

Advanced Economic Theory – Microeconomics
ECON 53015

Attribute Theory of Consumer Behavior

Prof. W. M. Semasinghe
Department of Economics

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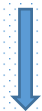
Lancaster, K. J. (1966). 'A new Approach to Consumer Theory'. Journal of Political Economy. 74, 132-157.

www.ss.kln.ac.lk/depts/econ/images/MA_MSSc/sem1.pdf

Traditional theories of consumer behavior do not take into account the dynamic adjustments of the market. ↓

- Attribute theory of consumer behavior emerged as a result of the efforts made to address these dynamics.

Important features of attribute theory!!!



Assumptions

1. Consumers obtain utility from the attributes of the goods:

Consumer gets utility from the attributes contain in the commodities although they consume directly commodities.

2. Several commodities are capable of producing one attribute and several attributes are produced by one commodity:

For example, all brands of milk powder are capable of producing fat and the given brand may produce fat and calcium.

3. Attributes contain in a combination of commodities may differ when these commodities consume separately:

For example, attributes of a tea with sugar differ when tea and sugar consume separately.

4. Attributes contain in commodities can be measured:

Quantity of attributes contain in a commodity can be measured cardinally and all consumers agree with these measurements. Thus, all consumers plan to allocate their income among various commodities so as to attain highest possible attribute combination.

5. The technical relationship between commodities and attributes are linear:

This implies that attributes contain in each commodity can be add together and the amount of attributes contain in two units of a commodity is as twice as the amount contain in one unit.

6. Attributes contain in a commodity or a combination of commodities are same for all consumers. In other words attributes do not differ among consumers.

In the traditional theory, consumers maximize *utility function* $U(x)$ subject to the budget constraint $px \leq M$.

In the attribute theory consumers maximize *attribute preference function* $U(z)$ subject to the budget constraint $px \leq M$.

Where, z is the vector of attributes $1. . . . r$, and p is the vector of prices of each of these commodities and M is the income.

Goods (x), can be transformed into attributes/characteristics (z), through the relation $z = Bx$, where B is an $(r \times n)$ matrix which transform the n goods into r attributes. X is the vector of commodities.

The optimization problem can be written as:

Maximize $U(z)$

Subject to $px \leq M$

With $z = Bx$ (Consumption technology)

Important concepts or tools involve

Attributes indifference curves

As constructed indifference curves in the commodity space, attribute indifference curves in the attribute space can be constructed.

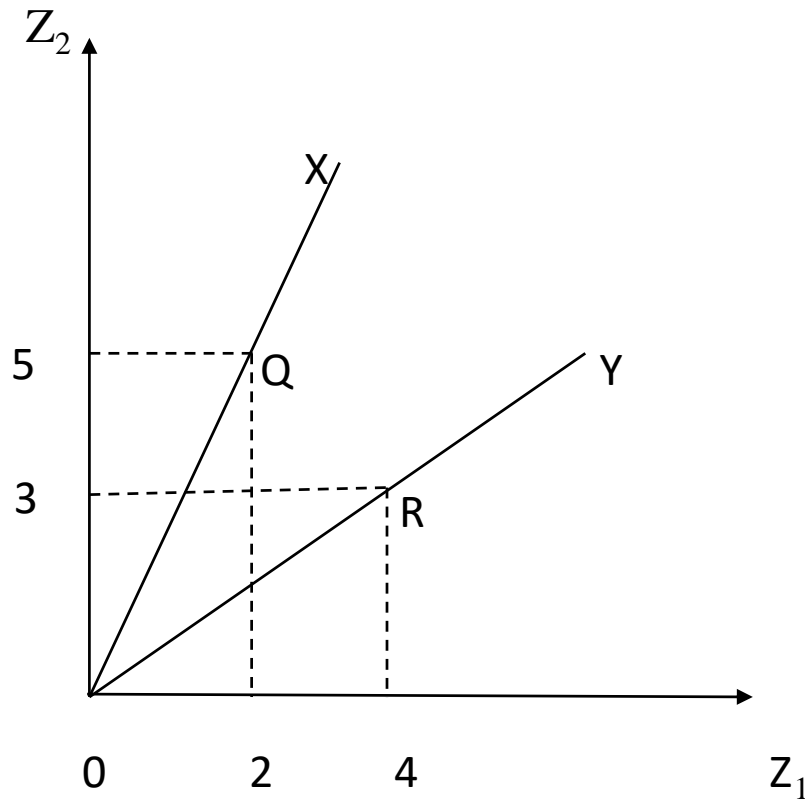
Assumes that a brand of food provides two attributes namely vitamin (z_1) and protein (z_2) respectively. Then relevant attribute utility functions is,

$$U(z) = f(z_1, z_2)$$



Production/Attribute rays

- Production ray is an important concept or tool which is essential to analyze consumer equilibrium under the attribute approach.
- An attribute ray is the '*locus of different combinations of two attributes which contain in a given commodity*'.
- Two goods X and Y, which contain two attributes z_1 and z_2 .
- By consuming one unit of each commodity consumer can obtain a certain combination of two attributes.
- According to the linearity assumption when he consumes two units, the attribute combination will be doubled.

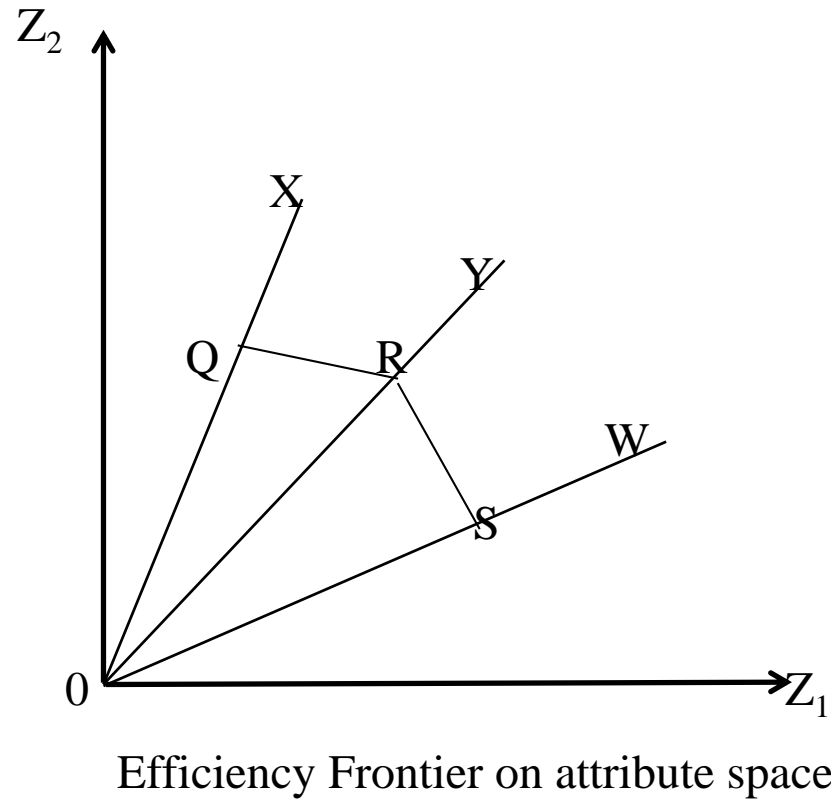


- Various attribute combinations of commodity X are measured along the O-X attribute ray
- Various attribute combinations of commodity Y are measured along the O-Y attribute ray.
- If consumer buys Q units of commodity X, he can obtain 5 units of Z_2 and 2 units of Z_1 .
- If he buys R units of commodity Y, he can obtain 3 units of Z_2 and 4 units of Z_1 .

- A particular point on an attribute ray such as R or Q can be found dividing income by the price of the commodity.
- The dimension or length of an attribute ray depends on the price of the commodity. When price increases the ray contracts towards the origin and vis-a-vis.
- The slope of an attribute ray of a commodity is determined by the ratio of the two attributes contained in a unit of the commodity.
- For example, if 5 units of Z_2 and 10 units of Z_1 are contained in a unit of commodity X, the slope of the attribute ray O-X is 0.5.

Efficiency Frontier

- The role of efficiency frontier in consumer equilibrium is similar to the role of budget line in traditional consumer behavior theories.
- Budget line demonstrate the maximum commodity combinations a consumer can be purchased from the given income.
- Efficiency frontier gives the maximum combination of characteristics/attributes that can be obtained from a given income.



- Point Q, R and S are obtained dividing income from the prices of X, Y, and W respectively.
- The line QR-RS defines as the *Lancaster's efficiency frontier* which shows the maximum attribute combinations the consumer can obtain from his income.
- The point Q, R and S define the *extreme points* in this frontier and the space O-Q-R-S is defines as the *feasible region*.

Consumer can buy any commodity combination lays within the feasible region. However, since a rational consumer spends his total income on the commodities, he will buy a commodity combination lays on the frontier.

Example: Suppose that there are 3 commodities W, X, and Y in the market which contain different levels of two attributes Z_1 and Z_2 . Income of the consumer is Rs. 100. Unit price and the amount of attributes contain in each commodity is given below:

Commodity	Unit price	Attribute combination		No. of Units
		Z_1	Z_2	
X	40	1	5	2.5
Y	40	4	4	2.5
W	50	7	2	2.0

Using these information we can construct the consumption technology $z = Bx$ as follows:

$$\begin{bmatrix} z_1 \\ z_2 \end{bmatrix} = \begin{bmatrix} 1 & 4 & 7 \\ 5 & 4 & 2 \end{bmatrix} \begin{bmatrix} X \\ Y \\ W \end{bmatrix}$$

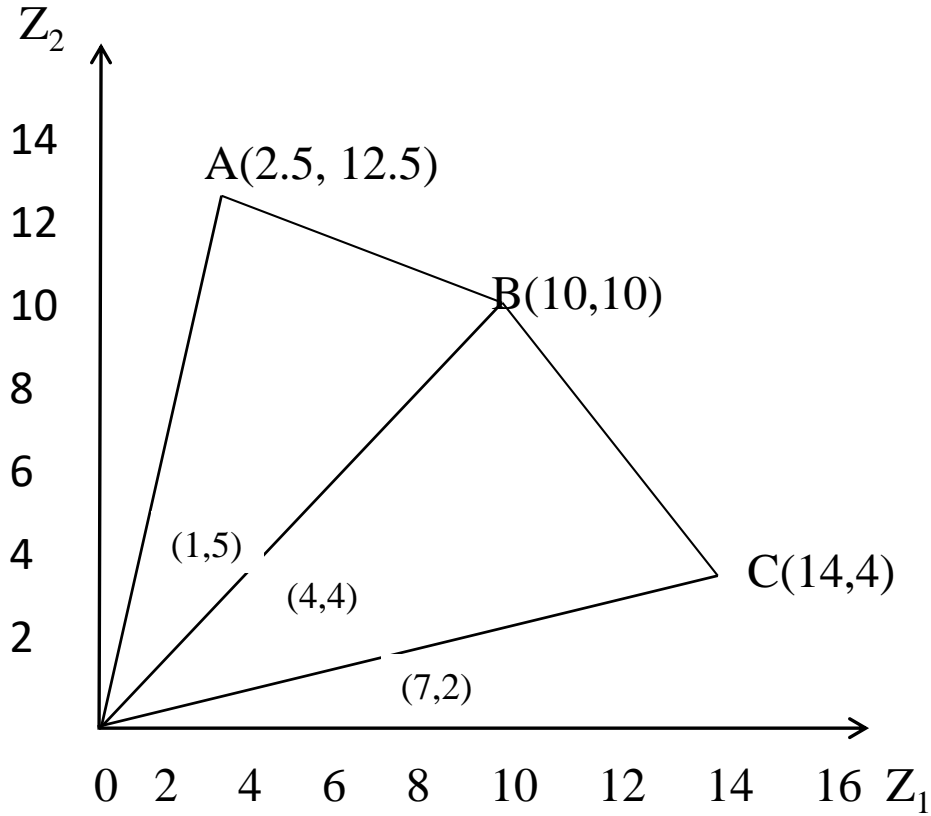
- Consumer can buy 2.5, 2.5 and 2 units respectively from commodities X, Y and W from his income
- Using the above matrix, which shows the consumption technology, we can calculate the maximum attribute combinations consumer can obtain from each commodity from his income.

$$\text{X: } \begin{bmatrix} z_1 \\ z_2 \end{bmatrix} = \begin{bmatrix} 1 \\ 5 \end{bmatrix} 2.5 = \begin{bmatrix} 2.5 \\ 12.5 \end{bmatrix}$$

$$\text{Y: } \begin{bmatrix} z_1 \\ z_2 \end{bmatrix} = \begin{bmatrix} 4 \\ 4 \end{bmatrix} 2.5 = \begin{bmatrix} 10.0 \\ 10.0 \end{bmatrix}$$

$$\text{W: } \begin{bmatrix} z_1 \\ z_2 \end{bmatrix} = \begin{bmatrix} 7 \\ 2 \end{bmatrix} 2 = \begin{bmatrix} 14.0 \\ 4.0 \end{bmatrix}$$

These attribute combinations can be plotted in a two-dimensional plane in order to obtain the efficiency frontier as follows:



- O-A, O-B and O-C are the attribute rays of commodities X, Y and W, respectively.
- Point A shows the highest attribute combination the consumer can attain if he spends his total income on X.
- Point B shows the highest attribute combination the consumer can attain if he spends all his income on Y.
- Point C shows the highest attribute combination the consumer can attain if he spends all his income on W.
- By joining the points A, B and C, efficiency frontier can be formed.

Consumer Equilibrium

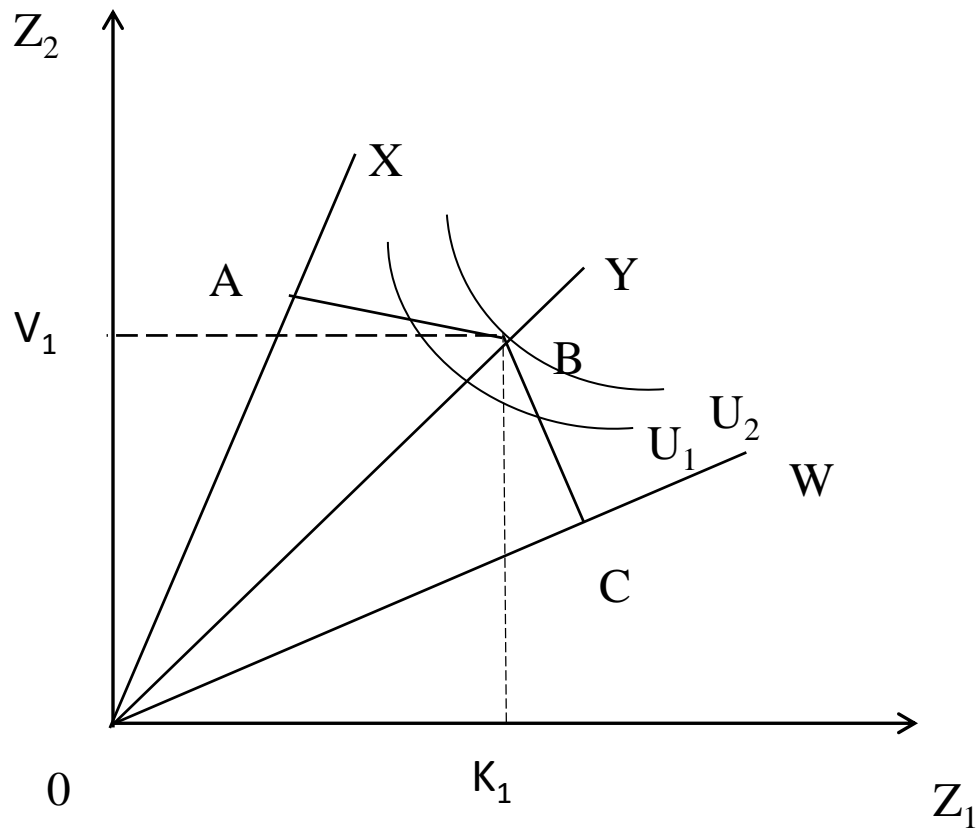
The main tools which utilize in the new approach are attribute indifference curve map, attribute rays and efficiency frontier.

This approach concentrates not on the equilibrium commodity combination but on the equilibrium attribute combination.

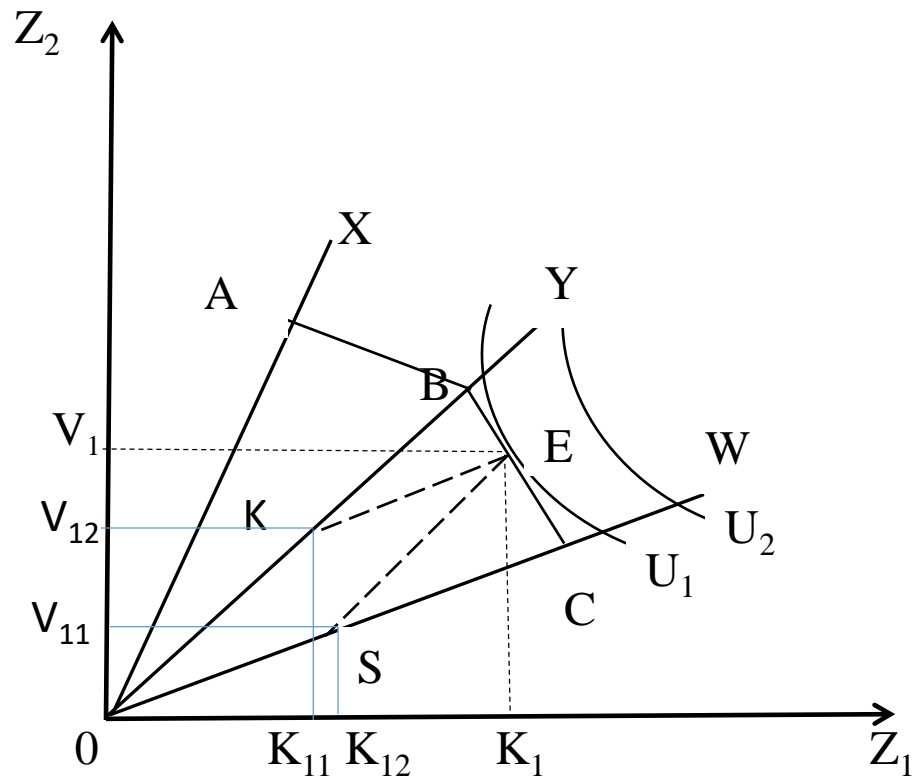
In order to determine the equilibrium attribute combination, attribute indifference curve map should be included into the two-dimensional plane, which appears attribute rays and efficiency frontier.

The consumer will come to the equilibrium at the point where one of the attribute indifference curves touches a point of the efficiency frontier.

The figure below shows the equilibrium of a consumer:



- Consumer equilibrium occurs at point B where U_2 indifference curve touches the efficiency frontier. Equilibrium attribute combination is V_1-K_1 .
- At this equilibrium, consumer purchases only the commodity Y.
- However, in practice at the equilibrium, consumer may consumes more than one commodities.



Consumer equilibrium: Consume two commodities

At point E \rightarrow V_1 of Z_2 and K_1 of Z_1 $V_1 = V_{12} + V_{11}$

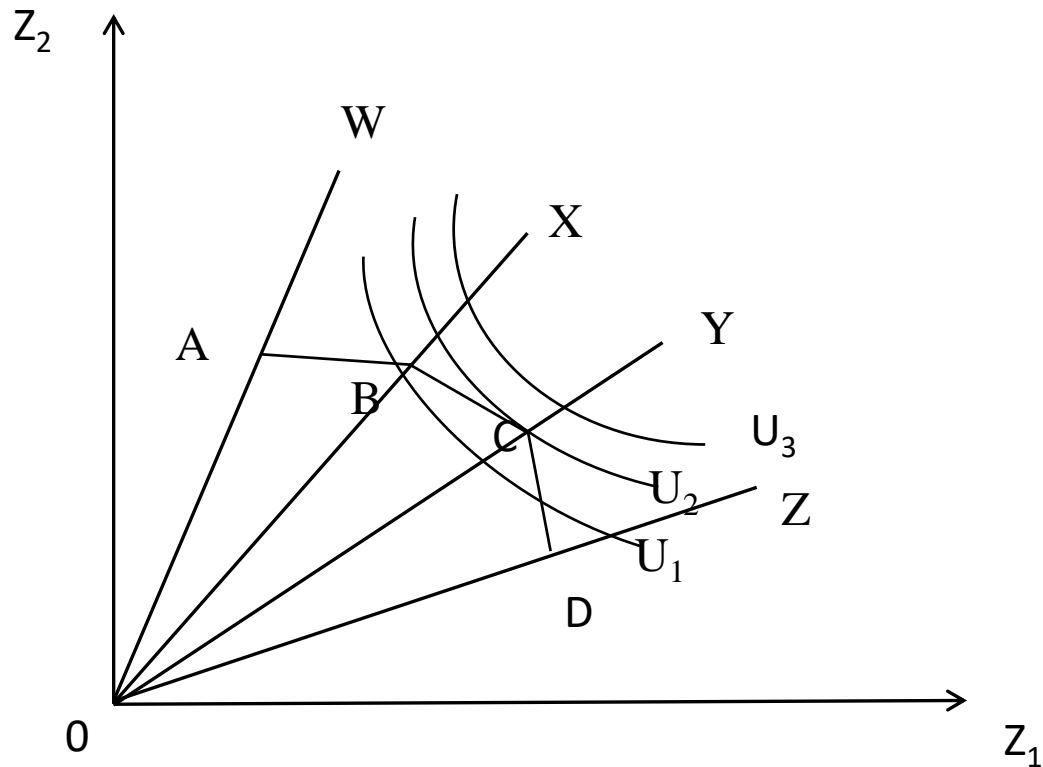
At point K \rightarrow V_{12} of Z_2 and K_{11} of Z_1 $K_1 = K_{1i} + K_{12}$

At point S \rightarrow V_{12} of Z_2 and K_{11} of Z_1

Impact of Price Change on Equilibrium

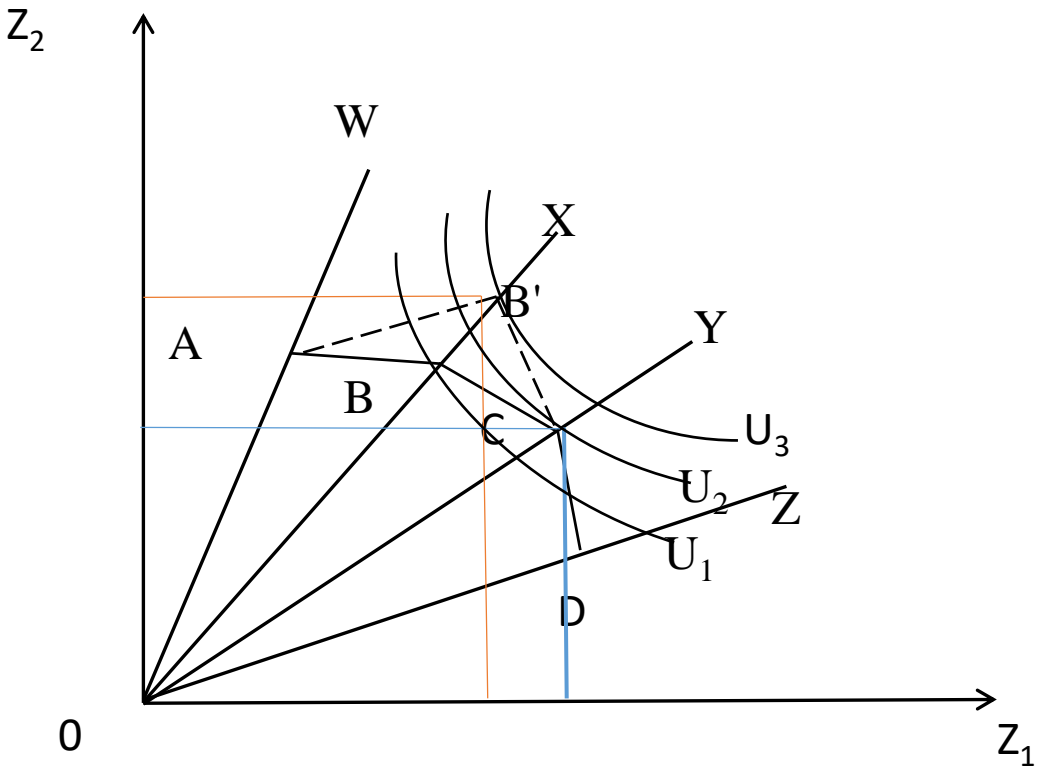
How consumer equilibrium change?

Change of equilibrium when price of a commodity change keeping all other factors constant.



There are four commodities W, X, Y and Z which gives the two attributes namely z_1 and z_2 . The line goes through the points A-B-C-D is the efficiency frontier. The consumer is in equilibrium at point C on U_2 indifference curve.

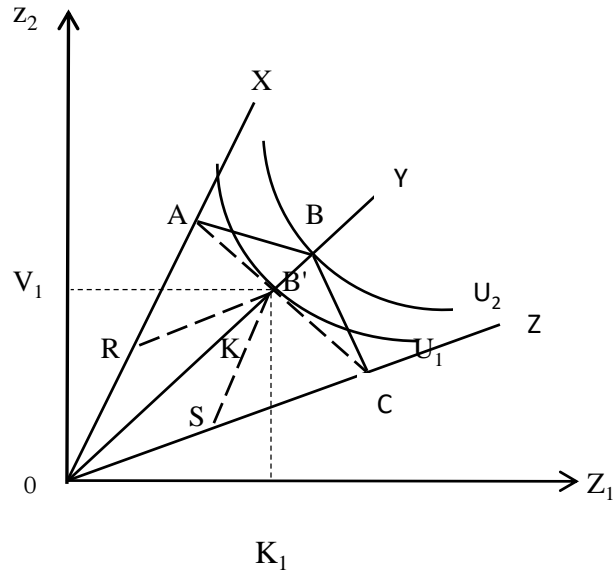
Price decrease and change of equilibrium



Suppose unit price of commodity X goes-down and point B on the efficiency frontier shifted towards B'. New efficiency frontier is A-B'-C-D.

As a result of decrease of the price of X consumer equilibrium has changed from point C to B'. He has shifted from commodity Y to X and utility level has increased from U₂ to U₃.

Price increase and change of equilibrium



Assume that the price of Y increased and the attribute ray contracted towards the origin up to the point B'

Efficiency frontier is now $A-B'-C$ and equilibrium point is B'

Attribute combination has decreased and the utility level has gone down.

If price of Y increased further the attribute ray will contract towards the origin up to a point, such as K.

Efficiency frontier will remain at $A-B'-C$ since consumer can obtain attribute combination at B' consuming combination of X and Z.

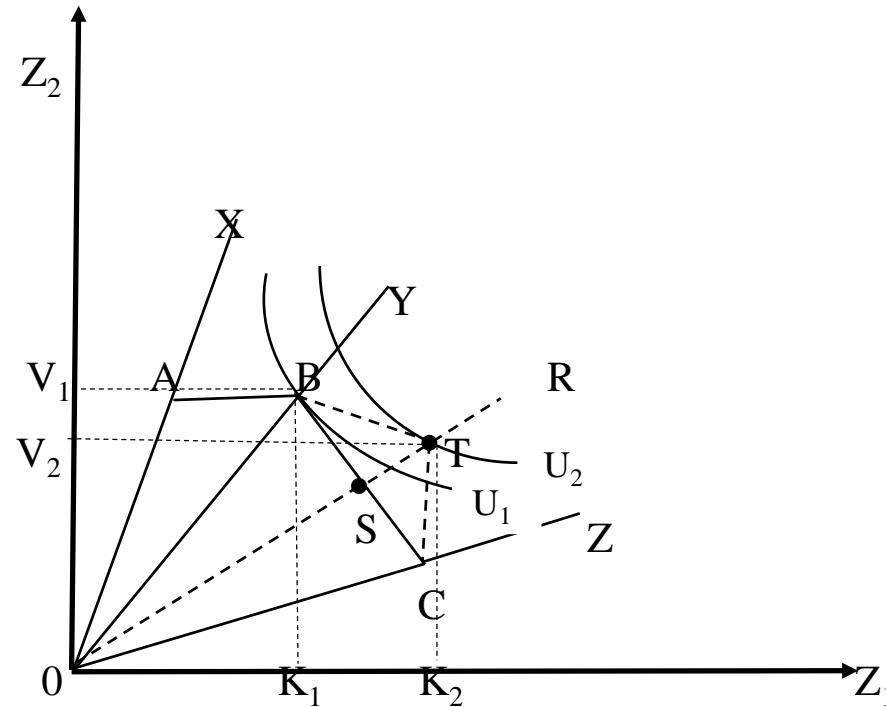
Now, consumer will not buy Y since it lays below the efficiency frontier.

The impact of introduction of a new commodity

Assume that there are three commodities X, Y and Z in the market which provide different attribute combinations.

The efficiency frontier is A-B-C. Consumer is in equilibrium at point B. He consumes only commodity Y.

Suppose that commodity R, which provides the same attributes is introduced and its attribute ray is given by O-R

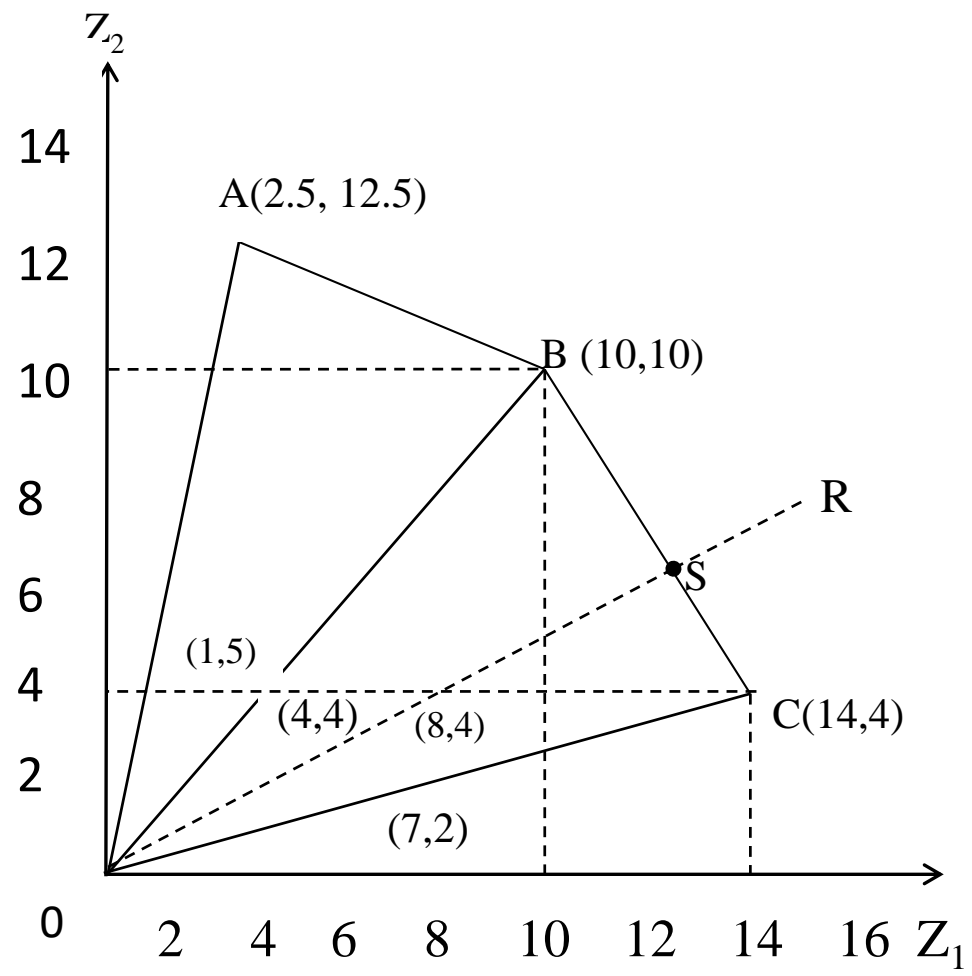


When consumer spends all his income on R, the maximum number of units the consumer can buy is given by point T. Now efficiency frontier has changed to A-B-T-C.

New equilibrium point is T, on U_2 indifference curve. Consumer buys 0-T units of R. As a result of the introduction of a new commodity consumer has moved to a higher indifference curve. Further, he has given up commodity Y which he was consuming earlier.

Next we will examine the maximum price the new commodity could be charged in order to create/exist any demand for it.

Let us take into account the previous numerical example. Assume that new commodity (R) consist 8 units of Z_1 and 4 units of Z_2 . Hence the slope of the attribute ray is $\frac{1}{2}$.



In order to make a demand for commodity R its maximum price should be the price relevant to attribute combination of S.

When the price is higher than that, attribute ray of R contracts towards the origin and it will lay some where in the feasible region. Thus, consumers will not buy any of this commodity.

Next we will calculate the price relevant to the point S.

The lines B-C and O-R are going through the point S.

By solving the equations of these two lines simultaneously, we can find the value of point S. The equation of a linear function is given by,

$$Y = a + bX$$

Analogous to this equation, the equation of any straight line in the above plane is,

$$Z_2 = a + bZ_1 \tag{1}$$

Since the line O-R is going through the origin, its intercept is zero and, the slope is $\frac{1}{2}$, the equation of line O-R is,

$$Z_2 = 0.5 Z_1 \quad (2)$$

Equation (1) satisfies point B as well as point C.

$$\text{Equation of point B is, } 10 = a + 10b \quad (3)$$

$$\text{Equation of point C is } 4 = a + 14b \quad (4)$$

By solving these two equations simultaneously, we get

$$b = -3/2 \text{ and, } a = 25$$

Thus, equation of straight line B-C is,

$$Z_2 = 25 - 3/2Z_1 \quad (5)$$

Since both equations (2) and (5) satisfy at S, we can solve the two equations simultaneously to get the attribute combination on S and the maximum price of R at point S.

Accordingly, attribute combination on S is $z_1 = 12.5$ and $z_2 = 6.25$

The point S on O-R is $M/P = Q_R$

Where M is the income, P is the price of R and Q_R is the number of units of R

Then, $100/P = 12.5/8$ OR $100/P = 6.25/4$

Thus, $P = 64$ OR $P = 64$

Thus, the maximum price of R is Rs. 64.

The number of units of R the consumer can buy is $100/64 = 1.5625$.

The attribute combination can be computed by consumption technology as follows:

$$\begin{bmatrix} z_1 \\ z_2 \end{bmatrix} = \begin{bmatrix} 8 \\ 4 \end{bmatrix} 1.5625 = \begin{bmatrix} 12.5 \\ 6.25 \end{bmatrix}$$

If the price of R is higher than 64, the attribute ray contracts towards the origin and lays it in the feasible region, the consumer will not buy any of R. Thus the maximum price of R is 64.

Evaluation

The common characteristic of the traditional theories was that consumers purchase commodities since they get utility from them. Utility is derived by commodities.

Fundamental
difference

But, according to the new theory, demand is based on the intrinsic attributes containing in commodities. Utility is derived not by commodities but the attributes containing in the commodities.

When the number of attributes consists of a commodity increases, the utility is higher. This is the reason for consumers purchase different varieties of a commodity though the price is same. This was not adequately explained by traditional theories.

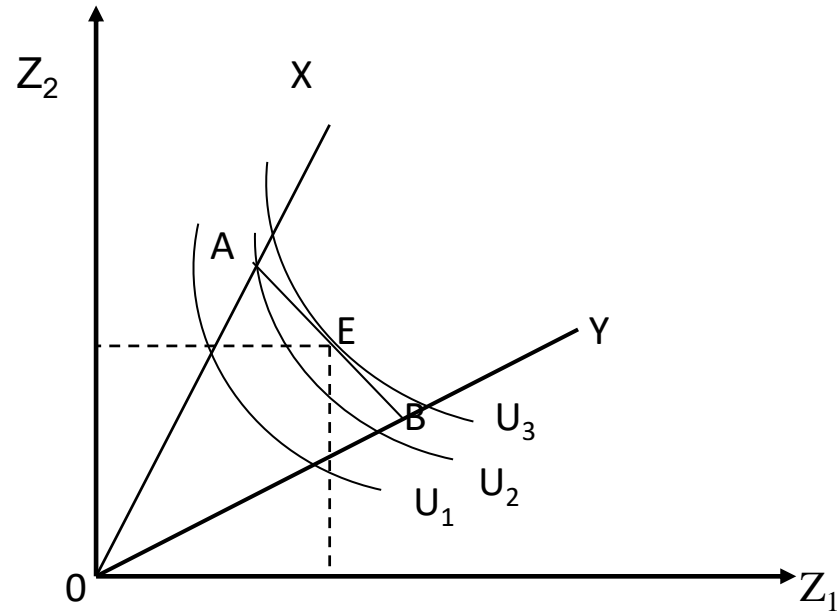
An
advancement

The new theory explain successfully the impact of introduction of a new commodity into the market. Further, it define the maximum price of the commodity that can be charged in order to make any demand for the commodity.

← An
advancement

Traditional theories do not explain adequately why consumers prefer to buy a combination of commodities rather than a single commodity. For example, why people buy not only rice but also gram, wheat flour etc. with rice for consumption. According to the new theory consumers do so because they can attain higher attribute combination as such higher satisfaction than consuming a single commodity

← An
advancement



If consumer satisfy at point A on A-B efficiency frontier, he gets only U_2 level of utility. But if he moves to point E on A-B efficiency frontier his level of satisfaction will be U_3 which is higher than U_2 . This is the reason for consumption of a combination of commodity instead of a single commodity.

← An advancement

Improvement of the quality of a commodity can be taken into account through the slope of the attribute ray. When quality improves the amount of attributes contain in a unit of the commodity increase. As a result the slope of the attribute ray change.

← An advancement

For example, suppose that as a result of the improvement of the quality of commodity X, amount of Z_1 contain in a unit of X increases from 4 to 6. Then the slope of the attribute ray change.

This implies that the quality improvement of a commodity can be depicted through the change of the slope of relevant attribute ray.

In graphical analysis: Traditional theories takes only two commodities

Attribute theory can take any number

← An advancement

This approach is capable of clearly describing the difference between substitute and complementary goods.

Substitute

The commodities which contain common attributes are substitute. For an example rice and wheat flour are substitute because both contain common attributes such as carbohydrate and protein.

Bread and wood are not substitute because they do not contain common attributes.

An
advancement



Complementary goods

If a particular attribute can be obtained if and only if from a mixture of two or more commodities they are called complementary goods.

For an example tea and sugar together gives the attribute called enthusiasm. Tea and sugar separately do not provide this attribute.

Weaknesses

Attribute of commodities is intangible and subjective concept. They cannot measure precisely. For example, the attributes such as taste, Fashions are depend on the perceptions of people. Hence, it is difficult to measure them.

In the market only goods are available but not attributes. Market forces determine the prices of commodities but not the prices of attributes.

The analysis is very complicated when there are large number of commodities and attributes .