point where $MRS_{x,y} = \frac{Mux}{Muy} = \frac{Px}{Py}$. The consumer is in equilibrium at point D where the budget line intersects the highest indifference curve IC_2.

4.5 Derivation of the Demand Curve using the Indifference Curve Approach

The derivation of the demand curve using the ordinal utility approach can be achieved by considering the effect of price and income changes on consumption. When the price of a commodity changes the slope of the budget line equally change because the consumer adjusts his consumption pattern to maximize utility. From Figure 4.6, let us assume a consumer consuming two commodities X and Y, assuming that the price of commodity X falls holding

other variables (consumer's income, price of the commodity, taste and preference) constant. The budget line will shift from its initial position AB_1 to a new position AB_2 and be tangent to a higher indifference curve IC_2, forming a new consumption point E_2. At this point, the consumption of Y has increase due to a fall in the price. This is known as the **price effect**.

Similarly, if the price of commodity Y reduces further to P_3, the consumer's equilibrium position will shift from E_2 to E_3, giving us the **price consumption curve.**

(a)

(b)

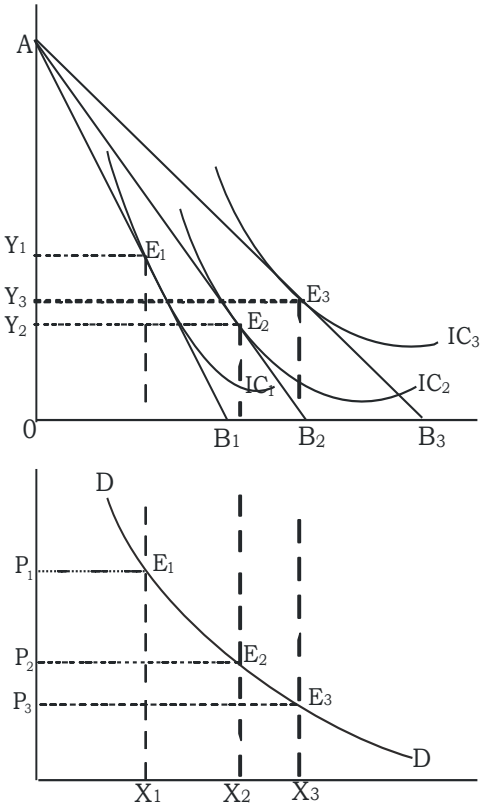


Figure 4.6 Derivation of the Demand Curve using the Indifference Curve

As the quantity of X purchased continues to increase as the price decreases, the law of demand is confirmed as shown by the downward demand curve in panel b.

4.6 Effect of Changes in Income on Consumer's Equilibrium

When the consumer's income changes (holding other determinants of demand constant) the capacity to buy goods and services changes too leading to a shift in the budget line.

Figure 4.7: Income Consumption Line

Let us assume the consumer has a given income and the prices of commodities X and Y are given while the initial budget line is depicted as AF. Let us also assume that the consumer's initial equilibrium is at point E_1, on the first indifference curve IC_1. Suppose the income rises as shown by a shift in the budget line from AF to BG. The rise in income leads to increase in quantities consumed thereby pushing the consumer to a higher indifference curve IC_2 and a new equilibrium position E_2. Further rise in income causes an outward shift in the budget line from BG to CH. The new budget line CH is tangent to the highest indifference curve IC_3. The consumer moves from equilibrium point E_2 to E_3 indicating increase in consumption as a result of increase in income. This is known as the **income effect**. A line joining the respective equilibrium points is known as **income consumption line or curve**. Income consumption line shows how the demand for two goods changes in response to changes in the consumer's income. Income effect of normal goods is always positive because consumption increases as income increases and decreases as income decreases; this is shown by the Engel curve. The income effect is negative for inferior goods because consumption decreases as income increases and vice versa and so the Engel curve slopes downward.

4.7 Income and Substitution Effects of Price Changes

The change in consumption pattern due to change in the price of consumer goods is called **total price effect**. Total price effect is divided into two: **Substitution effect and income effect**.

Substitutions effect arises due to consumer's ability to substitute cheaper goods for the expensive ones. Let us assume the consumer's real income is unchanged despite the reduction in money income. Now assume that the price of commodity X falls with the price of Y and other factors remaining constant. The consumer will consume more of X than Y due to reduction in the price of X. To derive the substitution effect, the budget line will shift inward parallel to itself but tangent to the original indifference curve at point E_3 with the quantity demanded as X_3. The new budget line is known as **compensated budget line**. The product combination at point E_3 yields equal utility as those on point E_1 on the same indifference curve IC_1. The consumer would prefer combination at point E_3 which gives more combination at a lower price. This is known as the substitution effect. The substitution effect

gives a higher quantity X_1X_3 with reduction in money income as shown in Figure 4.8. This is consistent with Slutsky's theorem which says that the substitution effect of a price change is always negative.

Similarly, let us assume that the real income of the consumer increases we draw a new budget line (AF) from the vertical intercept of the original budget line (AB) thereby placing the consumer on a higher IC_2. This leads to an increase in the quantity of X and Y. The increase in quantities of commodities from X_1 to X_2 and Y_1 to Y_2 is known as the total effect.

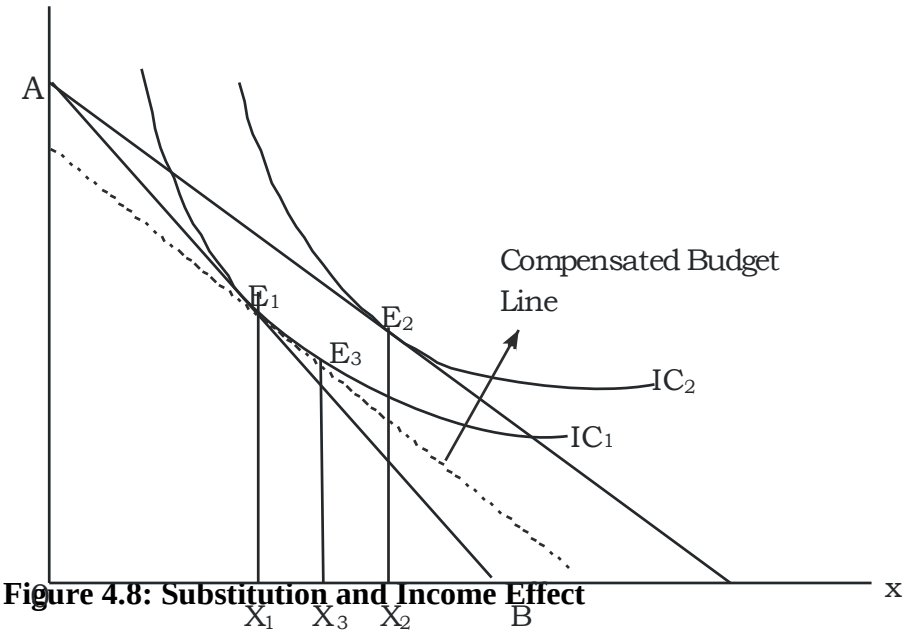


Figure 4.8: Substitution and Income Effect

The income effect can be calculated by subtracting the income effect from the total price effect. If

Total Price Effect = X_1 X_2

Substitution Effect = X_1 X_3

Income Effect = Total Effect - Substitution Effect

= X_1 X_2 - X_1 X_3

= X_2 X_3

The substitution effect is caused by change in the relative price of the commodity and is associated with the movements of the consumer along the same indifference curve (from E_1 to E_3). The income effect is caused by the change in the real income of the consumer and associated with a shift to a new indifference curve (from E_1 to E_2). The substitution and income effects of a normal good are positive while the substitution effect for inferior good is positive and the income effect is negative.

Table 4.2 A Summary of Geometric Representation of Substitution and Income Effect of Price Change

Type of Good **(i)**	Substitution effect, expressed quantitatively (or in terms of relationship between demand and price) **(ii)**	Income effect, expressed quantitatively (or in terms of relationship between demand and price) **(iii)**	Net effect, expressed quantitatively (or in terms of relationship between demand and price) **(iv)**
Normal	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑
Inferior	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑	Positive: Price and quantity moves in same direction (Px → Qx) ↓	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑
Giffen	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑	Positive: Price and quantity moves in same direction (↓Px → Qx) ↓	Negative: price and quantity moves in opposite direction (↓Px → Qx) ↑

Source: Adapted from Iyoha, Oyefusi and Oriakhi, 2003

Summary Points

1 The theory of consumer behaviour can be explained using the cardinal and the ordinal utility theory. The cardinal utility theory assumes that utility can be quantitatively measured using utils, while the ordinal utility theory assumes that utility cannot be measured but ranked according to preference.

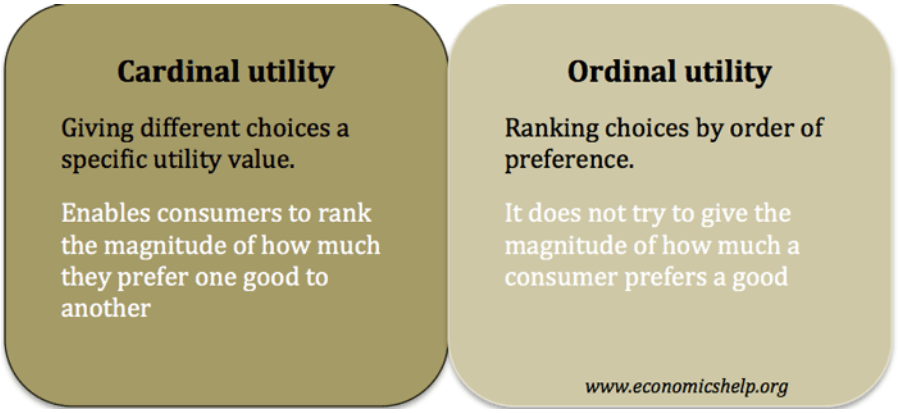
2 The ordinal utility theory used the indifference curve approach to explain consumer behaviour. They assume that choices are made subject to income represented by the budget line.

3 The consumer maximizes utility at the point where the budget line is tangent to the highest indifference curve.

4 The change in consumption pattern due to change in the price of consumer goods is called total price effect which is divided into income effect and substitution effect.

5 The substitution effect of price change on quantity demanded is a movement along the same indifference curve, while the income effect is a shift to a new indifference curve.

Cardinal utility gives a value of utility to different options. Ordinal utility just ranks in terms of preference.



Cardinal Utility is the idea that economic welfare can be directly observable and be given a value.

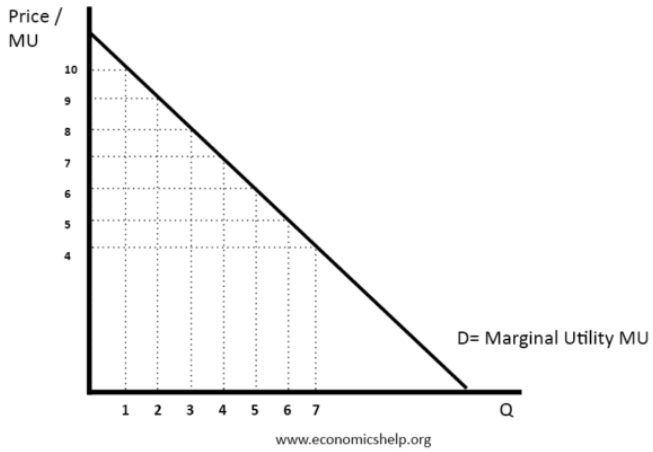
For example, people may be able to express the utility that consumption gives for certain goods. For example, if a Nissan car gives 5,000 units of utility, a BMW car would give 8,000 units. This is important for welfare economics which tries to put values on consumption. For example, allocative efficiency is said to occur when Marginal cost = Marginal Utility.

One way to try and put values on goods utility is to see what price they are willing to pay for a good.

If we are willing to pay £5,000 for a second-hand Nissan Car, we can infer we must get 5,000 utils. In other words, the value of cardinal utility is related to the price we are willing to pay.

The idea of cardinal utility is important to rational choice theory. The idea consumers make optimal choices to maximise their utility.

Demand curve showing cardinal utility



Cardinal utility is an important concept in utilitarianism and neo-classical economics. Jeremy Bentham talked about utility as maximising pleasure and minimising pain.

William Stanley Jevons, Léon Walras, and Alfred Marshall all developed concepts of utility, usually linked to market prices. However, proving exact measurement of utility proved elusive.

Ordinal Utility
In ordinal utility, the consumer only ranks choices in terms of preference but we do not give exact numerical figures for utility.

For example, we prefer a BMW car to a Nissan car, but we don't say by how much.

It is argued this is more relevant in the real world. When deciding where to go for lunch, we may just decide I prefer an Italian restaurant to Chinese. We don't calculate the exact levels of utility.

Carl Menger, an Austrian economist, developed concepts of utility which rested on ranked preferences.

In 1906 Vilfredo Pareto in 1906 concentrated on an indifference curve map. This placed preferences on bundles of goods but did not attempt to say how much.

John Hicks and Roy Allen in 1934 first produced a paper which mentioned ordinal utility.
Behavioural economics and utility
Recent developments in utility theory have tended to downplay the role of cardinal utility. The ability of consumers to make exact evaluations of utility is not clear.

Also, the idea of heuristics is that consumers don't have the ability to make perfectly rational choices but make rough rules of thumbs and quick judgements.