

**Module on
MICROEconomics (Econ -1071)
For ACFN Students**

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College of Business and Economics
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Preface

Microeconomics is one of the approach in which the study of economics is undertaken. It is divided into two parts (modules) each for instructional purpose because of its broadness. The first part of microeconomics is covered by Microeconomics-I and the second part with Microeconomics-II. This material is designed for both the course Microeconomics-I and II.

Regarding to the module's organization, there are Eight chapters to be covered in this course. The first chapter explains the theory of demand and consumer behavior; chapter two presents the details of theory of production, chapter three is about theory of cost of production, chapter four exclusively devoted to product market structures emphasizing on perfectly competitive market, chapter five give emphasis on pure monopoly market structure, chapter six exclusively give emphasis on the mixture of the previous two markets which is known as monopolistic competition, chapter seven focused on the less extreme market structure of oligopoly, and finally chapter eight give some highlights on asymmetric information.

All possible efforts have been made to enhance the usefulness of the material. In the module, it has been tried to discuss the main principles of economics and to make the science of economics understandable. Further, the explanation of various economic theories has been supported by appropriate tables, figures and examples. In addition, adequate number of activities and exercises are included for further learning procedures.

We are greatly indebted to my colleague, Mr Afework Birhanu, who patiently read through the typescript and provide many constructive comments and valuable suggestions.

Dear learners and other interested readers! We hope that you will find this material worth reading. And perhaps, if any editorial or technical errors are committed, they are all ours.

Teklebirhan Alemnew & Mulugeta Fekadu

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CHAPTER ONE


THEORY OF CONSUMER BEHAVIOR & UTILITY MAXIMIZATION

Dear distance learner! After completing this chapter, you will be able to:

- Explain the concept of cardinal and ordinal utility approach;
- Identify the difference between the indifference curve and indifference map;
- Discuss the properties of indifference curve;
- Derive the budget line
- State and explain consumer and producer surplus;
- Derive the market demand;

1.1. Introduction to Theory of Consumer Behavior

Dear distance learners, the theory of demand starts with the examination of the behavior of the consumers. In our everyday life we behave in different ways while buying and consuming a good or service. The simple calculations and human reasoning we undertake while doing any transactions have been transformed into principles which guide us to attain satisfaction or equilibrium in economic sense. When we go for shopping, we decide beforehand, what good to buy and how much to spend. It makes sense as we try to get most of what we are spending. In other words, we always want more of anything and for that purpose we negotiate and come to an agreed price which we are ready to pay happily. It is therefore, necessary to be first acquainted with the consumer behavior, which forms the basis of the demand theory.

 *Dear distance learner! Can you explain the concept of consumer behavior in your own word?*

Consumer Behavior is meant how consumers decide on the basket of goods and services they consume or is the way consumers take decisions among various alternatives called consumers behavior.

Dear distance learner, Consumer behavior is best understood in three distinct steps:

Step 1: Consumer Preference

Specifically, we need a practical way to describe how people might prefer one good to another.


Step 2: Budget Constraint

In this step, we must take in to account for the fact that consumers faces budget- constraint- they have limited incomes that limits the quantities of goods that they can buy.

Step 3: Consumer Choices

Given their preferences and limited incomes, what combinations of goods will buy to maximize their satisfaction? In other words, given their preferences and budget constraints (limited income), it is possible to determine how individual consumers choose how much of each good to buy. The basic assumption is that consumers make this choice in a rational way – that they choose goods to maximize the satisfaction they can achieve, given the limited budget available to them.

1.2. Consumer Preference and Utility


 ***Dear distance learner! Can you explain the difference between consumer preference and utility?***

❖ **Consumer Preference:** we mean what consumers like and dislikes. The theory of consumer behavior begins with three basic assumptions regarding people’s preferences for one market basket versus another. These assumptions hold for most people in most situations:

A) Completeness: Preferences are assumed to be ***complete***. In other words, consumers can compare and rank all possible baskets. Thus, for any two market baskets A and B, a consumer will prefer A to B ($A > B$), will prefer B to A ($B > A$), or will be indifferent between the two ($A = B$). (By “***indifferent***” we mean that a person will be equally satisfied with either basket.) Note that these preferences ignore costs. A consumer might prefer steak to hamburger but buy hamburger because it is cheaper. Therefore, it is hardly objectionable.

B) Transitivity: Preferences are ***transitive***. It means consumer preference should not be self-contradictory. In other words, Transitivity means that if a consumer prefers basket A to basket B ($A > B$) and basket B to basket C ($B > C$), then the consumer also prefers A to C ($A > C$). These preferences are normally regarded as necessary for consumer consistency.

C) More is better (Non satiation): consumers always prefer *more of any good to less*. In general, consumers always prefer larger quantity. (Assume goods are desirable; exclude undesirable goods.)

 ***Dear distance learner! Can you define the word “Utility” in your words?***

❖ **Utility:** Utility is defined as the power of a commodity or service to satisfy a human want. It is subjective concept and therefore varies from person to person because every person varies in their likes and dislikes. We should note that utility is the '*expected satisfaction*' whereas satisfaction implies '*realized satisfaction*'.

In the language of economics, the concept of *utility* refers to the numerical score representing the satisfaction that a consumer gets from a market basket. In other words, utility is a device used to simplify the ranking of market baskets. E.g. If buying three copies of a textbook gives you more pleasure than buying one shirt, then it is said that the books give you more utility than the shirt.

❓ *Dear distance learner have you ever hear the approaches economists used to measure utility?*

There are two approaches to measure utility theory (to the analysis of consumer behavior):

- 1) Cardinal utility analysis and
- 2) Ordinal utility analysis

1.2.1. Cardinal Utility Analysis

A utility analysis that describes by how much one market basket is preferred to another is called *cardinal utility analysis*. Unlike ordinal utility analysis, a cardinal utility analysis attaches to market baskets numerical values that cannot arbitrarily be doubled or tripled without altering the differences between values of various market baskets.


Dear distance learner! You should know that cardinal utility is the view that utility is quantitative or cardinally measurable feeling. It is used by Classical and Neo- classical economists.

Assumptions

- 1) ***Rationality***: It is assumed that the consumers are rational being in the sense that he/she satisfies his wants in the order of their merit/utility. The rational consumer has a powerful reasoning in evaluating which commodity can satisfy him most. They can identify what is good what is bad.
- 2) ***Limited money income***: the consumers have a limited money income to spend on the goods and services he/she chooses to consume.
- 3) ***Maximization of utility***: Every rational consumer intends to maximize his/her satisfaction from his/her given money income.

- 4) **Utilities Cardinally measurable:** the Cardinalists assume that utility can be measured in absolute terms/numerical numbers; 1,2,3.../. They hoped that individuals' preferences could be easily quantified or measured in terms of basic units. The units used to measure utility are known as *utils*.
- 5) **Utility is subject to the law of diminishing marginal utility:** As the consumer uses more and more units of a certain commodity, the extra increment of utility he derives from each extra unit of the good declines. It shows the inverse relationship between marginal utility & its quantity.
- 6) **Constant marginal utility of money (MUm):** the MU of money remains constant whatever the level of consumer's income and each unit of money has utility equal to one unit (MUm=1).
- 7) **Utility is additive:** the additive of the utility can be expressed through the utility function. If $U=F(x_1,x_2,x_3,\dots,x_n)$, then the sum of utilities that individual can derive from consuming various units of commodities as: $TU_n=U_1(x_1)+U_2(x_2)+U_3(x_3)+\dots+U_n(x_n)$.

1.2.1.1. Total Utility (TU) and Marginal Utility (MU)

 **Dear distance learner! Can you define the term “Total Utility” and “Marginal Utility” in your words?**

- A) Total Utility (TU):** The overall satisfaction enjoyed from consuming any given quantity of a good is called total utility. TU is the sum of the utility derived from all the units consumed of a commodity.
- B) Marginal Utility (MU):** The extra satisfaction a person receives over a given period by consuming one more unit of a good is called marginal utility. Thus, MU measures the extra or additional benefit that results from increasing the consumption of a single commodity by one more unit, holding the consumption of other commodities being equal.

Alternatively, we can define MU is the change in total utility resulting from the consumption of one extra unit of the product.

i.e. $MU = \frac{\Delta TU}{\Delta Q}$ (MU is the slope of the TU curve) Where, ΔTU and ΔQ are the changes in total utility and quantities (units) consumed respectively.

$$\text{Or } MU_n = \frac{TU_n - TU_{n-1}}{Q_n - Q_{n-1}} \quad \text{or} \quad MU_{n+1} = \frac{TU_{n+1} - TU_n}{Q_{n+1} - Q_n}$$

$$\Rightarrow \text{For } \Delta Q \rightarrow 0, MU = \frac{\partial TU}{\partial Q}$$

Example:

Table 1.1 Total utility and Marginal utility


Quantity(Q _x)	1	2	3	4	5	6	7	8	9
TU	12	22	30	36	40	40	39	37	32
MU	12	10	8	6	4	0	-1	-2	-5

Dear distance learner! The above table shows the consumer maximizes utility at zero MU when the TU of “X” is 40 units. At zero MU, the consumer reaches *saturation point*. Beyond this point, the MU becomes negative and the rational consumer will not cross the limit of consumption beyond 6 units of the commodity.

Dear distance learner! From the above concept we can build the Relationship between TU and MU as follows:

- ☞ When TU increases at an increasing rate, MU also increases (special case).
- ☞ When TU increases but at a decreasing rate, MU declines but positive. In other words, MU starts to continuously decline when the TU start to increasing at a decreasing rate.
- ☞ When TU reaches a maximum (constant level), MU is zero and this stage is a *saturation point*.
- ☞ When TU starts to fall, MU declines and it is negative, i.e. the consumers are dissatisfied.

1.2.1.2. The Law of Diminishing Marginal Utility (LDMU)

 *Dear distance learner! Do know how does MU of the commodity change when the quantity consumed of the commodity increases?*

To answer the question we need to study the basic law of economics known as the *law of diminishing marginal utility*. The law states that, as more and more of any single commodity is consumed during a specified time period, successive units usually yield smaller and smaller increases in satisfaction. The additional satisfaction attained from additional unit of a good is measured by the good’s MU than previous units. This principle is called the LDMU.

In other words, the law states that as the quantity of commodity consumed increases per unit of time, the utility derived from the successive units goes to decline provided the consumption of all other goods remains constant. For example, take the case of consumption of Banana. The first banana he consumes brings him considerable amount of satisfaction. However, taking more and more bananas would mean deriving less and less satisfaction from each extra unit consumed. In fact, the rational consumer may stop eating after some amount of bananas which implies $MU=0$ (i.e. *Saturation point*).

1.2.1.3. Consumer Equilibrium Under Cardinal Utility Approach

A consumer is said to be at optimum/equilibrium when he/she maximizes utility subject to income constraint. The utility maximizing consumer reaches his equilibrium points when he allocates his money in such a way that the last birr spent on each commodity yields the same utility and his money income available for the purchase of the goods has been exhausted.

Consider $U = f(x)$, price of X, P_x .

The consumer can either buy an additional unit of X or keep the income, which was to be spent on that additional unit of X unspent. Both give some satisfaction to the consumer. To determine the optimum of the consumer will need to compare the MU_x and P_x .

$MU_x > P_x$ \Rightarrow which the consumer will have to pay.

$P_x > MU_x$ \Rightarrow What the consumer has to pay.

$MU_x > P_x$ \Rightarrow the consumer can raise his/her satisfaction by purchasing more units of good of X.

$MU_x < P_x$ \Rightarrow The consumer can raise his level of satisfaction by reducing consumption of x.

$MU_x = P_x$ \Rightarrow Optimum of the consumer (TU is maximized).

When the utility function of the consumer contains more than one good; $U = f(x_1, x_2, \dots, x_n)$. The optimum of the consumer receives the following conditions to be fulfilled.

$$MU_{x1} = P_{x1} \quad \Rightarrow \quad \frac{MU_{x1}}{P_{x1}} = 1$$

$$MU_{x2} = P_{x2} \quad \Rightarrow \quad \frac{MU_{x2}}{P_{x2}} = 1$$

$$\frac{MU_{x_1}}{Px_1} = 1 = \frac{MU_{x_2}}{Px_2} \xrightarrow{MU_{x_1}} \frac{MU_{x_2}}{Px_2}$$

Therefore, the condition is

$$\frac{MU_{x_1}}{Px_1} = \frac{MU_{x_2}}{Px_2} = \dots = \frac{MU_{x_n}}{Px_n} \rightarrow \text{This is known as the } \textit{law of Equi-MU}.$$

$\frac{MU_{x_1}}{Px_1}$ is the satisfaction the consumer derives by spending one unit of money on x_1 . Spending one unit of money should result in the same satisfaction regardless of the good it is spent on x_1 . If spending one unit of money results in higher satisfaction when it is spent on x_1 compared to other goods. The consumer can raise his satisfaction by spending more on x_1 and less on other unit the above condition is fulfilled.

1.2.1.4. Derivation of Demand Curve

Dear distance learner! The derivation of demand is based on the axiom of diminishing marginal utility. The marginal utility of commodity x may be depicted by a line with a negative slope (fig. 1.2). Geometrically the marginal utility of x is the slope of the total utility function $U=f(q_x)$. The total utility increases, but at a decreasing rate, up to quantity x and then starts declining (fig. 1.1).

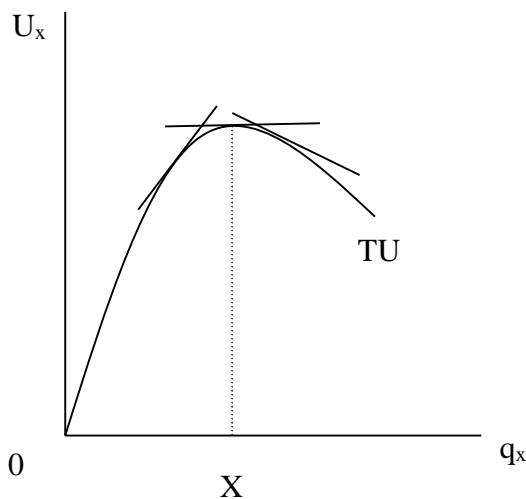


Fig. 1.1

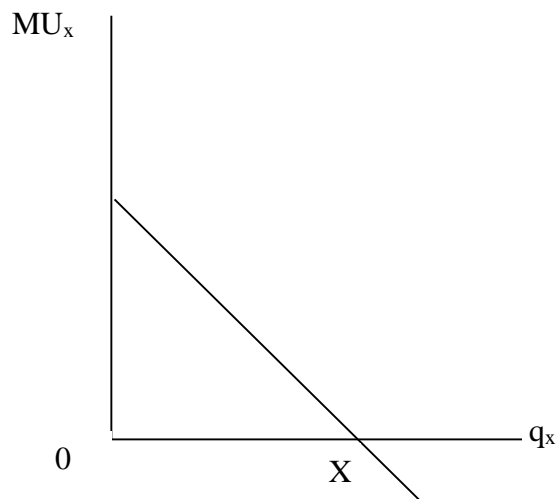


Fig. 1.2

Accordingly the marginal utility of x declines continuously, and becomes negative beyond quantity x . If the marginal utility is measured in monetary units, the demand curve for x is identical to the positive segment of the marginal utility curve above the x -axis. At x_1 the

marginal utility is MU_1 (fig. 1.3). This is equal to P_1 , by definition. Hence, at P_1 the consumer demands x_1 quantity (fig. 1.4).

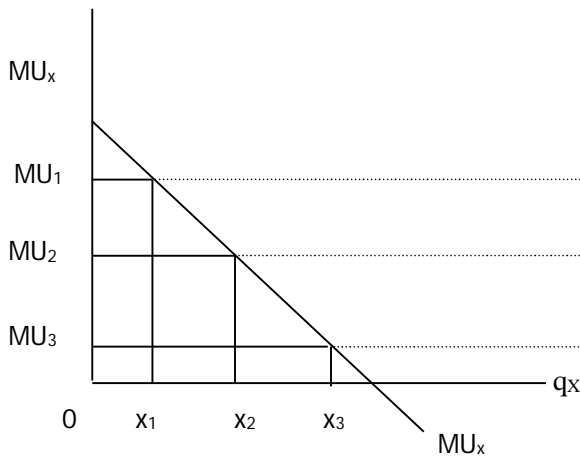


Fig. 1.3

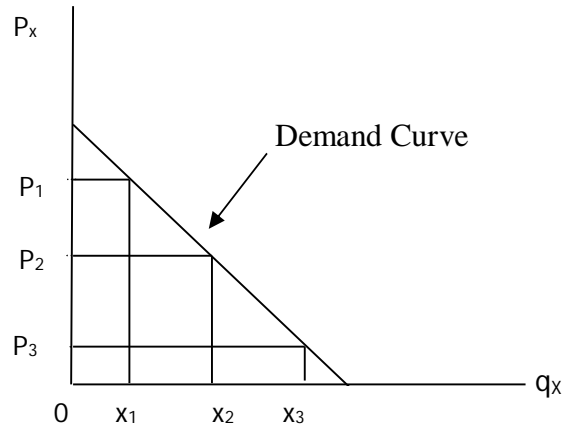


Fig. 1.4

It is clear that when the price of the commodity falls, the consumers buy more of the good so as to equate the MU to the lower price. At x_2 the marginal utility is MU_2 , which is equal to P_2 . Hence, at P_2 the consumer will buy x_2 , and so on. The negative section of MU curve does not form part of the demand curve because a rational consumer doesn't go beyond the zero level of MU, since negative quantities do not make sense in economics.

1.2.2. Ordinal Utility Approach

A utility analysis that generates ranking in order of most to least preferred of market baskets is called an *ordinal utility analysis*. In fact, numerical values are arbitrary, interpersonal comparisons of utility are impossible.

The only property of a utility assignment that is important is how it orders the bundles of goods. The magnitude of the utility function is only important insofar as it ranks the different consumption bundles; the size of the utility difference between any two consumption bundles does not matter. Because of this emphasis on ordering bundles of goods, this kind of utility is referred to as **ordinal utility**. It is also known as an *Indifference Curve Approach*. Her utility is not a quantitative or a numerical value. In other words, utility is not measurable rather it is comparable.

Assumptions

- 1) **Rationality:** The rational consumer has a powerful reasoning in evaluating which commodity can satisfy him most. They can identify what is good what is bad.
- 2) **Utility is Ordinal:** Utility is only ordinally measurable that is the consumer is able to express only the rank of his preference.
- 3) **Transitivity and Consistency of choice:**
 - ✓ **Transitivity:** If $A > B$, and $B > C$, then $A > C$.
 - ✓ **Consistency:** If $A > B$ in one period, should not be $B > A$, or $A = B$ for another period.
- 4) The total utility of the consumer depends on the quantities of the commodities consumed.
- 5) **Diminishing Marginal Rate of Substitution:** This rate is given by $\frac{\Delta Y}{\Delta X}$. The assumption is that $\frac{\Delta Y}{\Delta X}$ goes on decreasing, when consumer continuous to substitute X for Y.
- 6) **No Satiety:** a consumer always prefers a larger quantity of all the goods. In other words, this is the 'more is better than less' assumption.

❓ **Dear distance learner! Compare and contrast the assumptions of “Cardinal Approach” and “Ordinal Approach”?**

1.2.2.1. The Indifference Curve

Dear distance learner! It is an ordinal approach adopted for utility analysis. The Indifference curve(IC) is a locus of different combinations of two or more goods which yield the same level of satisfaction to the consumer. It is also called an **Iso-utility curve**. This is so, because moving along the same indifference curve leaves the consumer neither better nor worse-off. In other words, the consumer is indifferent between the different consumption bundles. Graphically,

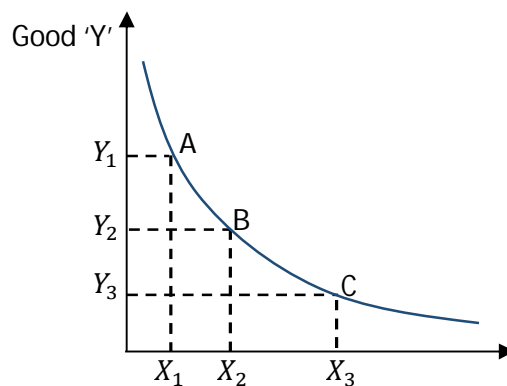


Fig. 1.5: The Indifference Curve

- ☞ All points on the indifference curve give the same level of satisfaction.
- ☞ The area between X and Y axis is known as **Indifference plane** or **Commodity Space**.

❖ **An Indifference Map:** is a set of indifference curves that describes a person's preferences. Each indifference curve representing different level of satisfaction for the consumers. But we should note that a higher indifference curve drawn up to the right of another on an indifference map yields a higher level of satisfaction to the consumer. For example, in $IC_3 > IC_2 > IC_1$ as shown in fig. 1.6 in the below diagram. In contrast, a lower indifference curve is likely to yield a low level of satisfaction to the respective consumer.

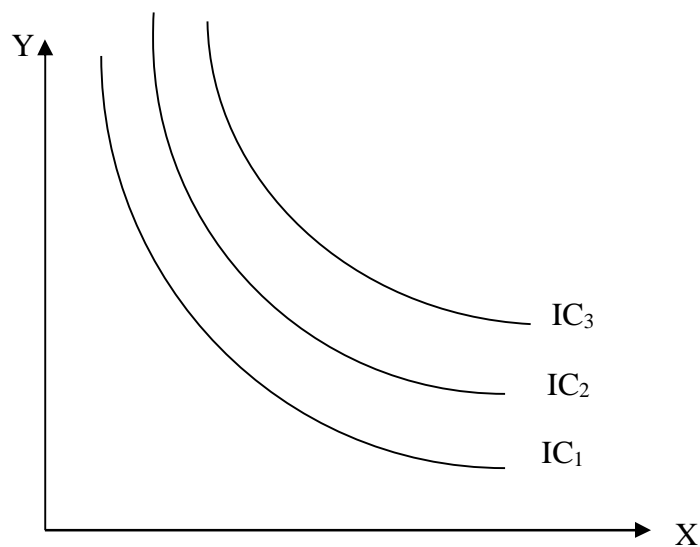


Fig 1.6. Indifference Map

1.2.2.2. The Marginal Rate of Substitution(MRS)

Dear distance learner! To quantify the amount of one good that a consumer will give up to obtain more of another, we use a measure called the *marginal rate of substitution* (MRS). The MRS is the rate of which one commodity can be substituted for another, the level of satisfaction remaining the same.

The *MRS* of x for y is the amount of y that a person is willing to give up to obtain one additional unit of x . Suppose, for instance, the MRS is 3. This means that the consumer will give up 3 units of y to obtain 1 additional unit of x . If the MRS is $1/2$, the consumer is willing to give up only $1/2$ unit of y so that the consumer maintains the same level of satisfaction. Thus, the MRS measures the value that the individual places on 1 extra unit of one good in terms of another.

The MRS_{xy} can be expressed by the slope of the indifference curve.

$$MRS_{xy} = \frac{\text{Number of units of } y \text{ give up}}{\text{Number of units of } x \text{ gained}} = \frac{\Delta y}{\Delta x}$$

Here, the consumption for good X increase and the consumption for good Y decrease.

slope Therefore, MRS is the slope of the indifference curve.

? Dear distance learner! Do you know the difference between MRS_{xy} and MRS_{yx} ? Explain it?

Here it is important to note that MRS_{xy} is different from MRS_{yx} because $MRS_{xy} = \frac{\Delta y}{\Delta x}$, but $MRS_{yx} = \frac{\Delta x}{\Delta y}$.

Dear distance learners! You should note that the concept of MU is implicit in the definition of the MRS .

Proof

Given $U = f(x, y)$

$$du = \frac{\partial u}{\partial x} \cdot dx + \frac{\partial u}{\partial y} \cdot dy \dots \dots \dots \text{total differential}$$

$$0 = MU_x \cdot dx + MU_y \cdot dy$$

B/c ΔU in an indifference curve is zero since consumers are in the same level of satisfaction along the same indifference curve.

$$MU_x \cdot dx = -MU_y \cdot dy$$

$$\frac{MU_x}{MU_y} = -\frac{dy}{dx} = MRS_{xy}$$

since, $MU_x = \frac{\Delta u}{\Delta x} = \frac{\partial u}{\partial x}$ and $MU_y = \frac{\Delta u}{\Delta y} = \frac{\partial u}{\partial y}$

In the same manner, $MRS_{yx} = \frac{MU_y}{MU_x} = -\frac{dx}{dy}$

☞ As we move from left to right on an indifference curve, the MRS_{xy} decreases in absolute values, this is referred to as the decreasing MRS ($LDMRS$).- It is not true for MRS_{yx} .

☞ As consumers receives more and more of a particular good, its value in terms of other goods declines.

❖ **Law of Diminishing Marginal Rate of Substitution:** The law states as more and more of one good are consumed, we can expect that a consumer will prefer to give up fewer and fewer units of a second good to get additional units of the first one. As we moved down the indifference curve in figure A page 9 and consumption of good X increases, the additional satisfaction that a consumer gets from still more food will diminish. Thus, he will give less and less good Y to obtain additional unit of good X. Here it is important to note that an indifference curve is convex if the *MRS* diminishing along the curve.

1.2.2.3. Characteristics of Indifference curve

Dear distance learner! Indifference curves have certain characteristics that reflect assumptions about consumer behavior. In fact, one of the major uses of indifference curves is to examine the kinds of consumer behavior implied by different preferences, prices, and incomes.

A) Indifference curves are normally negatively sloped. It implies that

- ✓ The two commodities can be substituted each other.
- ✓ That is quantities of one commodity decreases the quantity of the other commodity is increases if the consumer has to stay at the same level of satisfaction.

B) ICs are convex (bowed inward) to the origin. It implies that

- ✓ The two commodities are imperfect substitutes for each other. In other words, convexity of IC enables the consumer to buy more of good X and less good Y and yet the consumer remains on the same level of satisfaction.
- ✓ It exhibits the *law of diminishing marginal rate substitution*.

C) ICs don't intersect each other or tangent to one another. If they did, the point of their intersection would imply two different level of satisfaction, which is impossible. The intersection of ICs violets the consistency and transitivity rule which is logical necessity in IC analysis.

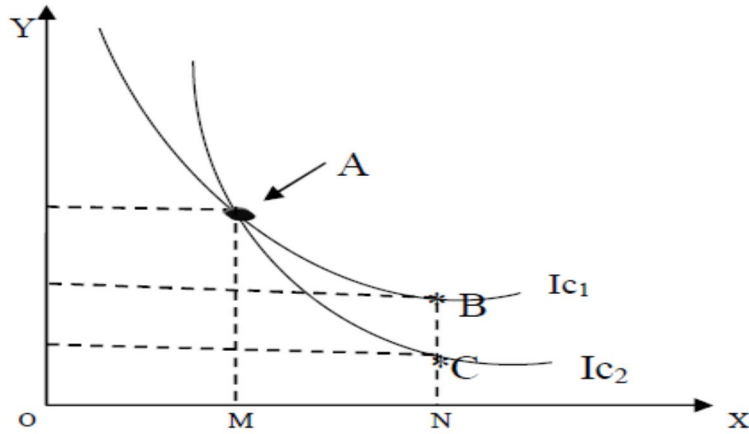


Fig 1.7

From the above fig 1.7 consumer satisfaction at point $A = B$, $A = C$. Therefore, based on the transitivity assumption $B = C$, but this is false because at point B consume $ONx + NB_y$ and at point C consume $ONx + NC_y$ so, $B \neq C$. The intersection of two ICs would mean that a commodity can be consumed either with a very much smaller or very much larger combinations.

- D) An indifference curve doesn't touch either axis. If it touch, it means that only one good is consumed and nothing of the other. This condition implies perfect substitutability.
- E) Higher IC represents a higher level of satisfaction than the lower one. In other words, more is preferred to less (*More is better* assumption of consumer preference). For example, in $IC_3 > IC_2 > IC_1$ as shown in the fig 1.8.

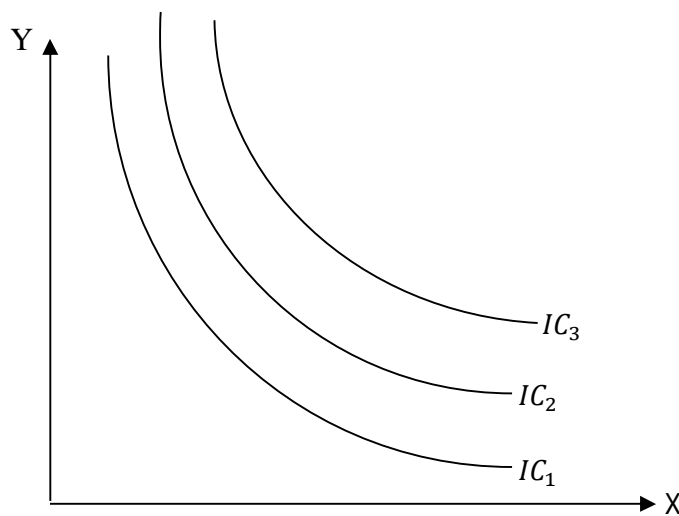


Fig 1.8

1.2.2.4. Special Cases of Indifference Curve

The shape of an indifference curve describes the willingness of a consumer to substitute one good for another. An indifference curve with a different shape implies a different willingness to substitute. There are two extreme cases of indifference curve. Such as,

Case 1: perfect Substitutes

If two goods X and Y are perfect substitutes, then the indifference curve will be a straight line (constant sloping downward) and intersecting the commodity axis. For goods X and Y to be perfect substitute, the MRS_{xy} must be constant. That means, no matter on what indifference curve we are, we must give up the same amount of good Y to get one additional unit of X .

Case 2: perfect Complements

If two goods X and Y are perfect complements to each other, they consumed together in fixed proportion. The indifference curve takes the shape of a **right angle (L-shaped)**. The MRS_{xy} will be zero in this case because there is no substitution possibility. These two extreme types of indifference curves are shown in panel (a) and panel (b) respectively. Panel (c) shows the normal indifference curve where we can have the possibility of substitution between two commodities.

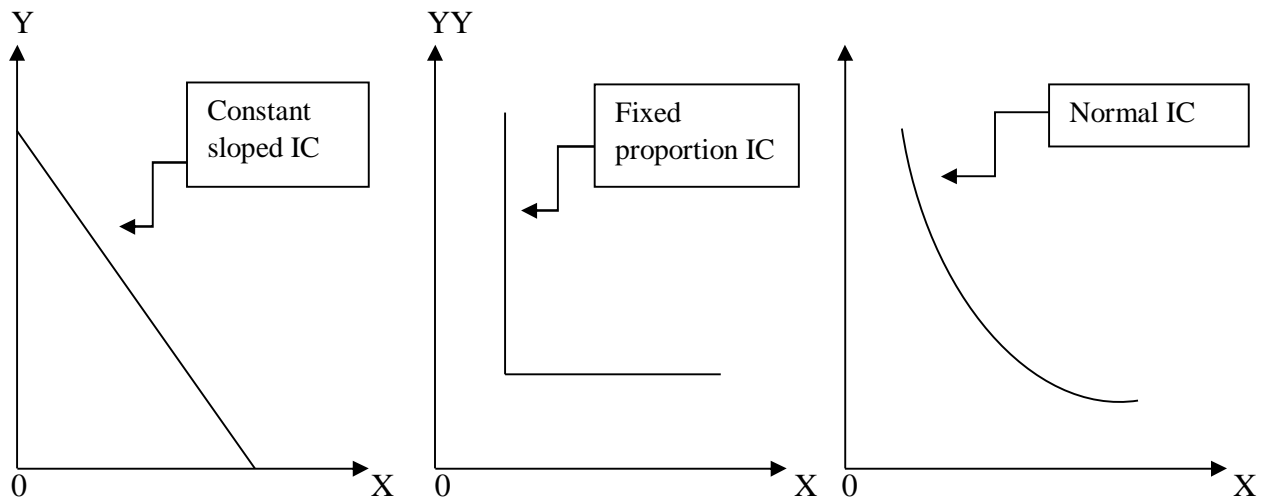




Fig 1.9: Types of Indifference Curves

Note: Greater the curvature of the indifference curves, lesser will the degree of substitution for goods. This reflects the law of *DMRS*. On the other hand, the curve is flatter (i.e. of less curvature) the degree of substitution between goods will be very high and MRS will tend towards constancy.

 *Dear distance learner! What influence the MRS will have on the shape of an indifference curve?*

1.2.2.5. The Budget Constraint (Line)

 *Dear distance learner! Explain in your own words what the budget line is?*

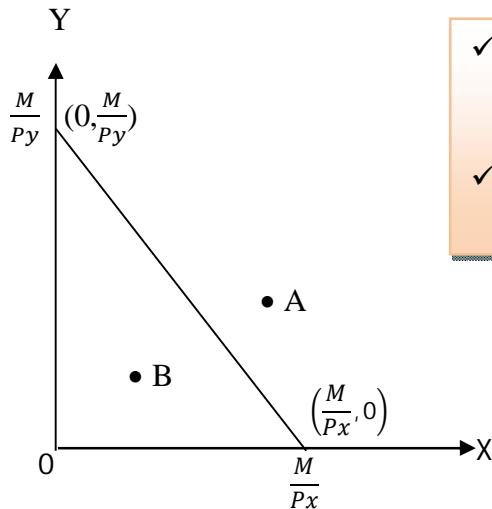
The limited income acts as a constraint to the quantities of goods the consumer can buy. This is known as *budget constraint*.

Budget constraint shows the various combinations of two commodities that a consumer can buy given his income and prices of the goods. The consumer's income limits the combinations of goods that the consumer can choose to consume. The combinations of the two goods that exhaust income are depicted by the budget line. The slope of the budget line represents the ratio of the prices of the two goods.

The income constraint in the case of two commodities can be written $P_x \cdot X + P_y \cdot Y \leq M$ where, the consumers purchase bundles (X and Y) at prices P_x and P_y respectively when the consumer has income M . The budget equation is $P_x \cdot X + P_y \cdot Y = M$. Then,

$$P_y \cdot Y = M - P_x \cdot X$$

$Y = \frac{M}{P_y} - \frac{P_x}{P_y} \cdot x$ By using this formula we can draw the budget line.



- ✓ Point "A" is unattainable, at this point the consumer have limited income to purchase the goods.
- ✓ Point "B" is attainable; at this point the consumer doesn't spend all of his income.

Fig 1.10: Budget Line

$$\text{Slope of budget line} = \frac{\Delta y}{\Delta x} = \frac{0 - \frac{M}{P_y}}{\frac{M}{P_x} - 0} = -\frac{P_x}{P_y}$$

→ The -ve sign show the negative (down ward) slope of the budget

- ☞ The slope of the budget line ($-\frac{P_x}{P_y}$) is show the market willingness not the consumer willingness to substitute one good for another.
- ☞ The Y-intercept (Vertical intercept or $\frac{M}{P_y}$) shows all the consumer income spent on the consumption of good Y.
- ☞ The X-intercept (Horizontal intercept or $\frac{M}{P_x}$) shows all the consumer income spent on the consumption of good X.

❖ Shift in the Budget Line

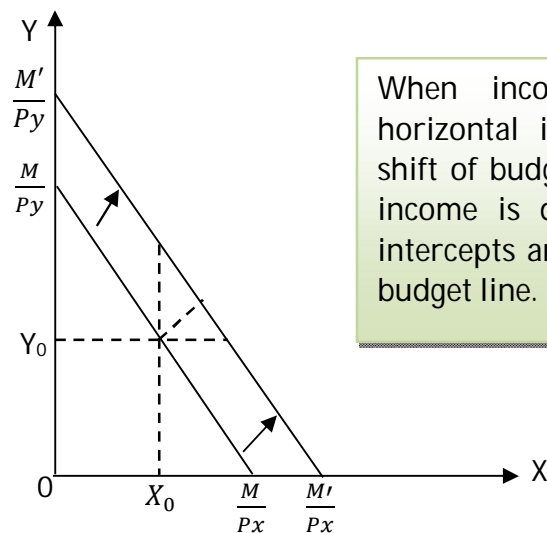
Dear distance learners! The budget line changes its position following the change in consumer's income and prices of commodity.



Dear distance learner! How do the prices and the income affect the shape of the budget line? What happens if the price of one good rises? What happen if income increases?

a) *Change in Money Income*

Increase in income of the consumer, P_x & P_y remaining the same, causes the budget line to shift upwards parallel to the original budget line. While the vertical and horizontal intercepts are increases. This type of change doesn't affect the slope of the budget line because income is not a part of slope. The inverse is also true.



When income is increase, vertical and horizontal intercepts are rise and outward shift of budget line. On the other hand, when income is decrease, vertical and horizontal intercepts are decline and inward shift of the budget line.

Fig 1.11: Change in Money Income

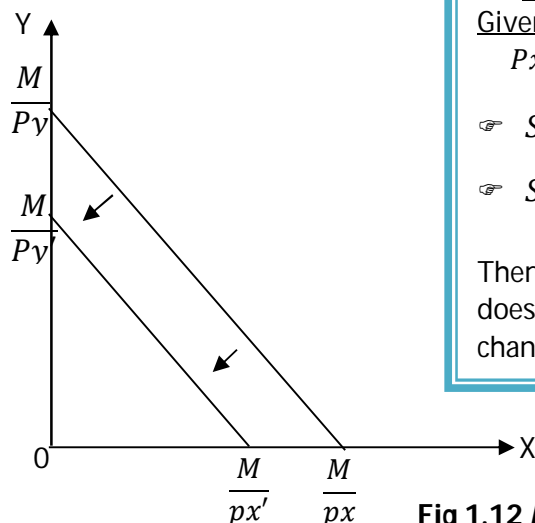
b) Change in Price

The slope and the intercepts of the budget line are affected by the changes in the price of the commodities. The change in price could have two types:

- i) Proportional change in price
- ii) Relative change in price

i) Proportional change in price

Proportional rise in the price of both goods, other things remaining unchanged, will reduce the total quantity of the two goods that the consumer can buy for the given income, and the vertical & horizontal intercepts are decline but leaves the slope of the budget line unchanged. Similar to price fall.



Calculating slope of the budget line
Given:
 $P_x \uparrow = 2 \rightarrow 4$ and $P_y \uparrow = 3 \rightarrow 6$, then

- ☞ $Slope(\text{before } P \text{ rise}) = \frac{P_x}{P_y} = \frac{2}{3}$
- ☞ $Slope(\text{after } P \text{ rise}) = \frac{P_x}{P_y} = \frac{4}{6} = \frac{2}{3}$

Therefore, the slope of the budget line doesn't change due to the proportional change in price.

Fig 1.12 Proportional change in price

ii) Relative change in price

It can occur as the result of change in one of the prices or change in both prices in different portions/direction (and magnitudes). In this case both slope and intercept affected by the change.

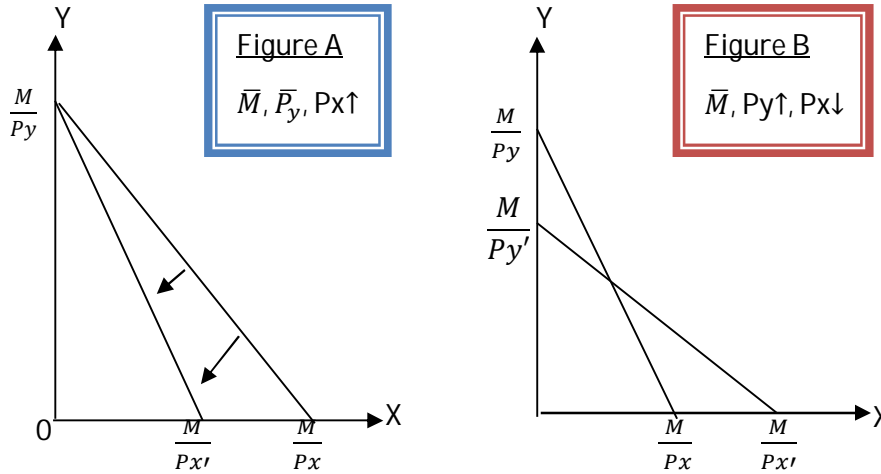


Fig 1.13 *Relative change in price*

1.2.2.6. Consumer Equilibrium(Under Ordinal Utility Approach)

Two conditions must be fulfilled for the consumer to be in equilibrium

- 1) The slope of the *IC* must be equal to the slope of the budget line

$$\frac{P_x}{P_y} = \frac{MU_x}{MU_y} (MRS_{xy}) \rightarrow \text{this is necessary condition}$$

- 2) The *IC* must be convex to the origin

Graphical presentation of the equilibrium

Given the indifference map of the consumer and his budget line, the equilibrium is defined by the point of tangency of the budget line with the highest possible indifference curve (Point “E”).

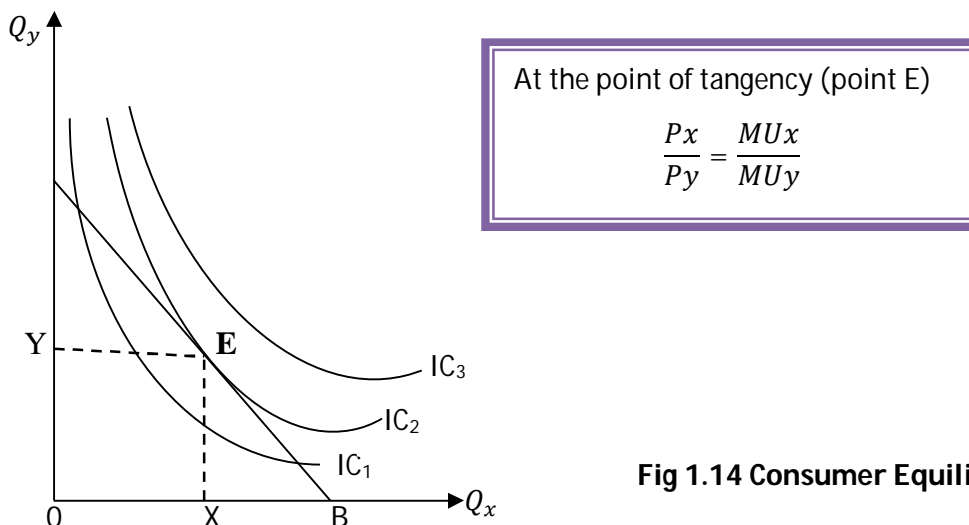


Fig 1.14 *Consumer Equilibrium*

Example:

Suppose the utility function of a person consuming two commodities X and Y with income of 600 Birr is given by $U = 2X^{0.6}Y^{0.4}$. If the per unit price of X and Y is Birr 20 and 40 respectively. Then, find

- A) The utility maximizing level of consumption of X and Y?
- B) The MRS_{xy} at optimum?
- C) The maximum utility?
- D) The value of λ & interpret the value?

Solution:

Formally the problem may be stated as

$$\begin{aligned} \text{Max } U &= 2X^{0.6}Y^{0.4} \\ \text{Subject to } 20X + 40Y &= 600 \end{aligned}$$

A) In order to calculate the utility maximizing level of consumption of X and Y we should formulate the Lagrangian function

$$L = 2X^{0.6}Y^{0.4} + \lambda(600 - 20X - 40Y)$$

To precede the consumer should satisfy the following first order conditions

$$\frac{\partial L}{\partial X} = 1.2X^{-0.4}Y^{0.4} - 20\lambda = 0 \rightarrow \lambda = 0.06X^{-0.4}Y^{0.4} \dots\dots\dots (1)$$

$$\frac{\partial L}{\partial Y} = 0.8X^{0.6}Y^{-0.6} - 40\lambda = 0 \rightarrow \lambda = 0.02X^{0.6}Y^{-0.6} \dots\dots\dots (2)$$

$$\frac{\partial L}{\partial \lambda} = 600 - 20X - 40Y = 0 \dots\dots\dots (3)$$

From (1) and (2)

$$\begin{aligned} \lambda &= \lambda \\ 0.06X^{-0.4}Y^{0.4} &= 0.02X^{0.6}Y^{-0.6} \end{aligned}$$

After we rearrange we obtain

$$\underline{X = 3Y} \dots\dots\dots (4)$$

Insert (4) in (3) we obtain

$$\begin{aligned} 600 - 60Y - 40Y &= 0 \\ \underline{Y = 6 \text{ units}} \end{aligned}$$

Insert the result of 'Y' commodity in (4) we obtain

$$\underline{X = 3Y = 18 \text{ units}}$$

The above result show that the consumer can maximize his/her utility by consuming 6 units of commodity ‘Y’ and 18 units of commodity ‘X’.

B) To compute the MRS_{XY} we should follow the following process

$$\text{We know that } MRS_{XY} = \frac{MU_X}{MU_Y}$$

Therefore, we should calculate MU_X and MU_Y to solve MRS_{XY} , so

$$MU_X = \frac{\partial U}{\partial X} = 1.2X^{-0.4}Y^{0.4} \quad \text{and} \quad MU_Y = \frac{\partial U}{\partial Y} = 0.8X^{0.6}Y^{-0.6}$$

At optimum,

$$MRS_{XY} = \frac{MU_X}{MU_Y} = \frac{1.2X^{-0.4}Y^{0.4}}{0.8X^{0.6}Y^{-0.6}} = \frac{1.2Y}{0.8X} = \frac{1.2(6)}{0.8(18)} = 0.5$$

The above result implies that the consumer should give up 0.5 units of commodity ‘Y’ in order to gain one unit of commodity ‘X’.

☞ **NB:** you should know the difference between MRS_{XY} and MRS_{YX} . And try to calculate the value of MRS_{YX} and compare the two results?

C) It is so simple to calculate the maximum utility by inserting the optimal amount of ‘X’ and ‘Y’;


$$\text{Max } U = 2X^{0.6}Y^{0.4} = 2(18)^{0.6}(6)^{0.4} = 23.198$$

The above result show that the consumer can drive the maximum satisfaction/utility 23.198 by consuming 6 units of commodity ‘Y’ and 18 units of commodity ‘X’.

D) The value of the Lagrangian multiplier, λ , can be manipulate by substituting the value of ‘X’ and ‘Y’ in to (1) or (2). Let’s take the first equation

$$\lambda = 0.06X^{-0.4}Y^{0.4} = 0.06(18)^{-0.4}(6)^{0.4} \approx 0.0387$$

Interpretation: It indicates that one unit change in the constant of the constraint will change the objective function by 0.0387 units.

 **Dear distance learner! State the definitions of price elasticity, income elasticity, and cross-price elasticity of demand. What do these definitions mean in words?**

1.3. Elasticity of Demand

Dear distance learners! Suppose we want to study the effects a price change has on the demand for a good. It is practical to do that in terms of percentages: if the price rises by one percent, how many percentages will demand change?

Elasticity of Demand is a measure of *responsiveness, or sensitivity*, of consumers to a change in one of the factors that affect demand (like price, income, price of other goods...). Accordingly, we have *price elasticity, income elasticity and cross-price elasticity of demand*.

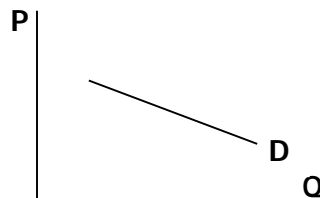
(A) Price Elasticity of Demand: -it is a measure of responsiveness, or sensitivity, of consumers (i.e. their quantity demanded) to a change in the price of a product, other factors being the same.

$$Ed = \frac{\% \text{ Change in Quantity Demand}}{\% \text{ Change in Price}}$$

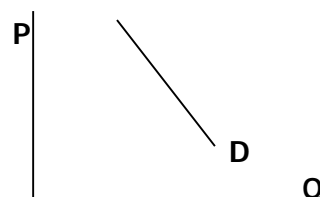
$$\text{Symbolically, } Ed = \frac{\Delta Qdx}{Qdo} \div \frac{\Delta Px}{Po} = \frac{Qd - Qdo}{Qdo} \div \frac{P - Po}{Po} \quad \xrightarrow{Ed =} \frac{Qd - Qdo}{P - Po} \cdot \frac{Po}{Qdo}$$

? *Dear distance learner! How can we interpret the price elasticity of demand results for products?*

a) Elastic Demand -demand is said to be elastic if a specific percentage change in price results in a larger percentage change in quantity demanded. Then Ed will be greater than 1. Example: if a 3% decline in price results in a 9% increase in quantity demanded, then demand is elastic and $Ed = 0.09 / 0.03 = 3 > 1$. The demand curve in this case is drawn *flatter*. Most luxury goods & comforts have elastic demand.

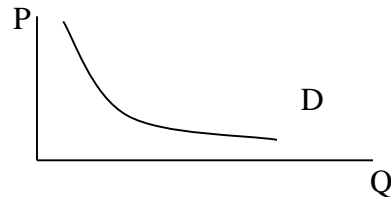


b) Inelastic Demand: -if a given percentage change in price is accompanied by a relatively smaller change in the quantity of the good or service, then demand is said to be inelastic. For example, if a 10% increase in the price of a product is accompanied by only a 2% decrease in the quantity demanded of that product $Ed = 0.02 / 0.1 = 0.2 < 1$. The demand curve in this case is drawn *steeper*. Most of the essential goods or necessities have inelastic demand. $0 < Ed < 1$

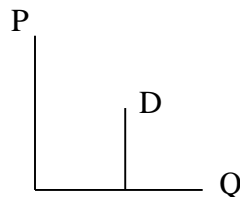


c) **Unitary Elastic:** - the case separating elastic and inelastic demands occurs where a percentage change in price and the accompanying percentage change in quantity demanded are equal. For example if, a 6% change in price results in 6% change in quantity demanded, then $E_d = \frac{6\%}{6\%} = 1$.

In this case the demand curve is a *rectangular hyperbola*.



d) **Perfectly Inelastic:** - this is a situation the coefficient of elasticity, $E_d = 0$. This shows that a change in the price of a good or service does not bring in any change in, what so ever is, the quantity demanded (i.e. $\Delta Q_d = 0$). Some essential goods like medicine or goods having caffeine content pose perfectly inelastic demand. Typical examples are an acute diabetic patient's demand for insulin or an addicted person's demand for heroin. The demand curve for perfectly inelastic demand is a *vertical line* parallel to the price axis.



e) **Perfectly Elastic:** - this indicates that one percentage change in price results in infinite change in quantity demanded. In this regard, the consumer can buy all possible quantities at the given price and nothing else at some other prices. The demand curve for a perfectly elastic demand is a *horizontal line* drawn parallel to the quantity axis.

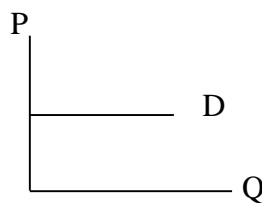


Table 1.2. Summary

Elasticity	Description	Implication	Demand curve
$E_d > 1$	Elastic	$\% \Delta Q > \% \Delta P$	Flatter
$E_d = 1$	Unitary elastic	$\% \Delta Q = \% \Delta P$	Rectangular Hyperbola
$0 < E_d < 1$	Inelastic	$\% \Delta Q < \% \Delta P$	Steeper
$E_d = 0$	Perfectly inelastic	$\% \Delta Q = 0$	Vertical
$E_d = \infty$	Perfectly elastic	$\% \Delta P = 0$	horizontal

From our definition of elasticity, $E_d = \frac{\% \text{ change in quantity demand}}{\% \text{ change in price}} = \frac{\% \Delta \text{ dependent var iabel}}{\% \Delta \text{ independent var iabel}}$

However, we have to distinguish b/n **point and arc** elasticities. Point elasticity measures elasticity at a specific point on a demand curve, i.e. consumer responsiveness to price changes. Whereas, arc elasticity refers to price elasticity over a distance on the demand curve. In other words, arc elasticity measures the average responsiveness of consumer demand to changes in price over a range of extended prices.

$$\text{Point elasticity of demand} = \frac{\% \Delta \text{ quantity demand}}{\% \Delta \text{ price}} = \frac{\Delta Qd}{\Delta p} \cdot \frac{p}{Qd}$$

$$\text{Arc elasticity of demand} = \frac{\% \Delta \text{ quantity demanded}}{\% \Delta \text{ price}} = \frac{\Delta Qd}{\Delta P} \cdot \frac{P_1 + P_2}{Q_1 + Q_2}$$

? *Dear distance learner! What determines the price elasticity of goods & services?*

The major **determinants** of price elasticity of demand are:

→ **Availability of close substitutes:** - a substitute for a product is one that serves the same general purpose. Therefore, the demand for a good that has many close substitutes is more elastic and the good that has few or no close substitute is inelastic.

→**The proportion of income consumers spends on the commodity:** - the demand for a product on which a consumer spends large percentages of his/her income is likely to be quite elastic. Other things being equal, the smaller the percentage of income spent on a product, the less elastic the demand unless the good is considered as a disposable luxury.

→**The nature of a commodity:** - the items that a consumer can use may be either necessary or luxury. In general, the demand for necessities is inelastic. This means that whatever be the changes in prices of such goods & services, certain quantities will still be purchased by consumers. However, if the item is a luxury good, the consumer may postpone his/her consumption, buy more when its price decreases or buy less when its price rises. Hence, demand is elastic for luxury goods. But, demand is inelastic in the case of addictive goods or alcoholic drinks. For example, if an individual is addicted to cigarettes or alcoholic drinks, he/she finds it difficult to forgo though price increases and demand is highly inelastic.

→**Price level:** - Assuming that the demand curve for a product is linear, demand tends to be more elastic at higher price than at lower prices. This means moving along a linear demand curve, elasticity is not the same at every point. Even though a linear demand curve has constant slope, its elasticity varies from point to point.

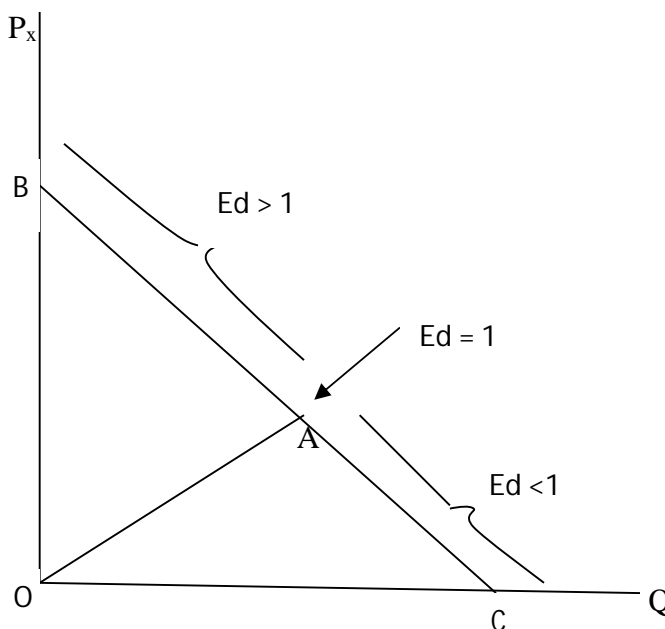


Fig 1.15 Elasticities on a linear demand curve

As shown in the above figure, along the, down-ward sloping demand curve, demand is elastic at higher prices, unitary elastic at the mid-point but becomes less elastic as price declines towards the lower end. At relatively low prices.

→**Adjustment time:** - In general, demand tends to be more elastic with longest time because the consumer can find more substitutes for the product in the long run. Over longer periods, we also have more time to adjust our consumption pattern in response to price changes which also contributes to a more elastic demand. Thus, in the short-run demand is inelastic while in the long-run it is elastic/relatively elastic.

Ex1. A 5% fall in the price of a good leads to a 20% rise in the quantity demanded.

Determine the elasticity and comment on its value.

Solution: $E_d = \frac{20\%}{5\%} = 4$ --- the demand is elastic

Ex2. With an 8% rise in the price of a commodity, the quantities demanded falls from 10 to 2 units. Determine the price elasticity of demand?

Solution $E_d = \frac{\% \Delta Q_d}{\% \Delta p} = \frac{2-10}{8\%} = \left| -\frac{80\%}{8\%} \right| = \underline{10}$ --- the demand is elastic

(B) Income Elasticity of Demand: - measures the responsiveness of demand of a particular commodity to changes in income of the consumer.

$$E_m = \frac{\% \Delta \text{quantity demanded}}{\% \Delta \text{income}}$$

This coefficient may be positive or negative. Goods that have positive income elasticity of demand are called **normal goods**. The quantity demand of such goods is positively associated with consumers' income. Whereas a negative income elasticity of demand implies an inverse relationship b/n income and the quantity of a good demanded. Such types of commodities are called **inferior goods**.

Normal goods may be either necessary or luxury items. We say a good is **necessity** good when $0 < E_m < 1$. But if $E_m > 1$, the commodity is **luxury**.

Table 1.3 Summary:

Em < 0	Em > 0	
The good is Inferior	The good is Normal	
	0 < Em < 1	Em > 1
	The good is Necessity	The good is luxury

C) Cross Elasticity of Demand: -Another useful price elasticity concept is the cross elasticity of demand, which measures the sensitivity of purchases of one goods say(X) to changes in the price of another good (say Y). We calculate the coefficient of cross elasticity of demand E_{xy} just as we do the coefficient of simple price elasticity, except that we relate the percentage change in the quantity demanded of commodity X to the percentage change in the price of Y:

$$E_{xy} = \frac{\% \Delta Q_x}{\% \Delta p_y} = \frac{\Delta Q_x}{\Delta p_y} \cdot \frac{p_y}{Q_x}$$

This coefficient tells us whether the two goods (X and Y) are substitutes, complements or independent (unrelated).

- i) **Substitute goods**: - If cross elasticity of demand is positive that is, the quantity demanded of X moves in the same direction as a change in the price of Y- then X and Y are substitute goods.
- ii) **Complementary goods**: - When cross elasticity is negative, we know that X and Y “go together” an increase in the price of one decrease the demand for the other.
- iii) **Independent goods**: - A zero or near-zero cross elasticity suggests that the two products are unrelated or independent goods.

Table 1.4 Summary

$E_{xy} > 0$	$E_{xy} < 0$	$E_{xy} = 0$
Substitutes	complements	Independent

1.4. Income and Substitution Effects

Dear distance learner! Now we will now use consumer theory to perform a slightly more complicated analysis of a price change.

Substitution Effect: Is the effect on the demand that depends on the change in relative price.

Income effect: is the effect on demand that depends on the fact that one can afford more after a drop in the price, and vice versa.

Suppose that we have a consumer, with a certain income, who has to choose between different quantities of good 1 and good 2 (which, again, can be thought of as “all other goods”) in such a way that she maximize her utility. If the price of good 1 falls, we get two different effects:

- ☞ Since the price of the good 1 falls, that good becomes cheaper relative the other good. This means that the marginal rate of substitution (MRS; slope of the budget line) changes. Say that the prices of both goods initially are 1. The relative price is then $1/1=1$. If the price of the good 1 falls to 0.50, the relative price becomes $0.50/1=0.50$. The consumer can now exchange one unit of good 2 for two units of good 1, and therefore good 1 becomes more attractive to her. As a result, she consumes more of the good 1. This effect is called the *substitution effect*.
- ☞ The purchasing power of the consumer becomes larger because of the drop in the price. She can now buy as much as she did before the price changed, and still have money left. The extra money she can spend on both good 1 and on good 2. This is called the *income effect*.

1.5. Consumer Surplus

The consumer’s surplus is a concept introduced by Marshall, who maintained that it can be measured in monetary units, and is equal to the difference between what consumers would have been willing to pay for each unit of a commodity and the amount they actually paid.

Graphically the consumer’s surplus may be found by his demand curve for commodity x and the current market price. Assume that the consumer’s demand for x is a straight line (AB in the Figure) and the market price is P. At this price the consumer buys q units of x and pays an amount $(q) \times (P)$ for it. However, he would be willing to pay p_1 for q_1 , P_2 for q_2 , P_3 for q_3 and so on. The fact that the price in the market is lower than the price he would be willing to pay for the initial units of x implies that his actual expenditure is less than he would be willing to spend to acquire the quantity q. This difference is the consumer’s surplus, and is the area of the triangle PAC (the shaded area) in the figure.

Dear distance learner! To find the shaded area or the consumer surplus (Cs) in fig 1.16 we can use the triangle formula:

$$Cs = \frac{1}{2}(PA) \times (PC)$$

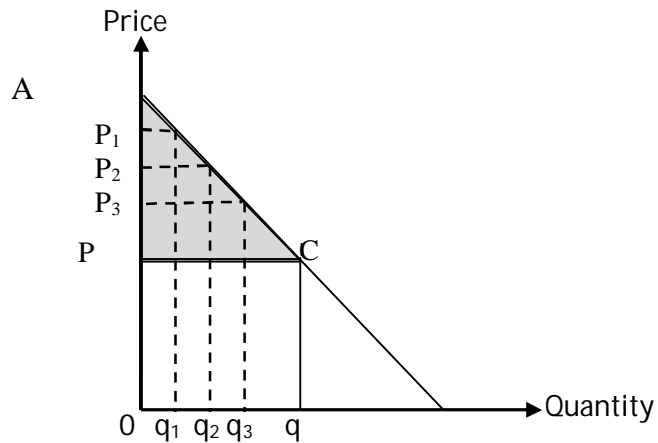


Fig 1.6. Consumer Surplus

Chapter- One: Review Questions

Part I: Choose the best answer from the given alternatives

- 1) Suppose the demand for banana sold from one roadside stand in Arba Minch is elastic. This fact means that a 7 percent increase in the price charged by the owner would lead to
 - A) A greater than 7 percent increase in the quantity demanded at this stand.
 - B) A less than 7 percent increase in the quantity demanded at this stand.
 - C) A less than 7 percent decrease in the quantity demanded at this stand.
 - D) A greater than 7 percent decrease in the quantity demanded at this stand.
 - E) None of the above

- 2) Which one of the following is **not** the assumption of cardinal utility approach?
 - A) Utility is quantitative feeling
 - B) Utility is measurable in objective units
 - C) Utility is subject to the law of diminishing marginal rate of substitution
 - D) Constant marginal utility of a unit of money
 - E) All except D

- 3) One of the following characteristics of indifference curve exhibited the law of diminishing marginal rate substitution concept
 - A) Indifference curves are normally negatively sloped

- B) Indifference curves are bowed inward to the origin
 - C) Indifference curves don't intersect each other or tangent to one another.
 - D) An indifference curve doesn't touch either axis.
 - E) None of the above
- 4) With an 8% rise in the consumer's income, the quantities demanded falls from 9 to 2 units. Which one of the following is true?
- A) The good is luxury
 - B) The good is necessity
 - C) The good is inferior
 - D) The good is Giffen
 - E) The good is normal
- 5) **Except one**, all of the following are **not necessarily true**?
- A) Transitive preference is not necessary for consumer consistency
 - B) If the good is undesirable, consumers always prefer more of any good to less
 - C) Due to the fall in price, if the consumer spend on/consume more of both good 1 and good 2
 - D) Under cardinal utility analysis, when $MU_x > Px$ the consumer can raise his/her satisfaction by consuming more units of good X
 - E) None of the above
- 6) The Iso-utility curves of the consumer that lie far further from the quantity axis of the consumer represent
- A) Higher level of satisfaction
 - B) Lower level of satisfaction
 - C) The same level of satisfaction
 - D) Higher level of profit
 - E) B & D

Part II: Give the appropriate answer for the following questions

- 7) Suppose the budget line changes its position by the relative change in price of good "X" and good "Y". If the price of the good "X" increase and the price of good "Y" decrease, assume money income is constant. Graphically show the effect of the price change on the position of the budget line?
- 8) Suppose the utility function of a person consuming two commodities X and Y with income of 480 Birr is given by $U = 50X^{0.5}Y^{0.5}$. If the per unit price of X and Y is Birr 20 and 40 respectively. Then, find
- A) The utility maximizing level of consumption of X and Y ?(NB: use the Lagrangian Multiplier Method)
 - B) The MRS_{XY} and MRS_{YX} at optimum & interpret the result?

- C) The maximum utility?
- D) The value of λ & interpret the value?
- E) Calculate the maximum utility the consumer can obtain if his/her income increases by 25 Birr?
- 9) If the demand and supply functions of a good are given as $Q = 250 - 3P$ and $Q = 2P - 50$, respectively; then calculate the consumer surplus?
- 10) If the utility function of the consumer is given as: $U = \sqrt{XY}$, and the budget line equation is: $P_X \cdot X + P_Y \cdot Y = M$, then find the demand equation for X and Y?

CHAPTER TWO


THEORY OF PRODUCTION

Dear distance learner! After successful completion of this unit, you will be able to

- Under the basic concept of production
- Define production and production function
- Compute the marginal and average product from the total production function
- Differentiate short run and long run, and fixed and variable inputs
- Know the concepts of short run production.
- Understand the concept of efficiency in production
- Understand the role of technology in production
- Know the concepts of long run production, laws of returns to scale and how to determine least cost production process.
- Determine the optimal input mix of a given production

2.1. Basic Concepts of Production

2.1.1. Production and Production Function

 *Dear distance learner! Describe in words what a production and production function is. Which variable are typically inputs?*

Production: is the process of using economic resources (factors of production) to make the final goods and services with value added. In other words, it is the transformation of inputs into outputs. The outputs can be tangible or intangible.

Production Function: is the technical and technological relationship between inputs and outputs. In other terms, a production function shows the maximum output that can be obtained from a given set of inputs. It describes not only a single isoquant but also the whole array of isoquants.

Symbolically, we can write this as follows:

$$Q = f (L_B, L, K, M, T, E, \text{etc})$$


2.1.2. Classification of Inputs

The classification of economic resources as *fixed* and *variable inputs* is related with the concept of short run and long run. This classification is mainly made depending on the degree of flexibility of economic resources to changes in business environment of products consuming those resources.

Fixed inputs: one that is used in fixed quantities for a certain level of output, i.e. its quantity does not change with the change in output. The supply of such resources is inelastic in the short run and therefore, a production system cannot employ more of it in the short run. Example: Machinery, buildings, etc.

Variable inputs: are inputs whose quantity can be readjusted in relation to the level of production; or these inputs are resources whose quantity changes with the level of output, e.g., labor and raw materials. In the short run the supply of these inputs is elastic and therefore, it is possible to employ more of them in the short run production process.

2.1.3. The Short- Run and Long-Run Production Period

 **Dear distance learner! What is the difference between the short run and long run production period?**

In economics, production period is classified as short run and long run.

Short- run production period: refers to a period of time in which the quantity of at least one of the inputs or resources is fixed. For example, capital goods like building, machinery, etc are fixed in the short run. In the short-run, production constitutes both variable and fixed inputs.

Long- run production period: on the other hand, refers to a period of time in which all inputs are variable or there is no fixed resource in general.


It must be understood that when we mean short run and long run it does not necessarily mean a relatively short or long period of time like one year or less than one year or like two or five years. It rather refers to the nature of economic arrangement of the inputs in response to the changing economic environment.

2.2. Production With One Variable Input

This is a phenomenon of short-run production period. The short-run decision of production is a time period over which production is carried out with the help of two categories of inputs i.e. fixed inputs and variable inputs. For simplicity purposes, we assume production is carried out with capital (K) as a fixed input and labor (L) as a variable factor. Therefore, the production function can be written as:


$$Q = f(\bar{K}, L) \text{ or } Q = f(L)$$

2.2.1. Total, Average and Marginal Product

 *Dear distance learner! State the definition of marginal product and average product both as a mathematical definition and with your own words.*

- A) **Total Product (TP)**: it is the overall amount of output produced by the factors of production employed over a given period. It is the gross or entire output by workers.
- B) **Average Product (AP)**: it is the ratio of total product to the amount of variable factor. This can be put in the form of; $AP_L = \frac{TP}{L}$. The average product is a good indicator of the *productivity* of labor. Productivity is a measure of output per unit input.
- C) **Marginal Product (MP)**: it is the increase in output which results from using one additional or extra unit of a single factor input, holding the quantities of other factors constant, is called the marginal physical product or simply marginal product. In other words, the MP is the percentage change in total output resulting from a percentage change in variable input or it is the additional output results from using one more unit of factor of production, all other things being equal. Mathematically, $MP_L = \frac{\partial TP}{\partial L} = \frac{\Delta TP}{\Delta L}$. It is the slope of total product.

2.2.2. The Law of Diminishing Marginal Returns (LDMR)

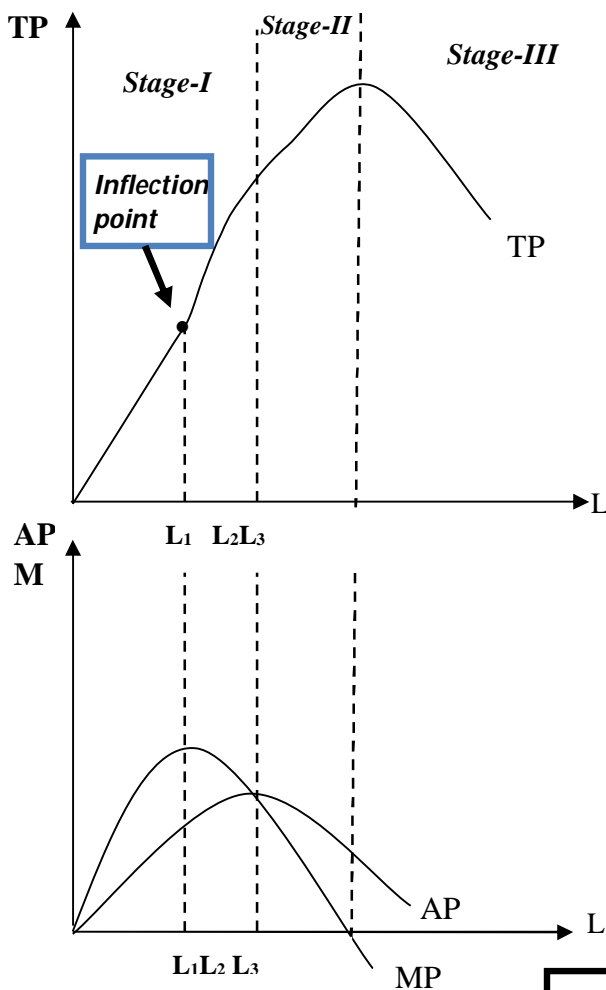
 *Dear distance learner! What is the “law of diminishing marginal returns”? How has it been derived?*

It is sometimes known as the “*law of variable Proportion*” or the “*law of returns to variable inputs*”. The law states that if some factors are held constant and more units of variable factors are employed, the marginal product of the variable input eventually decreases. In other words, it states that increasing the amount of the variable factor (labor) with fixed factor (capital) will lead to an eventual decline in

the marginal contribution of the additional labor to the total output. This is also accompanied by the eventual decline in total output.

2.2.3. The Stages of Production

A functional relationship between observed between total product(TP), average product(AP) and Marginal product(MP) help to describe stages in production function (see fig. 2.1) states that as more of variable input is applied, output(Q) increases until the maximum TP at which input usage L_3 is reached. Further application of variable input beyond L will only serve to reduce the total output.



Some Important points in the figure

- ☞ When MP reaches its maximum, TP reaches its **inflection point**.
- ☞ When MP increases, TP increases at increasing rate until its inflection point. Slope of TP is positive.
- ☞ When MP declines until $MP=0$, TP increases at decreasing rate.
- ☞ When $MP=0$, TP reaches its maximum (constant level).
- ☞ When TP start to decline, MP negative. Slope of TP is negative.
- ☞ The point at which MP attains its maximum is known as the point of LDMR. In other words, the LDMR begins to operate when MP begins to fall.
- ☞ The Point at which $MP=AP$ is the point of diminishing average return (DAR).

Fig 2.1 Stages of Production

Stage – I: it is a range of increasing average physical product. The stage goes from the origin where $TP=0$ to the point where AP_L is maximum ($AP_L=MP_L$). It indicates the range of rising average physical product for the variable input (labor).

- ✓ It is largely stage of increasing returns to L, because TP increase at increasing rate.
- ✓ Variable inputs remain under employed & fixed inputs remains underutilized.
- ✓ $MP_L > AP_L$.

Stage – II: it is the stage of production ranges from maximum AP_L to zero MP_L . In other words, the stage two production begins when AP_L starts to decline and ends when MP_L curves becomes zero, or TP reaches its maximum level.

- ✓ It is the stage of diminishing returns because TP increase at decreasing rate.
- ✓ $MP_L < AP_L$.
- ✓ Both MP_L & AP_L are diminishing but +ve. MP_L decline at faster rate than AP_L .
- ✓ It is optimum stage of production.
- ✓ There is proper utilization and employment of resources.

Stage – III: it is the stage of production where the marginal contribution of any additional labor becomes negative or it is the level of production where the TP starts to decline with one more labor employed. This stage implies that labor is over employed and capital is over utilized. This stage of production is known as *intensive margin*. This ranges from $MP_L = 0$ to through the –ve part of MP_L .

- ✓ It is the stage of negative returns because TP declines and MP_L decline.
- ✓ AP_L continues to decline though it remains positive.
- ✓ Both MP_L & AP_L are diminishing but $AP_L > 0$ and $MP_L < 0$.

A rational producer would not produce in stage-I because there is excess capital for the very limited variable input (labor). In stage I labor is underemployed and capital is underutilized. This stage of production is known as *extensive margin*. And also rational producer would not produce in stage-III because there is overutilization of capital and labor is over employed. Therefore, the only stage production can take place is the stage II where both MP_L and AP_L are declining but are showing positive values. In other words, the only feasible stage of production for a rational producer is stage II.

✚ **Relationship between MP_L and AP_L**

- ✓ The ascending and descending pattern of both AP_L and MP_L curves is similar.
- ✓ When $MP_L > AP_L$, AP_L is increasing
- ✓ When $MP_L < AP_L$, AP_L is decreasing
- ✓ When $MP_L = AP_L$, AP_L reaches maximum

✚ Relationship between MP_L and TP_L

- ✓ When MP_L is increasing, TP is also increasing at increasing rate.
- ✓ When MP_L is decreasing until it reaches zero, TP is increasing but at decreasing rate.
- ✓ When $MP_L=0$, TP reaches its maximum (saturation point or constant level).
- ✓ When MP_L is negative, TP is declining.

Example for Short-run production

Table 2.1 short run productions

Fixed input (a hectare of land)	Variable input (labor)	Total Product (TP) (In quintals)	Average product (AP)	Marginal Product (MP)	Stages of Production
1 hectare	0	0	-	-	Stage I
»	1	10	10	10	
»	2	28	14	18	
»	3	51	17	23	
»	4	76	19	25	
»	5	95	19	19	Stage II
»	6	108	18	13	
»	7	108	15.4	0	
»	8	96	12	-12	Stage III
»	9	80	8.88	-16	

Dear distance learner! As it can be seen from the table, the total product goes through three different stages. I hope that the above graphical representation of the production function make your understanding deeper as the graph has three different nature of steepness showing the corresponding stages of production. It also clearly explains the law of diminishing marginal returns.

2.3. Production With Two Variable Inputs

This is a phenomenon of long-run production period. It is a production period over which all factors of production are variable. For simplicity purposes, we assume production is carried out with both capital (K) and labor (L) as a variable factor. Therefore, the production function can be written as:

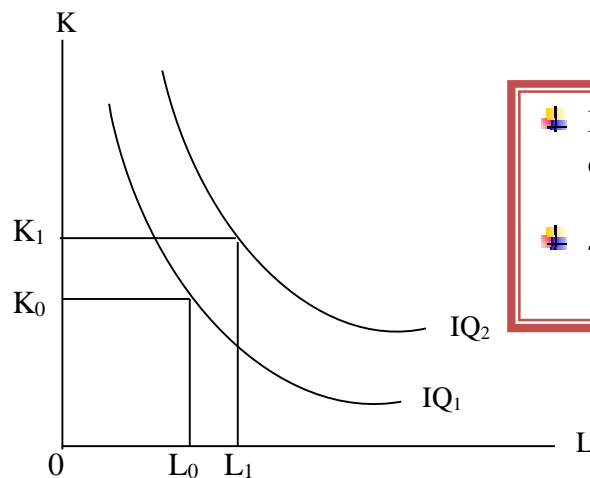
$$Q = f(K, L)$$

2.3.1. Isoquant Analysis of Production

The long-run production period can be analyzed using Isoquants. An *Isoquant (Isoproduct)* is a curve or a line which the various combinations of variable inputs yield the same level of output. In our case the combination of capital (K) and labor (L). In other words, an isoquant is a curve along which the maximum achievable rate of production is constant.

Characteristics of Isoquants

- A) Isoquants are normally negatively sloped: because when one factor increases, the other factor decreases.
- B) An isoquant laying above and to the right of another represents a higher level of output.




In figure 2.2 IQ₂ curve shows large output than IQ₁ curve.

$$\text{slope of Isoquant} = -\frac{\Delta K}{\Delta L} = -\frac{dK}{dL}$$

Fig 2.2 Two Isoquant

- C) Two isoquants cannot intersect each other or tangent to one another. If it is done, the various combination of variable inputs can produce the same level of output at the same time (at one point). Which is impossible.
- D) No isoquants can touch either axis: if an isoquant touches the x-axis it would mean that the product is being produced with the help of labor alone without using any capital at all and vice versa.
- E) Each isoquant is normally drawn convex to the origin: as more units of labor are employed to produce, lesser and lesser units of capital used. This is so, because the marginal rate of technical substitution (MRTS) between the two factors diminishes.

2.3.2. The Marginal Rate of Technical Substitution (MRTS)

 *Dear distance learner! State the definition of the, Marginal Rate of Technical Substitution, MRTS. What does that mean, in your own words?*

MRTS is the rate at which one input can be substituted for another, keeping the level of output constant.

$MRTS_{L,K}$ is the number of K which can be replaced/ substituted by one unit of labor, while \bar{TP} .

We are reducing the amount of K by fewer and fewer for each extra unit of labor. This is happens due to two reasons:

1. No factor of production is perfect substitute for another.
2. Inputs are subject to diminishing marginal return.

Mathematically,

$$MRTS_{L,K} = -\frac{\Delta K}{\Delta L} = -\frac{dK}{dL} = \frac{MP_L}{MP_K}$$

$-\Delta K MP_K = \Delta L MP_L$ The amount of loss is must equal to the amount of gain.

Proof

Given $Q = f(L, K)$

$$dQ = \frac{\partial Q}{\partial L} \cdot dL + \frac{\partial Q}{\partial K} \cdot dK$$

$$0 = MP_L \cdot dL + MP_K \cdot dK$$

$$MP_L \cdot dL = -MP_K \cdot dK$$

$$-\frac{dK}{dL} = \frac{MP_L}{MP_K} = MRTS_{L,K} \rightarrow \text{therefore, MRTS is the slope of Isoquant} \left(\frac{dK}{dL} \right)$$

In the same manner:

$$-\frac{dL}{dK} = \frac{MP_K}{MP_L} = MRTS_{K,L}$$

2.3.3. Elasticity of Substitution

Elasticity of substitution defined as the ratio of percentage change in the capital- labor ratio to the percentage change in the MRTS. In other words, it measures the degree of factors substitutability.

$$\delta = \frac{\text{percentage change in } \frac{K}{L}}{\text{percentage change in MRTS}} \rightarrow \delta = \frac{\% \Delta \left(\frac{K}{L} \right)}{\% \Delta (MRTS)}$$

$$\delta = \frac{d \left(\frac{K}{L} \right) / \left(\frac{K}{L} \right)}{d(MRTS) / MRTS} \quad \text{where, } \% \Delta \left(\frac{K}{L} \right) = \frac{\Delta \left(\frac{K}{L} \right)}{\left(\frac{K}{L} \right)} = \frac{d \left(\frac{K}{L} \right)}{\left(\frac{K}{L} \right)} \quad \text{and}$$

$$\% \Delta (MRTS) = \frac{\Delta (MRTS)}{MRTS} = \frac{d(MRTS)}{MRTS}$$

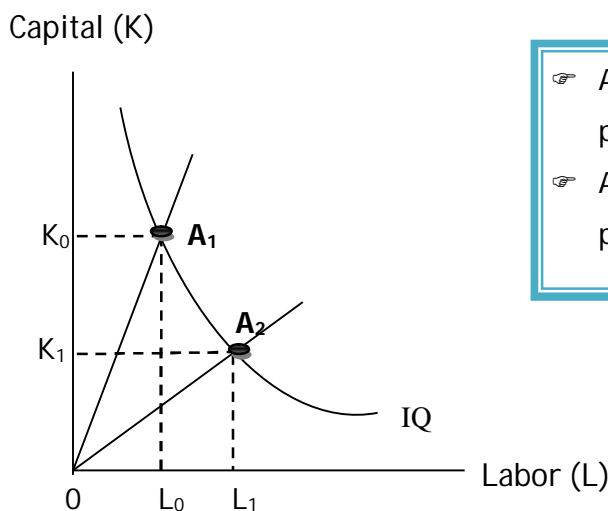
$$\delta = \frac{d \left(\frac{K}{L} \right)}{d(MRTS)} \times \frac{MRTS}{\left(\frac{K}{L} \right)}$$

$\delta = 0 \rightarrow$ For perfect complement inputs

$\delta = \infty \rightarrow$ For perfect substitute inputs

$\delta = 1 \rightarrow$ For imperfect substitute inputs

The factor intensity of any process is measured by the ratio of capital and labour $\left(\frac{K}{L} \right)$



- ☞ At point A_1 , $K > L$ then the production process is **Capital intensive**.
- ☞ At point A_2 , $L > K$ then the production process is **Labor intensive**.

Fig 2.3 Factor Intensity

2.3.4. Returns to Scale (law of production in the long run)

? Dear distance learner! What does “Returns to scale” mean, in your own words?

The term *returns to scale* refers to the changes in output as all factors change by the same proportion.

Suppose we start from an initial level of inputs and output.

$$Q = f(L, K)$$

And we increase all the factors by the same proportion ‘t’, we will clearly obtain a new level of output h (Q), higher than the original level Q,

$$h(Q) = f(tL, tK)$$

- ☞ If h (Q) increases by the same proportion ‘t’ as the inputs (h=t), we say that there is *constant returns to scale (CRS)*.
- ☞ If h (Q) increases less than proportionally with the increase in the factors (h<t), we have *decreasing returns to scale (DRS)*.
- ☞ If h (Q) increases more than proportionally with the increase in the factors (h>t), we have *increasing returns to scale (IRS)*.

1. **Increasing Returns to Scale (IRS):** occurs when a percentage change in all inputs caused a more than percentage change in output. ($\% \Delta input < \% \Delta output$)

Reasons for IRS: - technical and managerial indivisibility

- Increase in the scale of operation
- Higher degree of specialization

2. **Constant Returns to Scale (CRS):** occurs when a percentage change in all inputs leads to the same proportionate change in output. ($\% \Delta input = \% \Delta output$)

3. **Decreasing Returns to Scale (DRS):** occurs when a percentage change in all inputs leads a less than proportionate change in output. ($\% \Delta input > \% \Delta output$)

☞ **Returns to scale and Homogeneity of the Production Function**

When we multiply all factors of production by the same proportion “t”, “t” can be factored out from the function, it is homogeneous production function.

Given: $Q = f(L, K)$

Suppose we increase both factors of production by the same proportion “t”, and we observe the resulting new level of output:

$$Q^* = f(tL, tK)$$

If “t” can be factored out (that is may be taken out of the brackets as a common factor), then the new level of output Q^* can be expressed as a function of “t” and the initial level of output

$$Q^* = t^v f(L, K) \text{ or } Q^* = t^v Q$$

And the production function is called homogeneous production function. If “t” cannot be factored out, the production is non-homogeneous. Thus a homogeneous function is a function such that if each of the inputs is multiplied by “t”, then “t” can be completely factored out of the function. The power “v” of “t” is called the degree of homogeneity of the function and is a measure of the returns to scale.

- ☞ If $v = 1$, we have constant returns to scale. This production function sometimes called linear homogeneous production function.
- ☞ If $v < 1$, we have decreasing returns to scale.
- ☞ If $v > 1$, we have increasing returns to scale.

Example:

Given: $Q = 5L^{0.5}K^{0.2}$, State the returns to scale of the production function?

Solution: $Q^* = 5(tL)^{0.5}(tK)^{0.2}$

$$Q^* = 5t^{0.5}L^{0.5}t^{0.2}K^{0.2}$$

$Q^* = 5t^{0.7}L^{0.5}K^{0.2}$ → Therefore, it is decreasing returns to scale because $0.7 < 1$

2.3.5. Isocost Curve/ Isoclines

An *Isocost line* is the locus of points of various combinations of factors of production- capital & labor, that the firm can purchase or hire with a given expenditure /outlay/cost and input price of the firm.

We can better understand what cost looks like by recalling the total cost of production (C) given by the sum of the firm's labor cost and the cost of capital. The firm cost function is:

i.e. $C = wL + rK$ Where, w- price of labor (wage) and r – price of capital (rent)
L- Labor input and K- Capital input

Then, $rK = C - wL$

$K = \frac{C}{r} - \frac{w}{r}L$ By using this formula we can draw the Isocost line.

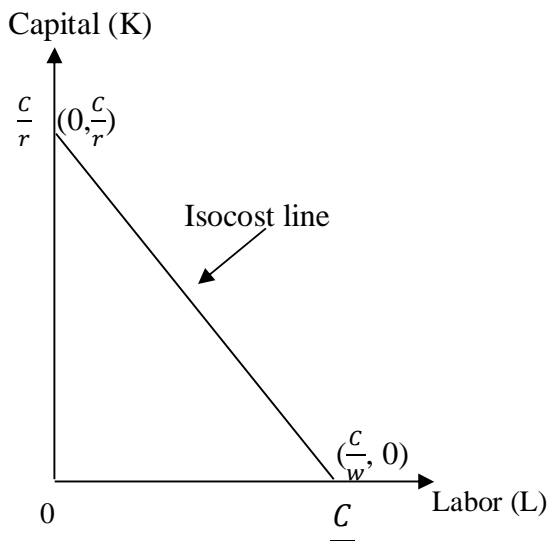


Fig 2.4 An Isocost

$Slope\ of\ Isocost\ line = \frac{\Delta y}{\Delta x} = \frac{0 - \frac{C}{r}}{\frac{C}{w} - 0} = -\frac{w}{r}$ → The -ve sign show the negative (downward) slope of the Isocost line.

- ☞ The Y-intercept (Vertical intercept or $\frac{C}{r}$) shows the maximum amount of capital can purchase by the given cost. In other words, the firm's expenditure is only on capital.
- ☞ The X-intercept (Horizontal intercept or $\frac{C}{w}$) shows the maximum amount of labor can hire by the given cost. In other words, the firm's expenditure is only on labor.

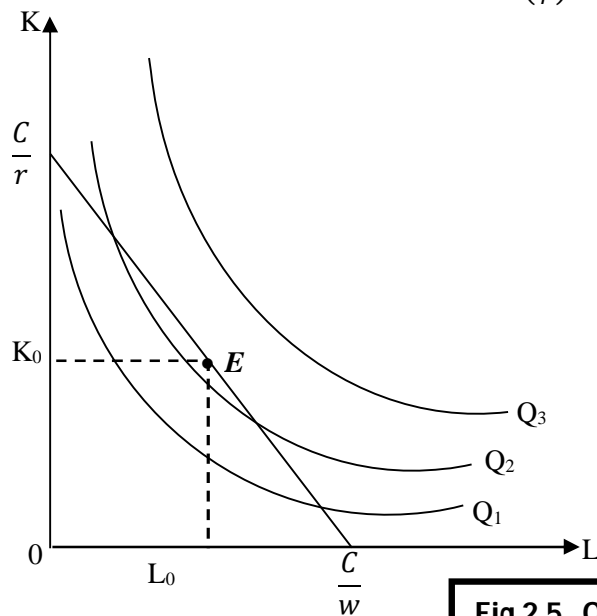
2.3.6. Choice of Optimal Combination of Inputs (Producer Equilibrium)

The optimal input combination of a firm depends on the ultimate goal of the producer. It is known that the main goal of the producer is to maximize output given a specified expenditure or to minimize the cost of production for producing a specified level of output.

Based on the above fact, the producer equilibrium can be described as:

A) Output Maximization for a given level of cost

The producer will be in equilibrium when he/she maximizes output for a given cost. This means that the producer reaches the highest isoquant for a particular cost. This occurs where the isoquant curve is just tangent to the isocost line (at point “E”). At this point, the slope of the isoquant (MRTS) = slope of isocost line $\left(\frac{w}{r}\right)$. i.e. $\frac{MP_L}{MP_K} = \frac{w}{r}$



Mathematically

Maximize $Q = f(L, K) \rightarrow$ Objective function

Subject to $C = wL + rK \rightarrow$ Constraint function

Then, the lagrangian function is:

$$L = f(L, K) - \lambda(wL + rK - C)$$

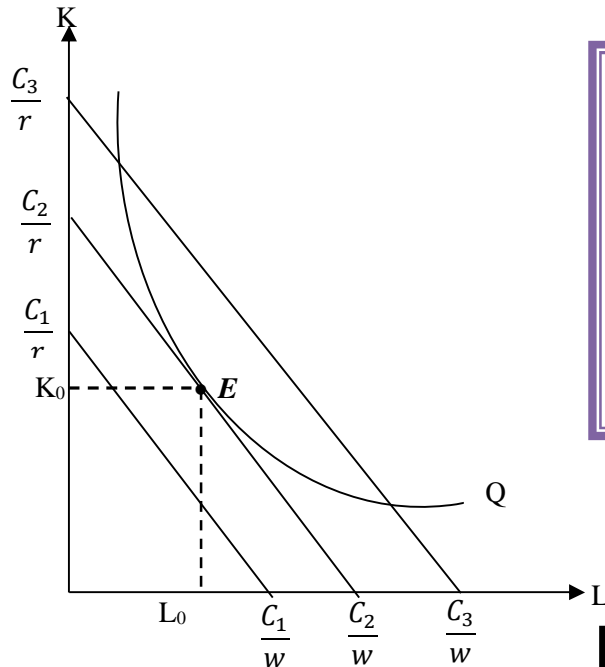
☞ In this case the total cost is known.

Fig 2.5 Output Maximization

B) Cost Minimization for a given level of output

The producer will be at equilibrium when he minimizes the cost of production for producing a specified level of output. This means that the producer reaches the lowest isocost for a particular output level (**Least cost rule**). This occurs where the isocost curve is just tangent to the isoquant curve (point “E”). At this point, the slope of the isoquant (MRTS) = slope of isocost line $\left(\frac{w}{r}\right)$.

i.e. $\frac{MP_L}{MP_K} = \frac{w}{r}$



Mathematically

Minimize $C = wL + rK \rightarrow$ Objective function

Subject to $Q = f(L, K) \rightarrow$ Constraint function

Then, the lagrangian function is:

$$L = wL + rK - \lambda[f(L, K) - Q]$$

☞ In this case the total output is known.

Fig 2.6 Cost Minimization

Numerical Example:

The production function for a firm is given by:

$$Q = 4L^{0.5}K^{0.5}$$

Suppose that the cost of labor is Birr 40 per unit and the cost of using capital is Birr 10 per unit.

- Determine the amount of labor and capital that should be used in order to minimize the cost to produce 40 units of output?
- Calculate the minimum cost of producing 40 units?

Solution :

A) Given: $Q = 4L^{0.5}K^{0.5}$, $w = 40$ birr per unit, $r = 10$ birr per unit, $Q = 40$ units

First, we should form the cost function: $C = wL + rK$ then, $C = 40L + 10K$

Minimize $C = 40L + 10K \rightarrow$ Objective function

Subject to $Q = 4L^{0.5}K^{0.5} \rightarrow$ Constraint function

Then, the lagrangian function (\emptyset) is:

$$\emptyset = 40L + 10K - \lambda(4L^{0.5}K^{0.5} - 40)$$

The first condition for the minimization of a function is that its partial derivatives be equal to zero. The partial derivatives of the above function with respect to L, K, and λ are:

$$\frac{\partial \phi}{\partial L} = 40 - \lambda 2L^{-0.5}K^{0.5} = 0 \rightarrow \lambda = \frac{40}{2L^{-0.5}K^{0.5}} \dots\dots\dots (1)$$

$$\frac{\partial \phi}{\partial K} = 10 - \lambda 2L^{0.5}K^{-0.5} = 0 \rightarrow \lambda = \frac{10}{2L^{0.5}K^{-0.5}} \dots\dots\dots (2)$$

$$\frac{\partial \phi}{\partial \lambda} = 4L^{0.5}K^{0.5} - 40 = 0 \rightarrow (3) \dots\dots\dots (3)$$

From (1) & (2): $\lambda = \lambda$

$$\frac{40}{2L^{-0.5}K^{0.5}} = \frac{10}{2L^{0.5}K^{-0.5}}$$

$$\frac{40}{10} = \frac{2L^{-0.5}K^{0.5}}{2L^{0.5}K^{-0.5}}$$

$$4 = \frac{K}{L} \rightarrow K = 4L$$

From the production function: $Q = 4L^{0.5}K^{0.5}$

$$40 = 4L^{0.5}(4L)^{0.5}$$

$$40 = 4L^{0.5}4^{0.5}L^{0.5}$$

$$40 = 4^{1.5}L$$

$$L = \frac{40}{8} = 5 \text{ units of labor}$$

Then, $K = 4L = 4(5) = 20 \text{ units of capital}$

B) $C_{\text{minimum}} = 40L + 10K = 40(5) + 10(20) = 400 \text{ Birr} \rightarrow \text{the minimum cost of production}$

2.4. The Expansion Path in the Long-Run

The expansion path in the long-run is the expansion of output with all factors variable. An expansion path is the locus of all equilibrium points when input prices remain constant and

expenditure on inputs increases. The producer moves on higher level of output in this type of change.

Dear distance learner! The expansion path is a useful concept because it gives an idea of how input proportion changes with increase in expenditure of the producer, input prices being constant. For a homogeneous production, the expansion path will be a straight line. Thus, the expansion path shows a producer's use of inputs will vary as the firm expands output.

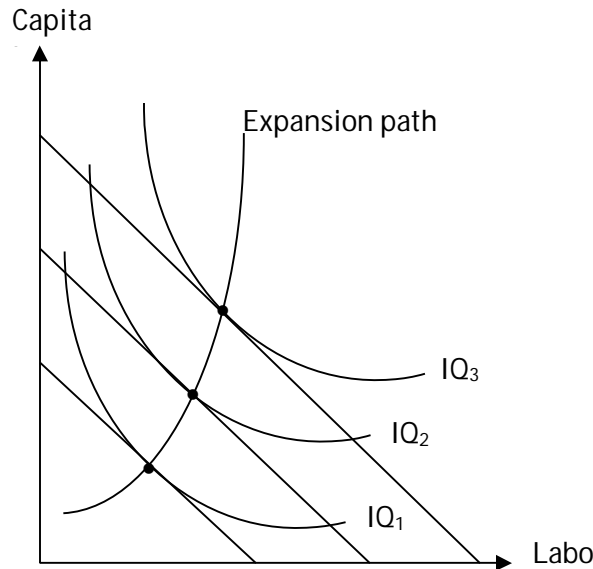


Fig 2.7 The Expansion Path

Assuming that the producer minimizes the cost of producing any given output, we can derive the expansion path by connecting point of tangency of isoquants and isocost lines. The minimum possible cost of producing each output is given by the tangency of each isoquant and isocost line.

Notice the expansion path in fig 2.7 bends upward as output is increased by moving to higher and higher isoquants. The shape of the expansion path implies that the ratio of capital input to labor input is increase as output expands. The ratio of labor to capital would be constant only in the case of a straight line expansion path.

The expansion path shown in fig 2.7 is quite realistic for most enterprises in the long-run because production methods become more capital- intensive as an enterprise grows. This is so, because as firms become larger, they tend to become more mechanized by increasing the ratio of capital to labor which is used to produce a given level of output.

2.5. Producer's Surplus (Ps)

Producer's surplus refers to the difference between what the producer actually receives over the minimum value and what he or she would have been willing to receive.

Geometrically, the producer surplus is measured by the area of the triangle between the supply curve and the market price. Given supply function: $P=f(Q)$, and equilibrium price and output (P_0, Q_0).

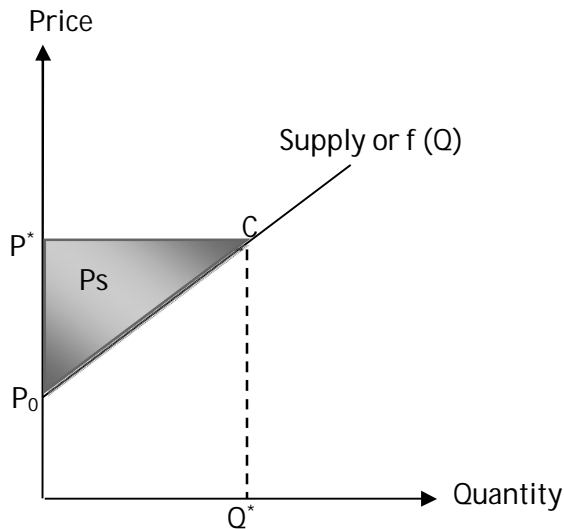


Fig 2.8 Producer's Surplus

To find the shaded area or the producer surplus (Ps) we can use the triangle formula:

1

Chapter-Two: Review Questions

Part I: Choose the best answer from the given alternatives

- 1) One of the following is **false** about Stage –II of production
 - A) It is the stage of diminishing returns because TP increase at decreasing rate.
 - B) MP_L is greater than AP_L .
 - C) Both MP_L & AP_L are diminishing but positive.
 - D) MP_L decline at slower rate than AP_L .
 - E) None
- 2) _____ Is a weighted average of the payoffs or values resulting from all possible outcomes of uncertain situation.
 - A) Expected value
 - B) Expected utility
 - C) Variability
 - D) Risk aversion
 - E) Risk spreading

- 3) **Except one**, All are **true** when total product reaches its inflection point
- A) Marginal product reaches its maximum D) This is the phenomenon of stage I
 B) Marginal product is above AP E) None
 C) At this point marginal cost reaches its minimum
- 4) If the capital-labor ratio changes from 4 units to 8 units, and marginal rate technical substitution changes from 1 unit to 2 units, then degree of factor substitutability of the two inputs are
- A) Perfect complement inputs C) Imperfect substitute inputs
 B) Perfect substitute inputs D) Imperfect complement inputs E) None
- 5) Assume first year economics student has **80 percent** probability to be succeeded in calculus and **20 percent** probability to be failed. Success yields a payoff of **4 point**; and failure yields a payoff of **2 point**. Then the expected point the student will get in calculus is
- A) 4 point B) 2.6 point C) 3 point D) 3.6 point E) None
- 6) **Except one**, all of the following are **true** about short-run production period
- A) The supply of variable inputs are elastic
 B) Both fixed and variable inputs are employed
 C) A production system cannot employ more of fixed inputs
 D) The supply of fixed inputs are elastic
 E) Both A & D

Part II: Give the appropriate answer for the following questions (NB. show all the necessary steps for the workout part)

- 7) Assume the production function a biscuit factory is given by:

$$Q = 6KL^2$$

Suppose that the cost of labor is Birr 20 per unit and the cost of using capital is Birr 30 per unit.

- A) Determine the amount of labor and capital that should be used in order to minimize the cost to produce 1458 units of output?
 B) Calculate the minimum cost of producing 1458 units?
 C) Calculate MP_L and MP_K ?
 D) Mathematically state the returns to scale of the production process?

8) The production function for a firm is given by:

$$Q = KL^2$$

Suppose that labor costs Birr 20 per unit and capital costs Birr 30 per unit. Then,

- A) Determine the quantity of labor and capital that the firm uses in order to maximize the output with total outlay of Birr 450?
- B) Calculate maximum level of output?
- C) Calculate MP_L and MP_K ?
- D) Determine the factor intensity of the production process? And why?
- E) State the returns to scale of the production process?

9) Assume $Q = -L^3 + 15L^2 + 10L$, then find

- A) The maximum AP_L ?
- B) The maximum MP_L ?
- C) The maximum TP_L ?
- D) The stages of production?

10) Suppose Arba Minch textile factory is facing the following production function of fixed supply of machineries (capital) and variable input (labor).

Machineries (in number)	Labor (in work-hour)	TP	AP	MP	Stage of production
10	0	0			
10	1	2			
10	2	5			
10	3	9			
10	4	12			
10	5	14			
10	6	15			
10	7	15			
10	8	14			
10	9	12			

- a) Calculate the corresponding values of AP_L and MP_L ?
- b) Draw curves for TP, AP and MP of labor?
- c) Identify the three stages of production and show their tabular and graphical justifications?
- d) Indicate the point (unit level of labor) where the LDNR starts to operate?

CHAPTER THREE

THEORY OF COST

Dear distance learner! In this unit, you will study the meaning and behaviors of costs of production, the relationship between production (output) and costs (i.e. cost function both in the short run and long run).

After successful completion of this unit, you will be able to:

- Explain different ways of measuring private costs, i.e. economic costs vs. accounting costs.
- Define the meaning and nature of cost functions both in the short run and long run.
- The distinction between short run and long run cost.
- Explain the relationship between short run production function and short run cost function.
- State how learning and experience affects the costs of production.
- The tradition theory of cost.

3.1. Introduction to Theory of Cost

 **Dear distance learner! State the definition production cost with your own words?**

Dear distance learner! The concepts of production and cost are inseparable facts. A production process in its pursue to secure profits will not exist without incurring the related costs. And the existence of costs without production or any addition to the total output will be of no economic meaning. Cost of production generally stands for the monetary outlays associated with production activity or it is the total expenditures and sacrifices made in the entire process of production and distribution of goods and services. In general, the cost of everything that is used up in the process of production is what we call the *cost of production*.

Cost functions are derived functions. They are derived from the production function, which describes the available efficient methods of production at any one time.

Economic theory distinguishes between short-run and long-run costs. Short-run costs are the costs over a period during which some factors of production (usually capital equipment and

management) are fixed. The long-run costs are costs over a period long enough to permit the change of all factors of production. In the long-run all factors become variable.

Both in the short-run and in the long-run, total cost is a multivariable function, that is, total cost is determined by many factors. Symbolically long-run cost function can be written as

$$C = f(X, T, P_f)$$

And the short-run cost function can be written as

$$C = f(X, T, P_f, K)$$

Where C = Total Cost, X = Output, T = Technology, P_f = Prices of factors, K = Fixed factor(s).

Based on the above facts, **costs** are defined as the monetary values of inputs used in production of items.

3.2. Types of Costs

A) *Explicit Vs Implicit costs*

Explicit costs: these are the *actual monetary payments* or **cash outlays** that business firms make to outsiders who are suppliers of inputs or resources to them. For example the rewards of labor, land, capital are all costs for a business firm employing them in certain production process. In addition, there are other payments made for other raw materials, fuel, transport, power and the like are all costs to a firm. Such costs are usually termed as *accounting costs*. Thus, **accounting cost** refers to the cost of purchased inputs only and this is the explicit cost paid “out of pocket.”

Implicit costs:- costs standing for the *values* of **non-purchased resources** owned and used by firms in their own production activities are said to be *implicit costs*. There are costs of firms owned and self-employed resources in carrying activities like the salary of an owner-manager or the estimated rent of a building that belongs to the owner of a firm and etc. The values of these self-owned resources should be estimated from what they could earn in their best alternative use.

$\text{Explicit costs} + \text{Implicit costs} = \text{Economic costs (opportunity costs)}$

B) Economic or Opportunity cost

The opportunity cost of a good or service is the value of the best alternative that is forgone in order to produce a good or undertake the service. These costs are also called as ***economic costs*** for it includes both explicit costs (costs involving actual payments) and implicit costs (the benefits that would have resulted from choosing the sacrificed alternatives but do not involve direct payments).

Economic Vs accounting profits

It is clear that costs and profits are inseparable concepts of business. Here the main insight is to understand the cost treatment differences and its consequence in profit analysis of business activities.

The term profit refers to the difference between total revenue and total cost. But economists and accountants define it differently for they treat costs differently. Economists define costs in terms of opportunity costs and they include implicit costs in profit calculations. Thus,

$$\text{Economic profit} = \text{Total revenue} - (\text{implicit} + \text{explicit costs})$$

As the economic profit becomes zero, it means that the activity is earning the same profit as the next best alternative use of the employed resources because it is total revenue less opportunity cost.

Accounting profit, on the other hand, would be the difference b/n total revenue and accounting cost. Thus,

$$\text{Accounting profit} = \text{Total revenue} - \text{explicit costs}$$

C) Social Vs Private Costs

Social costs: are costs which a society bears on account of production of a commodity. Social costs include both private and the extra cost. Extra cost includes:

- i) The cost of resources for which the firm is not compelled to a price e.g. atmosphere, rivers, lakes, roads and drainage systems.
- ii) The cost in the form of disutility created through air & water and noise pollution etc.

Private costs: are costs which are actually incurred or provided for by an individual or a firm on the purchases of goods and services from the market. For a firm all the actual costs both explicit and implicit are private cost in the sense that the firm must compensate the resource owner in order to acquire the right to use the resource.

D) Fixed Vs Variable costs

Fixed costs (FC): are those costs that do not vary as the firm changes the level of output. These costs are costs that are always incurred even if the firm does not produce anything. These are also costs of fixed inputs. E.g. rents on leased properties, interest on borrowed funds, the wear and tear of machineries, cost of administrative staff and etc.

Variable costs (VC): are those costs of production that directly vary with the level of output of the firm. These are also costs of variable inputs. When output is zero variable costs are also zero. But as the firm expands its output these costs tend to rise. Therefore, can be expressed as a function of output (Q) i.e. $VC = f(Q)$

? *Dear distance learner! Based on the above explanations of types of costs please answer the following questions*

- i) Consider a barber in your locality. What are the explicit and implicit costs that the barber incurs to provide the service?*
- ii) What are the main differences between accounting and economic ways of measuring costs? Which one do you believe is more appreciate? Why?*
- iii) Explain the distinction between social and private costs of production*

3.3. Theory of Cost in the Short-Run

? **Dear distance learner! What do we mean by short run and long run in economics?**

? **Dear distance learner! Differentiate between TVC and TFC, and give at least three examples of each.**

Like short-run production, the short-run cost is a period during which there is at least one variable cost and at least one fixed cost in the process of production. Normally, the cost of labor considered as a variable cost and the cost of capital considered as a fixed cost. In the short-run,

costs constitute both ‘variable costs’ and ‘fixed costs’. The nature and behavior of different types of short run costs are examined and discussed below with the help of the following table and graphical presentation.

Table 3.1: Short-run costs (in Birr)

Quantity	TFC	TVC	TC	AFC	AVC	AC	MC
0	100	0	100	-	-	-	-
1	100	50	150	100	50	150	50
2	100	90	190	50	45	95	40
3	100	120	220	33.33	40	73.33	30
4	100	140	240	25	35	60	20
5	100	150	250	20	30	50	10
6	100	170	270	16.67	28.33	45	20
7	100	200	300	14.29	28.57	42.86	30
8	100	240	340	12.50	30	42.50	40
9	100	290	390	11.11	32.22	43.33	50
10	100	360	460	10	36	46	70

A) Total Fixed Cost (TFC): is constant through the period i.e. 100 Birr

B) Total Variable Cost (TVC): is zero when output is zero and rises as output rises but at varying rates. First at a decreasing rate and then at an increasing rate.

C) Total Cost (TC): is the aggregate money expenditure on the inputs used to produce a given level of output. It is 100 when output zero and after this it follows the same pattern as TVC but differ only in amount as total cost is the sum of TFC and TVC.

$TC = TFC + TVC$ But, in the long-run since there is no fixed cost, total cost is equal to total variable cost only (i.e. $TC=TVC$)

D) Average Fixed Cost (AFC): it is the ratio of TFC over total quantity (output). i.e. $AFC = \frac{TFC}{Q}$. TFC is constant, due to this reason AFC falls continuously as output increases.

E) Average Variable Cost (AVC): is the ratio of TVC over total quantity (output). i.e. $AVC = \frac{TVC}{Q}$

First it declines then reaches its minimum at 6 unit of output and then rises as output increases.

F) Average Cost (AC): this is the total cost per unit output and is calculated by dividing the total cost by quantity produced. This means, $AC = \frac{TC}{Q}$. It can also be separated into two parts, like Average Variable Cost (AVC) and Average Fixed Cost (AFC).

$$\text{Thus, } AC = \frac{TFC}{Q} + \frac{TVC}{Q}; \text{ } AFC = \frac{TFC}{Q} \text{ \& } AVC = \frac{TVC}{Q} \text{ then, } AC = AFC + AVC$$

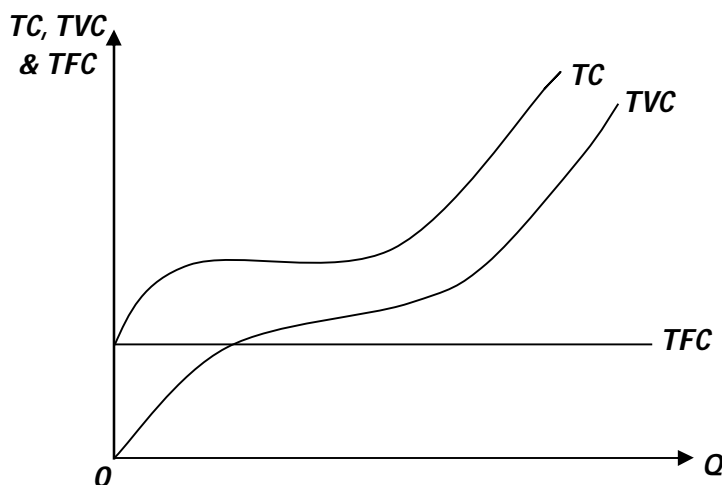
AC like AVC, initially decreases as quantity increases, reaches its minimum at 42.50 when the firm produces 8 units of output and then increases. Note that both AVC & AC curves have U- shape and AC reaches its minimum after AVC does.

G) Marginal Cost (MC): is the extra or additional total cost that results from producing one more unit of output or it is the change in total cost resulting from a percentage change in output i.e. $MC = \frac{\Delta TC}{\Delta Q}$ or $MC = \frac{\Delta TFC}{\Delta Q} + \frac{\Delta TVC}{\Delta Q}$

$$\text{Or } MC = \frac{\Delta TVC}{\Delta Q}, \text{ when } \Delta TFC = 0 \text{ (in the short run)}$$

It also initially falls, reaches its minimum at birr 10 when the firm produces 5 units of output and then rises. It reaches minimum before AVC & AC curves do. It is also a U-shaped curve. MC is the slope of TC curve (which is of course the same as the slope of the TVC)

Graphical presentation of short-run costs



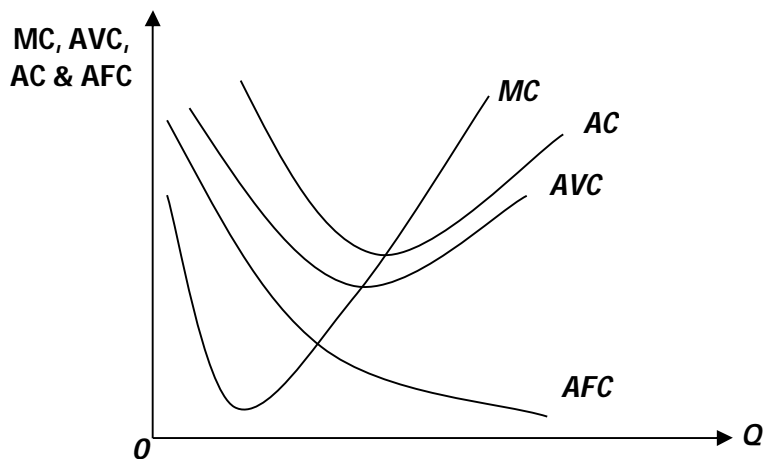


Fig 3.1 Short-run costs

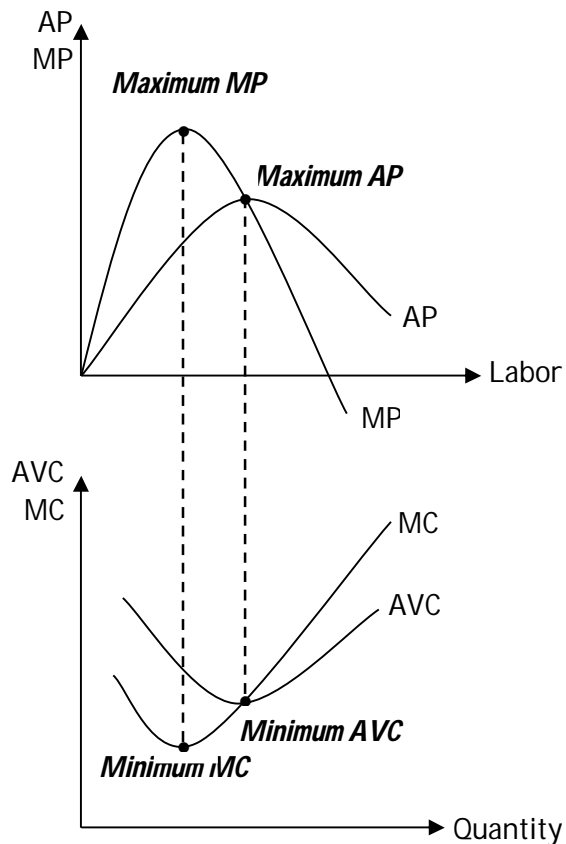
Now, note the following points from the diagram:

- ☞ For the output range where MC curve lies below the ATC curve, the ATC curve is falling. The ATC curve is rising for the output range where MC curve is above the ATC curve.
- ☞ For the output range where MC curve lies below the AVC curve, the AVC curve is falling. The AVC curve is rising for the output range where MC curve is above the AVC curve.
- ☞ The MC curve cuts both the ATC and AVC at their minimum points, while it is rising.
- ☞ The ATC is above the AVC for all output levels because the ATC is the sum of AVC&AFC.
- ☞ The gap between ATC and AVC is getting smaller and smaller for the reason that the AFC continuously decreases with the increasing output.
- ☞ The MC, AC, AVC curves are U-shaped due to the law of diminishing marginal returns.

*** The Relationship between Production and Cost**

There is an inverse relationship between AVC and AP: MC and MP. Now look at the following graph to understand the relationships in detail.

The MC curve and AVC curve are the mirror reflections of the MP and AP curves respectively.



The link between Production and Cost:

- ✓ When MP increase, MC decrease
- ✓ When MP decrease, MC increase
- ✓ When MP at its maximum, MC at its minimum
- ✓ When AP increase, AVC decrease
- ✓ When AP decrease, AVC increase
- ✓ When AP at its maximum, AVC at its minimum
- ✓ When $MC=AVC$, $MP=AP$

Therefore,

- ✓ MP is the mirror of MC
- ✓ AP is the mirror of AVC

Fig 3.2 The Link between Production and Cost

For the output level where MP is above AP, the MC is below AVC. For the output level where MP is below AP, the MC is above AVC. And for the output level where MP is equal to AP, the MC is equal to AVC. MP is equal to AP when AP is at its maximum point and hence MC equals AVC when AVC is at its minimum.

3.4. Theory of Cost in the Long-Run

Dear distance learner! The fundamental difference between the short-run and the long-run cost is that, in the short-run some costs are fixed where as in the long-run all costs become variable. It implies that in the long-run firms can hire more of both labor and capital.

In the long-run cost firm can control output and costs not only by varying the intensity of operating of a given plant but also by varying the size and the number of plants. Here the relationship is between changing size of the firm and outputs.

In the long-run there is no fixed input, therefore we didn't give attention to fixed cost. So, the total cost is equal to total variable cost and *the average cost is*: $AC = \frac{TC}{Q} = \frac{TVC}{Q} = AVC$

Since long-run is the sum of short-run, long-run cost curves would be composed of series of short-run cost curves. Now we shall derive long-run cost curves and study the relationship between cost and output.

🚧 *Long –Run Average Cost (LAC) Curve*

The derivation of the LAC has been lustrated in fig 4.3 below. As it is shown in the figure, there are three SAC (short-run average cost) curves corresponding to the three different plant size (small, medium, large size) each particular plant size generates its own short-run average total cost curve i.e. small size: SAC₁, medium size: SAC₂, and large size: SAC₃.

The AC of the first plant minimum cost is Q₁C₁. The AC of the second plant is lower than that of the first and its minimum cost is Q₂C₂ which is lower than Q₁C₁ due to economies of scale since the second plant is added (i.e. plant size increased). This happens because the larger plant size makes possible specialization and the availability of capital per worker increases and productivity of labor increases. However, when the third plant is brought in, diseconomies of scale happened because management becomes highly complex, managers are overworked and decision making process becomes less efficient.

The long-run average cost curve can now be drawn by drawn by joining the falling part of the SAC curves for points to the left of the minimum point of the SAC₂; the rising part of the SAC curves for points to the right of the minimum points of the SAC₂, and at minimum of SAC₂ curve. This long-run average cost curve is also called '*Envelope*'/ '*Planning*' curve.

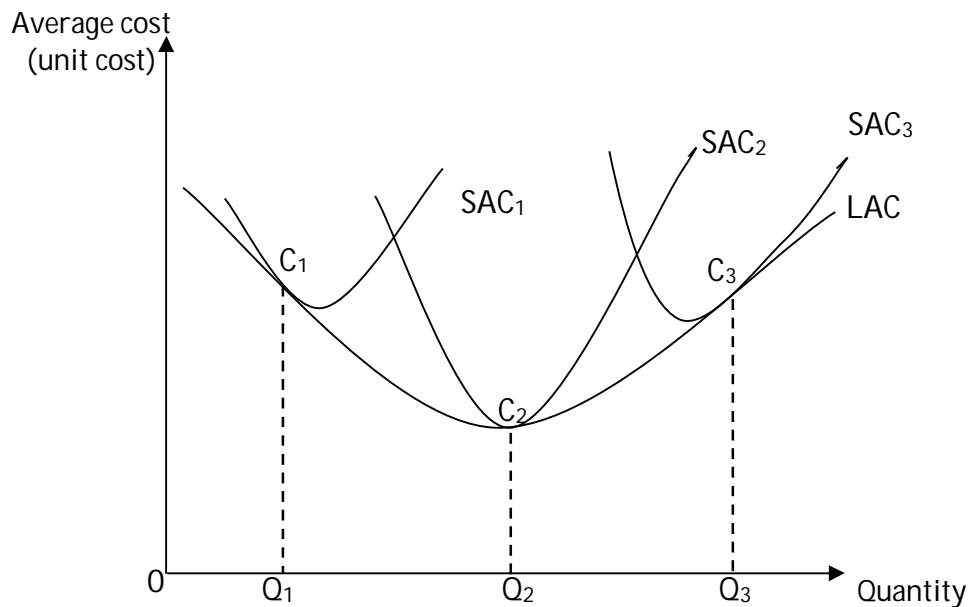


Fig 3.3 Derivation of Long-run Average Cost

As you can see in the figure 3.3, output Q_2 is the optimum as at this point LAC is minimum (which equals with the second plant i.e. medium size plant with minimum short-run average cost). This is because; in this plant all possible economies of scales are fully exploited. If the plant increase further than this optimum size (i.e. large size plant with SAC_3) diseconomies of scale will be created.

Chapter- Three: Review Questions

Part I: Choose the best answer from the given alternatives

- 1) Which one of the following is an implicit cost?
 - A) The price of a plane
 - B) Ticket to a football match
 - C) Time spent in line buying tickets
 - D) Rent payment for an apartment
 - E) None of the above

Consider a firm has the following costs for the short-run production of different quantities of a good:

Quantity produced(Q) (in units)	0	1	20	40	60	80	100
Total cost (C) (in Birr)	27	30	40	60	80	130	220

Answer questions 2-4 based on the above table:

- 2) The marginal cost of producing 80 units is,
A) 1.2875 B) 1.625 C) 2.5 D) 4.5 E) None of the above
- 3) The fixed cost of production is,
A) 30 B) 3 C) 220 D) 27 E) None of the above
- 4) The average variable cost when 40 units are produced is,
A) 0.725 B) 1.5 C) 33 D) 0.825 E) None of the above
- 5) Which of the following is **false**?
A) ATC always above the AVC
B) With the increasing output, ATC & AVC are getting closer.
C) TC change only due to the change in TVC
D) AFC forming a rectangular hyperbola
E) None of the above
- 6) The value of resources that belong to the owner of the firm that are employed in the production but they are not included in the cash flow of the company are:
A) Private cost D) Accounting cost
B) Social cost E) Implicit cost
C) Economic cost
- 7) All the following are **true except one** if the Short run MC curve equal to short run AC curve, equal to long run MC curve, and equal to long run AC curve
A) Long run full capacity production
B) The unit cost of production is minimum
C) The firm have an economies of scale advantage
D) The inflection point of economies of advantage
E) None of the above

Part II: Give the appropriate answer for the following questions

- 1) Analyze the relationship between production and cost using the relevant tool of analysis?
- 2) As a matter of cumulative experience with production the firm's marginal and average costs of producing a given output decreases because of certain reasons. Identify and give description of four reasons that contributes for the above mentioned idea.
- 3) Explain the scenarios behind the "U" shaped curves of the traditional short-run curves of cost.
- 4) Consider a barber in your locality. What are the explicit and implicit costs that the barber incurs to provide the service?
- 5) Discuss how long run average cost change due to economic of scale and learning scale.
- 6) Assume the total cost function is: $TC = 10 + 6Q - 0.9Q^2 + 0.05Q^3$, then find
 - A) The AFC & AVC function?
 - B) The Minimum AVC?
 - C) The Minimum AC?
 - D) The Minimum MC?

CHAPTER FOUR

PERFECT COMPETITION

Dear distance learner! In this chapter, we shall try to see how a given firm operating in a perfectly competitive market determines the profit maximizing level of output and price, and how equilibrium market price and level of output are determined in a perfectly competitive market. Our discussion starts with giving a brief description about perfect competition.

After successful completion of this unit, you will be able to:

- Characterize a perfectly competitive market.
- Know how a perfectly competitive firm determines the profit maximizing output both in the long run and short run.
- Derive the short run supply schedule of an individual firm and industry.
- Explain when a perfectly competitive firm should decide to shut down.
- Explain how a perfect competition results in efficient allocation of resources.

4.1. Introduction: Definition and Basic Assumptions of Perfect Competition



Dear distance learner! How do you define a perfectly competitive market in your own words? Is there a real competition among firms operating in such markets?

Perfect Competition is a market structure characterized by a complete absence of rivalry among the individual firms as there are so many firms in the industry so that no personal recognition among the individual firms in the market.

Basic Assumptions of perfectly competitive market

Perfectly competitive market is characterized by the following assumptions:

A) Large number of sellers and buyers

The industry or market includes a large number of firms; so that on the supply side, each firm has small share relative to the total market, in that it cannot affect market price by changing its output supplied. The buyers are also numerous; so that on the demand side, individuals influence on the total market is very small. This means that each buyer purchases a small portion of the total market demand that he cannot obtain special consideration of price reduction from the seller.

B) Homogeneous product

The industry is defined as a group of firms producing a homogeneous (standardized) product. The product of each seller is identical to the product of every other seller. There is no way in which a buyer could differentiate among the products of different firms. If the products were differentiated the firm would have some discretion in setting its price. The assumption of large number of sellers and product homogeneity imply that the individual firm in pure competition is a **price-taker**. Its demand curve is infinitely elastic, indicating that the firm can sell any amount of output at the prevailing market price. The demand curve of the individual firm is also its average revenue and its marginal revenue curve.

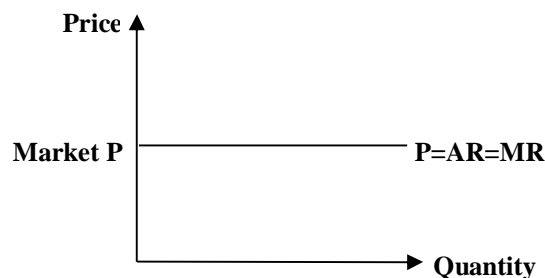


Fig 4.1 Firm's demand curve

C) Perfect knowledge (information)

It is assumed that all sellers and buyers have complete knowledge of the conditions of the market. Each buyer and seller has full information about price, quality of the product and other characteristics of the product. Information is free and costless. This knowledge refers not only to the prevailing conditions in the current period but in all future periods as well. Under these conditions uncertainty about future developments in the market is ruled out.

D) Free entry and exit of firms


There is no legal or market barrier to entry or exit from the industry. Firms have freedom of movement in and out of the industry.

E) No government regulation

There is no government intervention in the market (tariffs, subsidies, rationing of production and so on are ruled out).

F) Perfect mobility of factors of production

The factors of production are free to move from one firm to another throughout the economy. It is also assumed that workers can move between different jobs, which imply that skills can be learned easily. Finally, raw materials and other factors are not monopolized and labor is not unionized. In short, there is perfect competition in the markets of factors of production. In addition to this, there is no collusion among the buyers or sellers. The trade and manufacturing associations do not exist in the market.


 ***Dear distance learner! Based on the above concepts please answer the following questions***

- i) Is promotion activity (such as advertising the product) necessary for a firm operating under perfect competition? Why or why not?***
- ii) What are the assumptions used to construct the model of perfect competition?***
- iii) Explain why the demand curve of an individual firm operating in a perfectly competitive market is perfectly elastic. What will happen to the quantity of sales of an individual firm if he raises the price above the market price?***

4.2. Short-Run Equilibrium of the Firm and the Industry

In order to determine the equilibrium of the industry we need to derive the market supply. This requires the determination of the supply of the individual firms, since the market supply is the sum of the supply of all the firms in the industry.

4.2.1. Short-Run Equilibrium of the Firm

 ***Dear distance learner! What do we mean when we say the firm is in equilibrium?***

Profit maximization is the popular objective of business firms. Thus the firm is said to be in equilibrium when it realizes maximum profit or minimum losses. There are two approaches to determine the profit maximizing (equilibrium) level of output; ***Total approach and marginal approach.***

A) Total Approach

In this approach the firm is in equilibrium when it maximizes its profit (π), defined as the difference between total cost (TC) and total revenue (TR). $\Pi = TR - TC$

Figure 4.2 shows the total revenue and total cost curves of the firm in a perfectly competitive market. The total revenue curve is a straight line through the origin; showing that the price is constant at all levels of output. Because the firm is price taker & can sell any amount of output at the ongoing market price, with its TR increases proportionately with its sales. The slope of the TR curve is the marginal revenue. It is constant and is equal to the prevailing market price, since all units are sold at the same price. Thus in pure competition; $MR=AR=P$

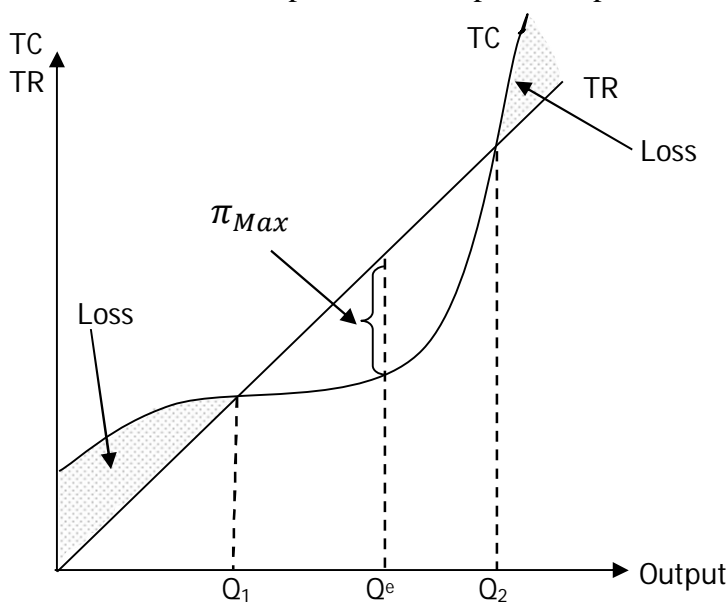


Fig 4.2 Total Approach

The firm maximizes its profit at the output Q^e , where the distance between the total revenue & total cost curves is the highest. At output levels smaller than Q_1 and larger than Q_2 the firm has losses.

B) Marginal Approach

When we use the marginal approach, two conditions should fulfill. The first order condition for maximization of a function is that its first derivative would be equal to zero.

$$\text{i.e. } \frac{d\pi}{dQ} = \frac{dTR}{dQ} - \frac{dTC}{dQ} = 0$$

i.e. $\frac{dTR}{dQ} = \frac{dTC}{dQ} \rightarrow MR = MC$ (Slope of TR & TC, respectively)

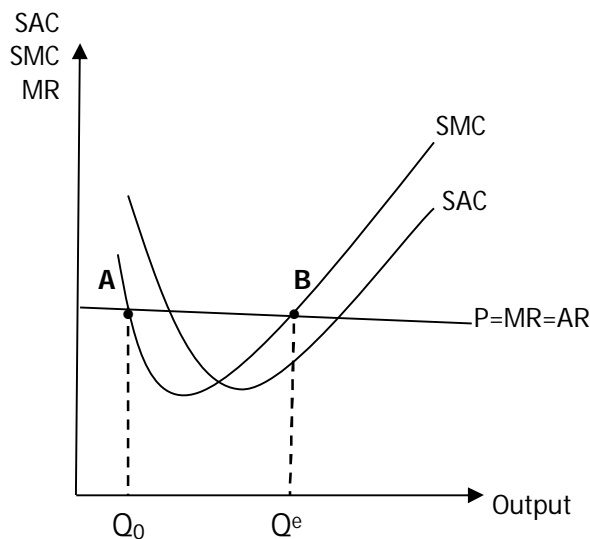
The second order condition for maximization of profit requires that the second order derivative of the function must be negative.

i.e. $\frac{d^2\pi}{dQ^2} = \frac{d^2TR}{dQ^2} - \frac{d^2TC}{dQ^2} < 0$

i.e. $\frac{d^2TR}{dQ^2} < \frac{d^2TC}{dQ^2} \rightarrow \text{Slope of MR} < \text{slope of MC}$.

As you know slope of the MR=0 in the perfect competition since it has horizontal demand curve. It should be noted that the MC positive. In summary the two conditions are:

- i) MC=MR
- ii) (Slope of MC) > (Slope of MR) → MC is rising so that it intersects the MR curve from below.

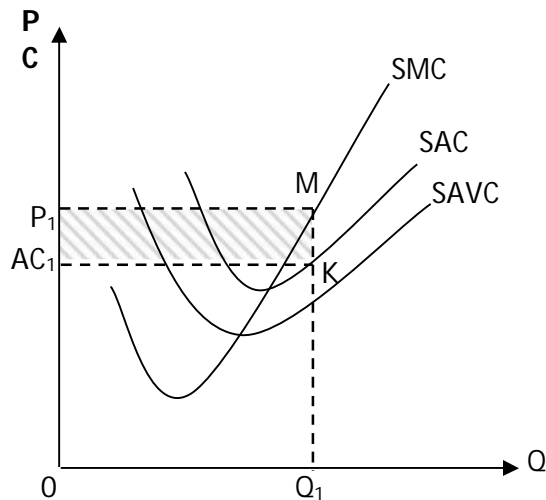


Therefore, Q^e is the profit maximizing output level.

Fig 4.3 Marginal Approach

❖ Now let us go through the following five different cases of the optimum price-output combinations.

- 1) When $P > AC$ at the optimal level: (E.g. P_1), revenue per unit (Average revenue = P_1) is greater than cost per unit (AC_1). As a result, the firm gets **Abnormal / Positive profit or Super-normal profit**.



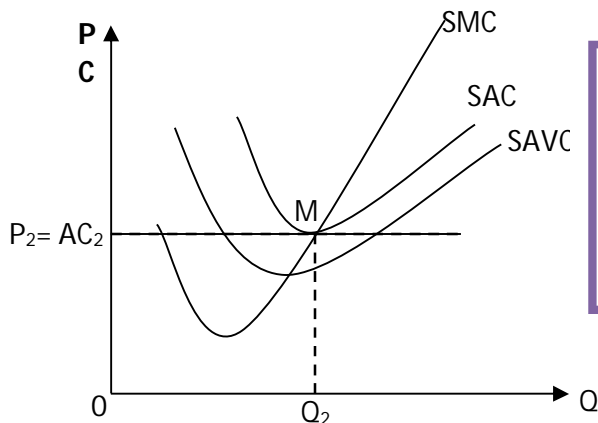
$$TR_1 = P_1 \cdot Q_1 = \text{area}(P_1MQ_1O)$$

$$TC_1 = AC_1 \cdot Q_1 = \text{area}(AC_1KQ_1O)$$

$$\text{Profit} = TR_1 - TC_1 = (P_1MKAC_1)$$

Fig 4.4

- 2) **When $P = AC$ at the optimal level:** (E.g. P_2), revenue per unit (Average revenue = P_2) is equal to cost per unit (AC_2). As a result, the firm gets **normal profit (zero economic profit)**. This is the case when the firm covers all of the economic costs of production, i.e. it covers both implicit and explicit costs; this point is also called **break – even point**, and P_2 is called the break – even price and Q_2 the break – even quantity.



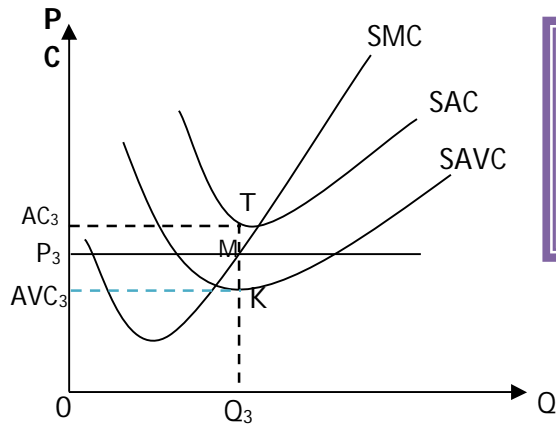
$$TR_2 = P_2Q_2 = \text{area}(P_2MQ_2O)$$

$$TC_2 = AC_2 \cdot Q_2 = \text{area}(AC_2MQ_2O) = \text{area}(P_2MQ_2O)$$

$$\text{Profit} = TR_2 - TC_2 = (P_2MQ_2O) - (P_2MQ_2O) = 0$$

Fig 4.5

- 3) **When the prevailing price is between the average cost and the average variable cost at the optimum level ($AVC < P < AC$),** the firm is said to be minimizing loss, because without production the firm has to incur the fixed cost amount but by producing the optimal output (Q_3) the firm loses less than the total fixed cost. In this case, the firm can cover a portion of its **total fixed cost** by producing the optimal output.



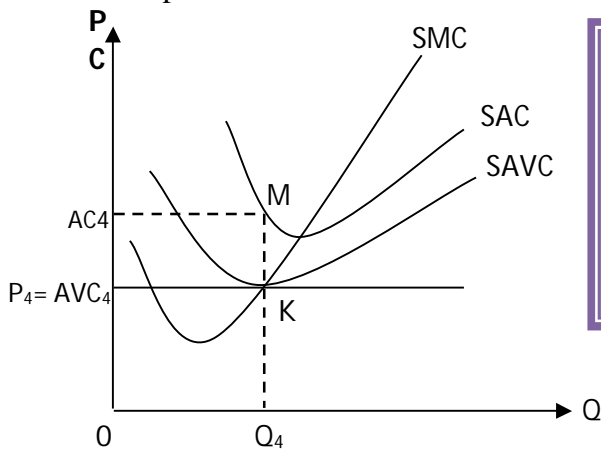
$$TR_3 = P_3 \cdot Q_3 = \text{area } (P_3 M Q_3 O)$$

$$TC_3 = AC_3 \cdot Q_3 = \text{area } (AC_3 T Q_3 O)$$

$$\text{Profit} = TR_3 - TC_3 = \text{area } (-AC_3 T M P_3) \rightarrow \text{(Loss)}$$

Fig 4.6

- 4) When the price (P_4) is determined by the forces of market demand and supply is equal to the minimum average variable cost ($P = \min.AVC$), at that level of output, the firm is indifferent between producing and not producing because what the firm incurs by producing the optimum level and shutting business is the same (that is, the amount of fixed costs). Hence, we call this point the *shutdown point* and the corresponding price and quantity are called the shut down price and quantity, respectively. Still we advise the firm to continue production for the reasons of *learning by doing*, i.e. the firm may through time be able to reduce the costs per unit.



$$TR_4 = P_4 \cdot Q_4 = (P_4 K Q_4 O)$$

$$TC_4 = AC_4 \cdot Q_4 = (AC_4 M Q_4 O)$$

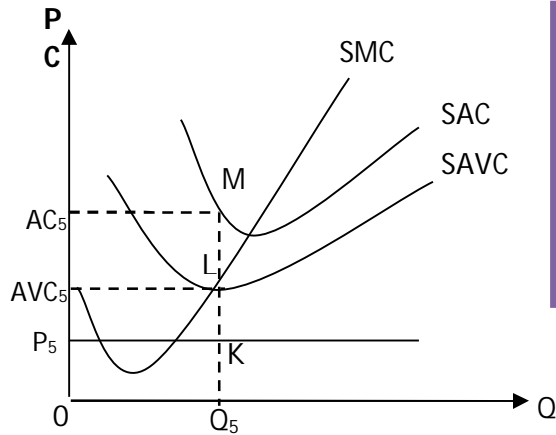
$$\text{Profit} = TR_4 - TC_4 = -AC_4 M K P_4 \rightarrow \text{(Loss)}$$

$$= -AFC \cdot Q_4 = -TFC$$

Fig 4.7

☞ In this case, the firm is able to cover fully its variable cost, but not its fixed costs.

- 5) Finally, when the price is below the minimum point of the AVC ($P < \min.AVC$) curve at the “optimum level”, we say the firm exits out of the market because the firm loses more than the total fixed costs if it decides to operate. Therefore, the firm incurs more by producing than shutting its business. Let’s see the outcome of producing at the “optimal level”.



$$\begin{aligned}
 TR_5 &= P_5 Q_5 = (P_5 K Q_5 O) \\
 TC_5 &= AC_5 Q_5 = (AC_5 M Q_5 O) \\
 \text{Profit} &= TR_5 - TC_5 = -AC_5 M K P_5 > TFC \text{ by} \\
 &\quad (AVC_5 L K P_5)
 \end{aligned}$$

Fig 4.8

☞ In this case, it is more economical to exit out of the market in the short run in order to save $(AVC_5 L K P_5)$ amount.

Numerical Example:

If the total cost function of a firm under perfectly competitive market is given by:

$$TC = 2Q^2 - 28Q + 100$$

(a) Find the optimum level of output and the corresponding profit when price of the product is Br. 20?

Solution: $MC = 4Q - 28$

$$P = MR = 20 \text{ Br.}$$

$$MC = MR = P \rightarrow 4Q - 28 = 20$$

$$. Q * = \underline{12 \text{ units}}$$

$$\Pi = TR - TC = 240 - 52 = 188 \text{ (maximum profit), where } TR = PQ$$

(b) If the total fixed cost has increased by Br. 100 and the price of the product is reduced to Br. 4 per unit. Then, what is the optimum production level and the firm's profit? If you are the management advisor for the firm, what do you suggest?

Answers $Q * = 8$

$$\begin{aligned}
 TC &= 2Q^2 - 28Q + 200 = 104 \text{ and } TR = 4 \times 8 = 32 \text{ then } \Pi = TR - TC = 32 - 104 \\
 &= -72
 \end{aligned}$$

⇒ Continue production in order to minimize loss, because loss is less than TFC (i. e. $72 < 200$)

Derivation of Short-run Supply Curve of the Firm

Dear distance learner! The supply curve of an individual firm is derived on the basis of its equilibrium output. The equilibrium output which is determined by the intersection of MR& MC curve is the optimum supply by a profit maximizing firm. To retain in the business and continue production, the firm must cover its SAVC. For this reason the price must be at least equals with SAVC i.e. P_1 . As shown in the figure below, the firm produces and supply different level of output with their respective price. But if the price decreases further to p_1 , the firm stops production and its supply will be zero. From this we can understand that the firm's supply curve is that the segment of the MC curve above the minimum of SAVC.

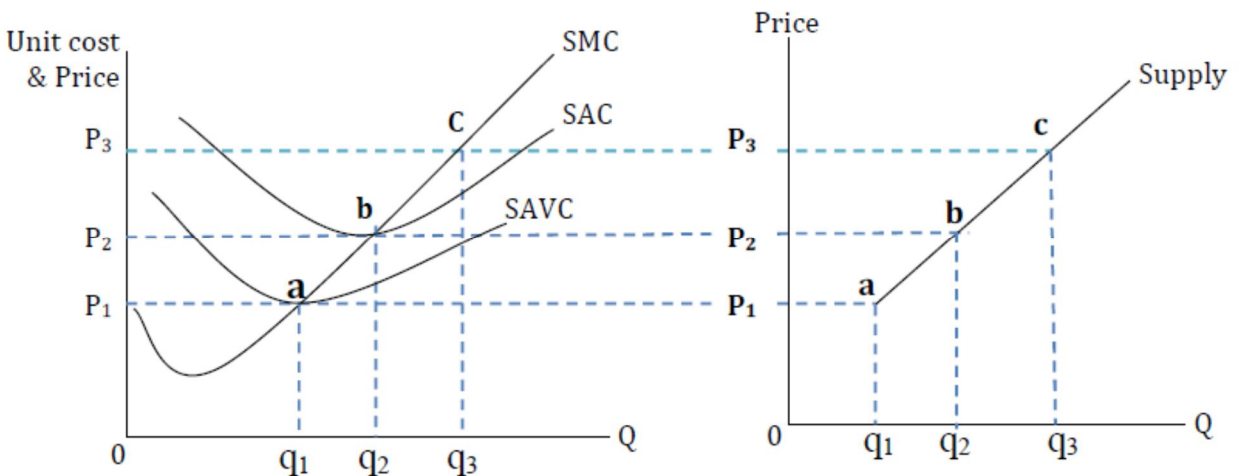


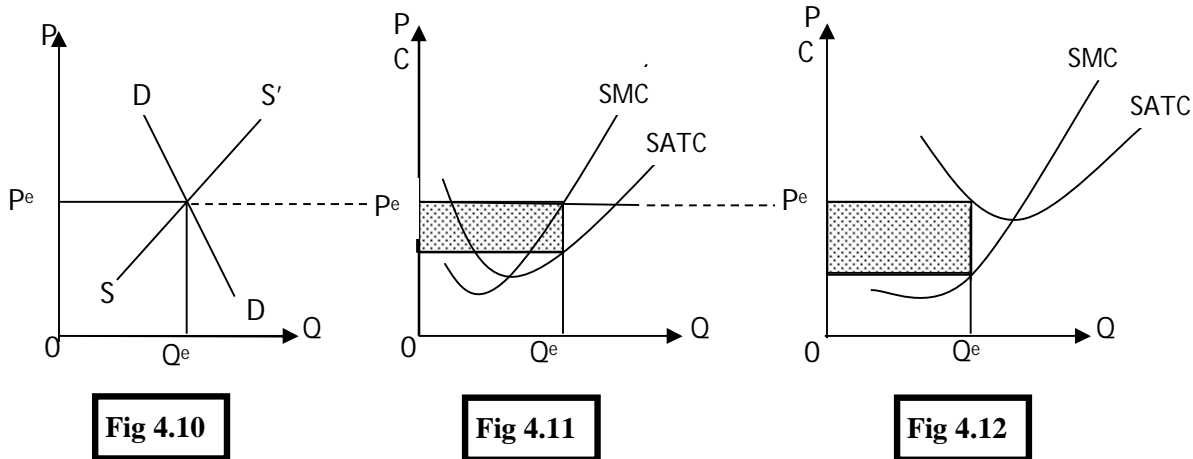
Fig 4.9 Derivation of Firms Supply Curve

Note, however, that this profit or loss making is a short run phenomenon where as in the long run all the firms earn only normal profit because a super normal profit will attract new entrants in to the market, substantially affecting the market supply and consequently the price. On the other hand, a firm will not operate making a loss since there is free exit out of the market.

4.2.2. Short-Run Equilibrium of the Industry

Given the market demand and the market supply, the industry is in equilibrium at that price which clears the market; i.e. at the price at which the quantity demanded is equal to the quantity supplied. In fig.4.10 the industry is in equilibrium at price P^e , at which the quantity demanded and supplied is Q^e . However, this will be short run equilibrium, if at the prevailing price firms are making excess profits fig. 4.11 or losses Fig. 4.12. In the long run, firms that make losses

and cannot readjust their plant will close down. Those that make excess profits will expand their capacity, while excess profits will also attract new firms into the industry. Entry, exit and readjustment of the remaining firms in the industry will lead to a long-run equilibrium in which firms will just be earning normal profits and there will be no entry or exit from the industry.



The supply of the industry in the short-run is the sum of the supply of the firm within the industry.

4.3. Long-Run Equilibrium of the Firm and the Industry

4.3.1. Long-Run Equilibrium of the Firm

The short-run by definition, is a period in which firms cost and revenue curves are given, firms cannot change their size as capital is fixed, existing firms cannot leave the industry, and new firms cannot enter the industry. By contrast, long run is a period in which these constraints are absent. Long-run permits change in technology and employment of both labor and capital i.e. firms can change their size, some of the existing firms may leave and new firms may enter the industry. In the long run supply curve not only shift right ward but also becomes more elastic.

Thus a firm is in equilibrium under perfect competition when marginal cost is equal to price (MR). But for the firm to be in the long run equilibrium, besides MC being equal to AC. This is because, if the Price is greater than average cost, the firm will earn more than normal profit. These super normal profits will attract other firms in to the industry. With the entry of new firms in the industry, the price of the product will decline as the result of the increase in the supply of the output and the cost will increase as a result of more competition for factors of production as the industry expands. The firms will enter to the industry until the price is equal to long run

average cost (LAC) so that all firms are earning only normal profit. If the price is below the average cost the firms in the industry incur losses. To avoid heavy losses, some firms leave the industry. This decrease the production and forces the price to stay at the average cost, so that the firms remaining in the industry earn normal profit.

It, therefore, follows that a perfectly competitive firm to be in the long-run equilibrium, the following conditions must be fulfilled.

1. Price (AR)= LMC=MR
2. Price =Average cost

Hence, in the long-run, the firm will be in equilibrium if; $P=AR=LMC=LAC=MR$, this condition can be illustrated with the help of the following graph.

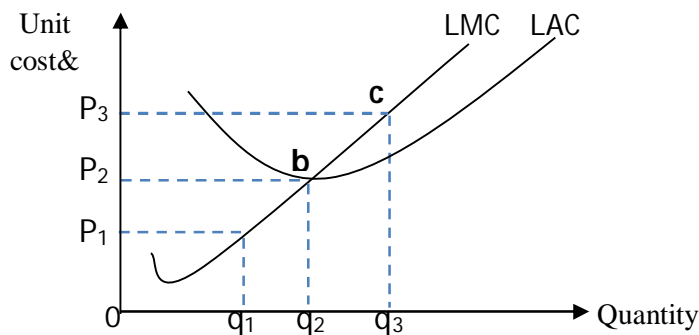


Fig 4.13 Long-run Equilibrium of the Firm

At price OP_3 , the firm is in equilibrium at point 'c' at output $0q_3$. The firm earns per unit abnormal profit of 'cb', as a result new firms enter the industry and increase production. The increase in production lowers down the price to OP_2 . If the price is OP_1 which is below LAC, firms will incur losses. In consequence, to avoid losses, the firms will leave the industry in the long run. This reduce supply in the market raising the price to OP_2 & equal LAC; where the firm makes normal profit and the LAC is tangent to the demand curve ($P_2 = MR_2 = AR_2 = DD_2$). So in the long run firm's supply will be the output level in which:

$$P = AR = MR = LMC = SMC = LAC = SAC$$

4.3.2. Long- Run Equilibrium of the Industry

The industry is in the long run equilibrium when a price is reached at which all firms are in equilibrium (producing at the minimum point of their LAC curve and making just normal profits). Under these conditions, there is no further entry or exit of firms in the industry.

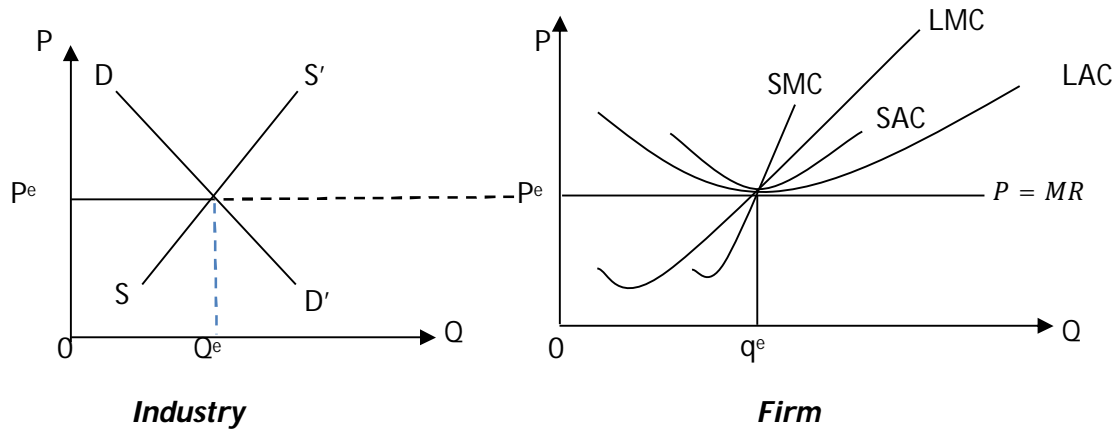


Fig 4.14 Long-run Equilibrium of the Industry

At the price P^e the industry is in equilibrium because profits are normal and all costs are covered so that there is no incentive for entry or exit. That the firms earn just normal profit (neither excess profit nor losses) is shown by the equality

$$P = MR = LMC = SMC = LAC = SAC$$

This is observed at the minimum point of the LAC curve. With all firms in the industry being in equilibrium and with no entry or exit, the industry supply remains stable, and, given the market demand (DD' in figure 5.14), the price P^e is a long-run equilibrium price.

Chapter-Four: Review Questions

Part I: Choose the best answer from the given alternatives

- 1) One of the following is **true** about short-run equilibrium of the perfect competitive firm
 - A) The second order derivative would be equal to zero at equilibrium
 - B) Slope of MC is less than the slope of MR
 - C) Total revenue is a convex to the origin
 - D) At equilibrium the firm will maximize its losses
 - E) None of the Above

- 2) Assume a profit-maximizing firm in perfect competition industries producing soft. The firm sells its soft at the prevailing market price, why? Due to the assumption of
- A) Large number of sellers and buyers, and producing similar product
 - B) Producing homogenous product and no individuals influence on the market
 - C) Cost less information and no government regulation
 - D) Free entry and exit of firms
 - E) Perfect mobility of factors of production
- 3) **Except one**, all of the following are **true** about the long-run equilibrium of perfectly competitive firms
- A) Firms will leave the industry to avoid normal profits
 - B) Long-run average cost curve is tangent to the demand curve
 - C) Firms can change their plant size
 - D) Firms earn a normal profit
 - E) Price and average cost of the firm are equal due to free entry
- 4) One of the following is **not** assumption of perfectly competitive market
- A) There is a personal recognition
 - B) Single buyer and sellers cannot affect the market price
 - C) Any amount of output sells at constant price
 - D) Consumers have no any room to differentiate the products of different firms
 - E) Government doesn't intervene in the market
- 5) Firms within perfectly competitive market may encounter one of the following in short run depending on average cost:
- A) Excess profit
 - B) Normal profit
 - C) Negative profit
 - D) All of the above
 - E) Unknown
- 6) In a perfectly competitive market, which one of the following is **false** when the prevailing price is between the average cost and the average variable cost at the optimum level in the short-run?
- A) The firm loses less than the total fixed cost

- B) The firm can cover some portions of its total fixed cost
 - C) It is more economical to exit out of the market
 - D) The firm can cover all of its total variable cost
 - E) Without production the firm incur the fixed cost
- 7) Suppose a profit-maximizing firm in a competitive market produces gasoline. Which one of the following is **false** when the market price for gasoline falls below the minimum of its average total cost, but still lies above the minimum of average variable cost?
- A) The firm loses less than the total fixed cost
 - B) The firm can cover a portions of its total fixed cost
 - C) It is more economical to exit out of the market
 - D) The firm can cover all of its variable costs
 - E) The firm is said to be minimizing loss
- 8) In a perfectly competitive market, which one of the following is **true** when the prevailing price is at the minimum point of the average variable cost in the short-run?
- A) It is more economical to exit out of the market
 - B) The firm can cover some portions of its total fixed cost
 - C) The firm can cover all of its total variable cost
 - D) The firm loses is equal to the total fixed cost
 - E) It is a break-even point of production
- 9) In short run, supply curve of perfectly competitive firm is
- A) The segment of MC curve above its minimum point
 - B) The segment of AVC curve above its minimum point
 - C) The segment of MC curve above the minimum point of AVC curve
 - D) The segment of AC curve above its minimum point
 - E) The segment of AC curve above the minimum point of MC curve

Part II: Work out –Show all the necessary steps

- 1) If the total cost function of a firm under perfectly competitive market is given by:

$$TC = 3Q^2 + Q + 90. \text{ Then,}$$

- a) Find the optimum level of output and the corresponding profit when the price of the product is Birr **25**? (3 pts)
- b) If you are the advisor of the firm, what do you suggest? And why? (2 pts)

CHAPTER FIVE

PURE MONOPOLY

Introduction

Dear learner! In this chapter we would like to instigate you with some of the basic concepts and principles in the pure monopoly market structure. We start with monopoly market definition, discussing its characteristics and broaden our scope on gradual basis towards the discussion of short run and long run equilibrium of the market. But, we need to keep our mind cool as to the depth of our discussion in this chapter as well.

Chapter objectives: Generally speaking, the learner will be expected to get familiar with the following key issues:

- What a monopoly market is all about;
- The main marketing principles that are accomplished while working on monopoly market and
- Social cost of monopoly market

5.1. Characteristics and Source of Monopoly

Definition: A monopoly is a market that has only one seller, but many buyers. A monopoly is the polar opposite of perfect competition. As the sole producer of a product, a monopolist is in a unique position. In a perfectly competitive market, there are enough sellers and buyers of a good so that no single seller or buyer can affect its price. Price is determined by the market forces of supply and demand. Individual firms take the market price as a given in deciding how much to buy. If the monopolist decides to raise the price of the product, it need not worry about competitors who, by charging a lower price, would capture a larger share of the market at the monopolist's expense. The monopolist is the market and has complete control over the amount of output offered for sale.

Dear learner! The following points are worth mentioning while discussing on the inherent characteristics of a monopoly market structure in a given area.

▪ **Characteristics of Monopoly**


Dear learner! The following points are common and worth mentioning while discussing on the inherent characteristics of a monopoly market structure in a given area.


- i. **Single Seller:** It is a market structure in which the entire supply is controlled by one firm, which implies that the firm and industry are same.
- ii. **No clear substitutes:** there is no any close substitutes for the goods produced.
- iii. **The monopolist is price maker:** It does not a price, which is determined by the interaction of market demand and supply. In order to expand its sale, it decreases the price of a product.
- iv. **Entry Barrier:** Entry is blocked in such market structure. The barriers may be legal, financial and natural.
- v. **No Collusion and Competition:** Because there is only one firm there is no competition exists and no collusion among firms also.

▪ **Causes of Monopoly:**

1. Exclusive knowledge of technology.
2. Exclusive ownership/access to strategic raw materials needed for production.
3. Government Policies: Patent Rights.
4. Size of market:
5. Natural Monopolies: Electricity, Water etc.,

Dear learner, given the above characteristics of a monopoly market structure, let you reflect on your views on the following lines.

 *Define the monopoly market structure as a working concept in your day to day life. It would be appreciated if you substantiate your definition with real world examples.*

 *What do you think is the basic difference between perfect competition and monopoly market structures [in the context of microeconomics]?*

▪ **Demand and Revenue for a Monopoly**

Dear learner! The whole market supply is controlled by a single firm. In order to sell more output the firm reduces price and to increase price the firm reduces its output. Consequently, output and

price decisions are interdependent. So that increasing of one will result in a reduction of the other and vice versa. As a result, the demand curve of the monopoly is downward sloping.

Note: The monopoly firm faces the industry demand function which is negatively sloped.

Suppose the demand function of the monopoly is given by $Q = a - bP$.

$$\begin{aligned} \text{Solve for } p \quad P &= \frac{a}{b} - \frac{1}{b}Q \\ TR &= PQ \\ TR &= \left[\frac{a}{b} - \frac{1}{b}Q \right] Q \Rightarrow TR = \frac{a}{b}Q - \frac{1}{b}Q^2 \\ AR &= \frac{TR}{Q} \\ AR &= \frac{a}{b} - \frac{1}{b}Q \end{aligned}$$

At any level of output average revenue and price are the same.

$$MR = \frac{dTR}{dQ} = \frac{d\left[\frac{a}{b}Q - \frac{1}{b}Q^2\right]}{dQ} = \frac{a}{b} - \frac{2}{b}Q$$

Comparison of price and marginal revenue will result in having identical vertical intercepts, but marginal revenue is twice as steep as the inverse demand.

$$\text{From } TR = PQ \text{ and From } MR = \frac{dTR}{dQ} = P \frac{dQ}{dQ} + Q \frac{dP}{dQ} \quad \text{and} \quad MR = P + Q \frac{dP}{dQ}$$

$$P = MR - Q \frac{dP}{dQ} \text{ since } \frac{dP}{dQ} \text{ is negative. } \mathbf{P > MR}$$

P is always greater than MR. It is so because the firm has to reduce price for all the units of output to sell additional units of output.

Costs: It is similar to competitive firms. ATC, AVC, and MC curves are U shaped and AFC is rectangular hyperbola. The marginal cost curve is not the supply of the monopolist as in the case of pure competition.

5.2. Short-Run and long-Run Equilibrium

A. Short-Run Equilibrium

The monopolist maximizes his short run profit if the following two conditions are fulfilled.

1. The *marginal cost* is equal to the *marginal revenue*.
2. The slope of marginal cost is *greater than* the slope of the marginal revenue at the point of the intersection.

Proof: The monopolist aims at the maximization of his profit

$$\Pi = R - C$$

(a) *The first – order condition for maximum profit Π*

$$\frac{\partial \Pi}{\partial Q} = 0$$

$$\frac{\partial \Pi}{\partial Q} = \frac{\partial R}{\partial Q} - \frac{\partial C}{\partial Q} = 0 \quad \text{or}$$

$$\frac{\partial R}{\partial Q} = \frac{\partial C}{\partial Q}$$

That is $MR = MC$

The second – order condition for maximum profit

$$\frac{\partial^2 \Pi}{\partial Q^2} < 0$$

$$\frac{\partial^2 \Pi}{\partial Q^2} = \frac{\partial^2 R}{\partial Q^2} - \frac{\partial^2 C}{\partial Q^2} < 0$$

or
$$\frac{\partial^2 R}{\partial Q^2} < \frac{\partial^2 C}{\partial Q^2}$$

$$[\text{Slope of MR}] < [\text{Slope of MC}]$$

A Numerical Example:

Given the demand curve of the monopolist

$$Q = 50 - 0.5P \quad \text{and} \quad 50 - Q = 0.5P$$

Which may be solved for P,

$$P = 100 - 2Q$$

Given the cost function of the monopolist

$$C = 50 + 40Q$$

The goal of the monopolist is to maximize profit

$$\Pi = R - C$$

(i) We first find the MR

$$TR = QP = Q(100-2Q)$$

$$TR = 100Q - 2Q^2$$

$$MR = \frac{\partial R}{\partial Q} = 100 - 4Q$$

(ii) Next find the MC

$$TC = 50 + 40Q$$

$$MC = \frac{\partial TC}{\partial Q} = 40$$

(iii) Equate MR = MC

$$100 - 4Q = 40 \quad 100 - 40 = 4Q$$

$$60 = 4Q \quad Q = 60/4 = 15$$

(iv) The monopolist's price is found by substituting $Q = 15$ into the demand-price equation

$$P = 100 - 2Q = 70$$

(v) The profit is $\Pi = TR - TC$

$$= PQ - TC = 70(15) - [50 + 40(15)]$$

$$= 1050 - 650 = 400$$

This profit is maximum possible, since the second-order condition is satisfied:

(a) When $\frac{\partial^2 R}{\partial Q^2} < \frac{\partial^2 C}{\partial Q^2}$

$$\frac{\partial MC}{\partial Q} = \frac{\partial(40)}{\partial Q} = 0$$

(b) from $\frac{\partial MR}{\partial Q} = \frac{\partial(100-4Q)}{\partial Q} = -4$ we have $\frac{\partial^2 R}{\partial Q^2} = -4$, Clearly $-4 < 0$.

So we can say output level 15 maximizes profit; and hence it is optimal. Therefore, we can see that the classical condition for equilibrium of equating the marginal revenue and marginal cost remained intact, except that price is different from marginal revenue (unlike the case of perfect competition).

Graphically: The decision for the maximization of the monopolists profit is the equality of his MC and MR, provided that the marginal cost cuts the marginal revenue curve from below.

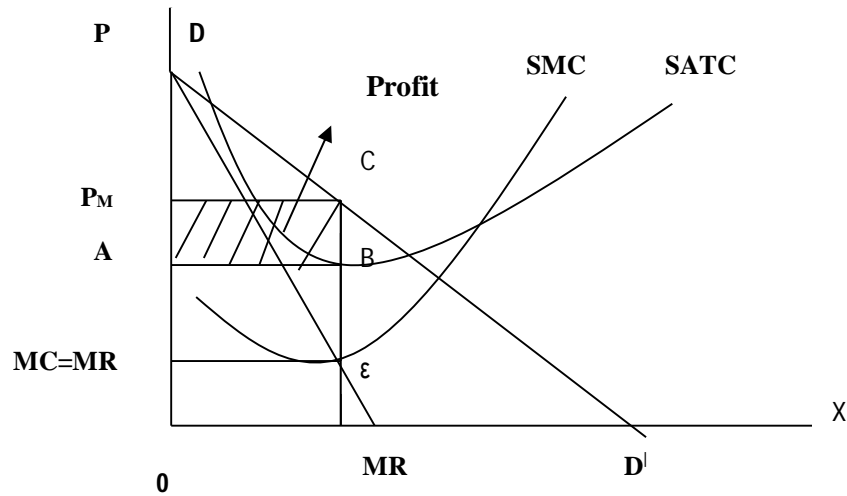


Fig 5.1: Short run Equilibrium of a Monopolist Firm

There is no unique supply curve for the monopolist derived from his MC, the same quantity may be offered at different prices depending on the price elasticity of demand. Graphically:

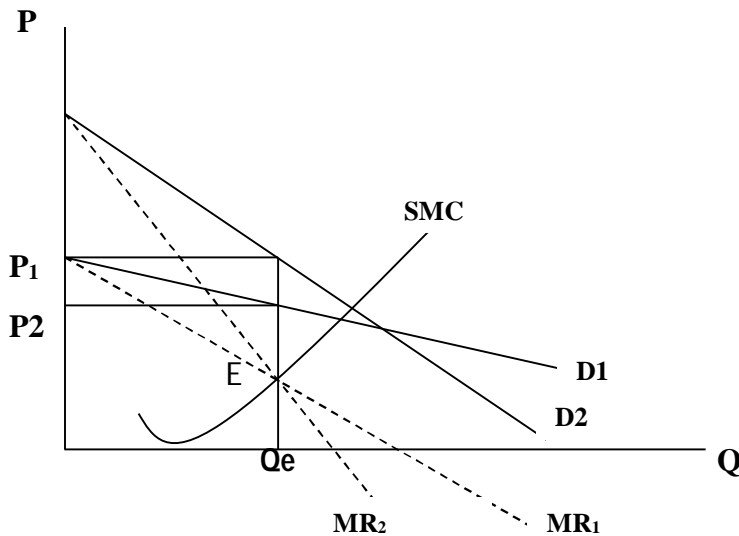


Fig 5.2: Price discrimination of a monopolist
 Q_e is sold at P_1 for some consumers and at P_2 for others.

Similarly, given the MC of the monopolist, various quantities may be supplied at any one price, depending on the market demand and the corresponding marginal revenue curve.

Graphically:

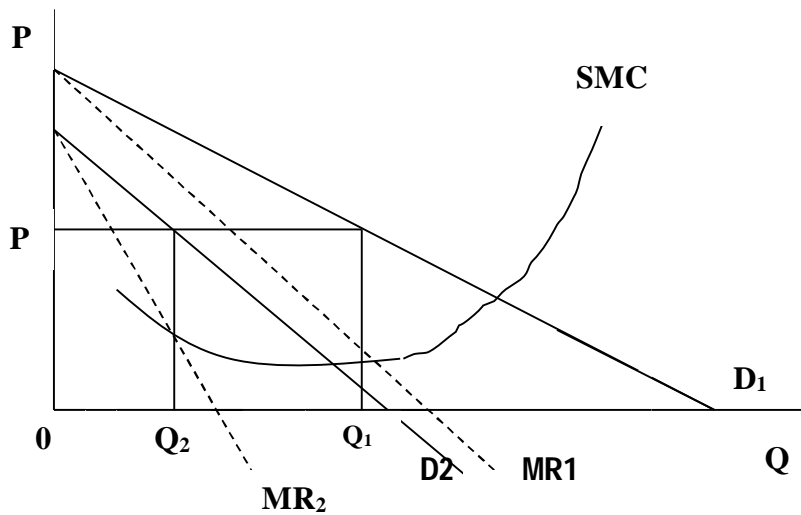


Fig 5.3: Both Q_1 and Q_2 are sold at the same price P .

Since the monopolist can sell the same quantity of output at different prices and can sell different quantities at the same price, depending on elasticity of demand, there is no distinct relationship between price and quantity and supply by a monopolist. To conclude we must say that “the supply curve is not clearly defined.

B. Long run Equilibrium

In the long run the monopolist has the time to expand his plant or to use his existing plant at any level which will maximize his profit. But given entry impossibility into a monopolist market the firm may not necessarily build the optimal plant size. (That is to build up his plant until he reaches the minimum point of the LAC). Given entry barrier, the monopolist may probably continue to earn super normal profits even in the long run.

However, the size of his plant and the degree of utilization of any given plant size depend entirely on the market demand. The monopolist may reach the optimal scale (minimum point of LAC) or remain at suboptimal scale (falling parts of his LAC) or operate beyond the optimal scale (expand beyond the minimum LAC) depending on the market condition.

- (i) For instance if market is limited/small the firm will maintain a sub-optimal plant and may under utilize the plant.

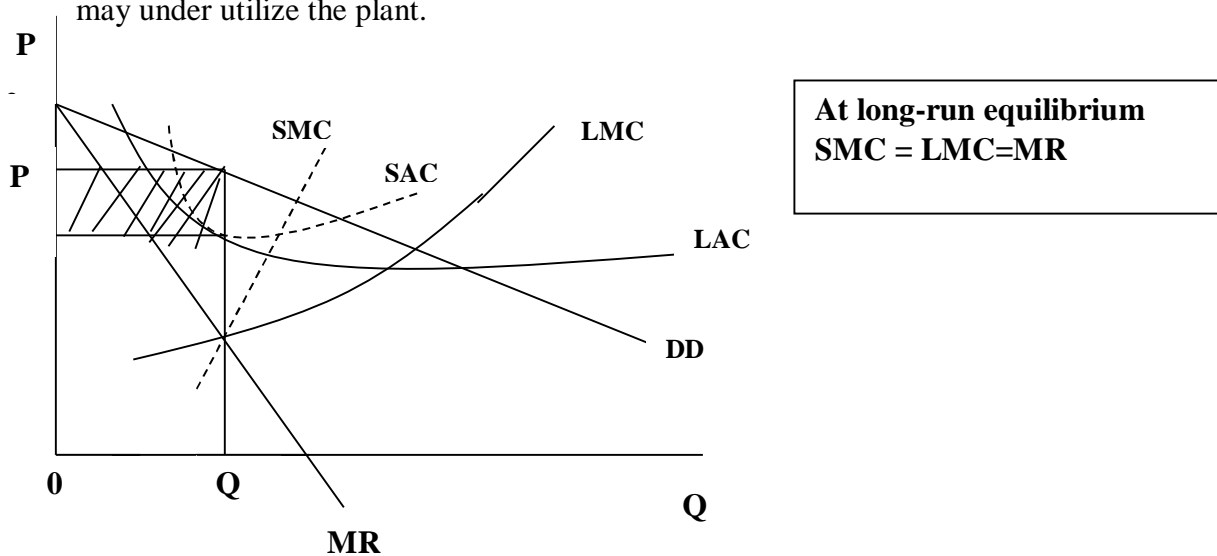


Fig 5.4: Monopolist with suboptimal plant and excess capacity.

The firm is employing plant size smaller than the optimum and it is under utilizing the plant (excess capacity).

- (ii) If the market is so large relative to the expansion path, the firm may build a production plant larger than the optimal and may over-utilize the plant. When the market is larger, the optimum occurs to the right of the minimum point of Long run average cost as at point e.

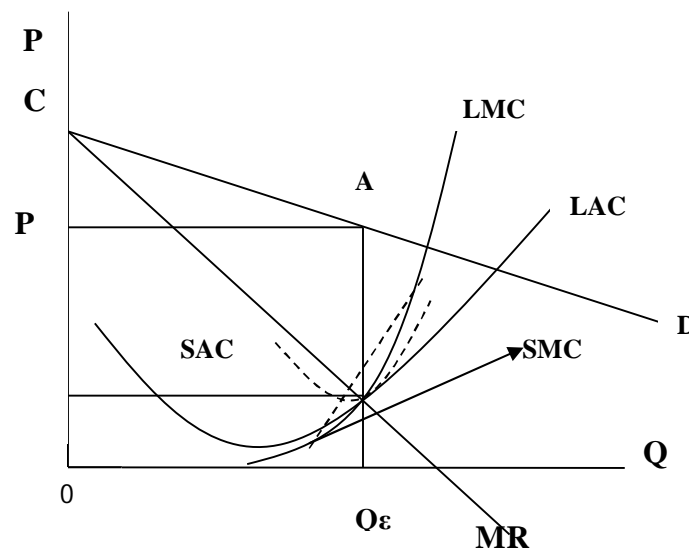


Fig 5.5: Monopolist operating in a large market: his plant is large than the optimal (e) and it is being over-utilized (at ϵ).

(iii) If the market size is just large enough to permit the monopolist to build the optimal plant, the firm will be operating at minimum point of LAC.

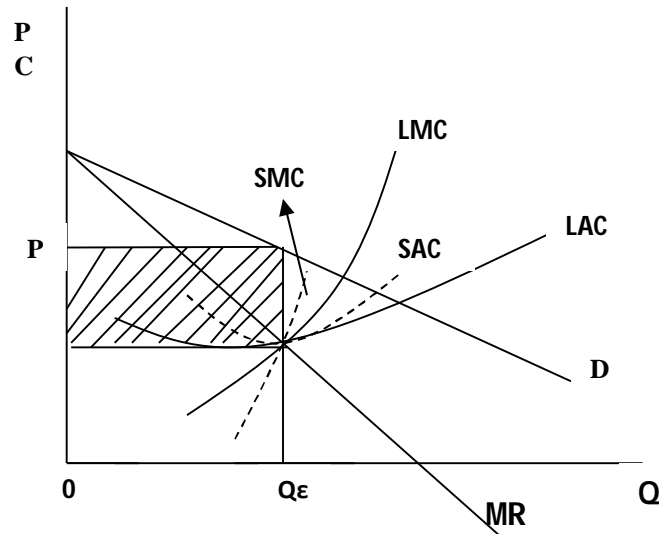


Fig 5.6: Monopolist operating at his optimal plant size (Full capacity utilization)

If the monopolist is at his optimal plant size $SMC = LMC = SAC = MR$ at minimum of LAC.

Note: The firm still earns supernormal profit because price is greater than the marginal revenue (profits in the shaded area).

5.3. Price Discrimination

Price discrimination exists when the same product is sold at different prices to different buyers. The cost of production is either the same or different but not as much as the difference in the changed prices. Ex: different binding of the same book, different locations of seats in a theater etc.,) The necessary conditions for the firm to practice price discrimination are as follows:

1. The monopolist must distinguish between more price elastic consumer and less price elastic consumer. (The market must be divided into sub markets with different price elasticities.)
2. There must be effective separation of the sub markets, (no reselling can take place from a low price market to a high price market). Eg., Services like transport, a show, services of doctor, electricity supply etc.,

By practicing price discrimination the monopolist can increase revenue and hence profit by selling the optimal output (where $MR = MC$) at different prices in different markets. Monopolists

normally practice three kinds price discrimination. First Degree price discrimination: Second Degree Price Discrimination and finally and Third Degree Price Discrimination.

Third Degree Price Discrimination

Revenue earned from price discrimination is greater than the revenue from a single (uniform) price sale. Since the cost is the same, profit is also higher under price discrimination. This is third degree price discrimination. In this type of price discrimination in which output is sold for two different categories of individuals at different prices but every individual in the same group takes the same price is called third degree price discrimination.

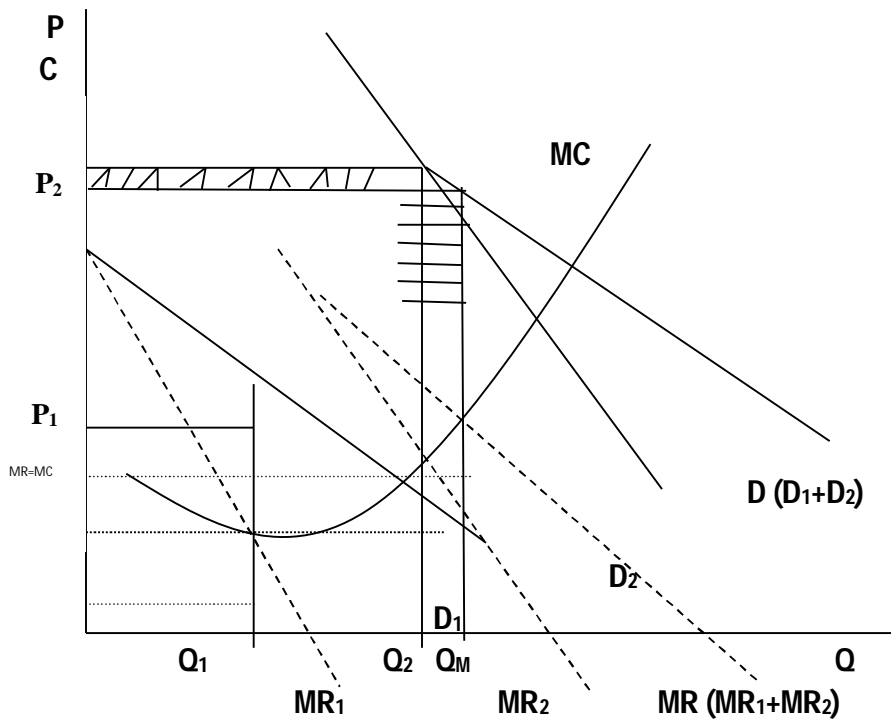


Fig 5.7: Price Discrimination

Suppose the monopolist takes his market into two sub markets (the above figure) based on different elasticity of demand existence. Market 1 with more elastic demand will be treated with demand curve D_1 .

Market 2 with less elastic demand will be treated with demand curve D_2 .

The price discriminating firm has to decide a) The total output that it must produce and b) How much to sell in each market and at what price, so as to maximize its profits? Total quantity to be produced is defined by the point of intersection of the MC and the aggregate MR curves.

If the firm charges uniform price in two markets the total revenue is $OPAQ$. But the firm increases its revenue or profits by charging different prices according to $MR_1=MR_2=MC$.

$MR_1=MR_2=MC$ condition is fulfilled at points at which the horizontal dotted line through e ($MR=MC$) intersects MR_1 & MR_2 .

CASE 1: The firm charges uniform (identical price) P where $MC =MR$.

CASE 2: The firm charges different prices depending on the elasticity of demand.

$$TR_1 = OP_1FQ_1$$

$$TR_2 = OP_2EQ_2$$

$$TR = OP_1FQ_1 + OP_2EQ_2 \quad \text{since } OP_1FQ_1 = CBQQ_2$$

$$TR = OP_2EQ_2 + CBQQ_2$$

By practicing price discrimination the firm gains PP_2ED and losses $ABCD$. But the gain (PP_2ED) is greater than the loss. Revenue from price discrimination is greater than revenue from a uniform price. Since the cost is the same, profit is also higher under price discrimination. Third degree price discrimination can also be illustrated by using two different prices for different quantities on the same market demand curve.

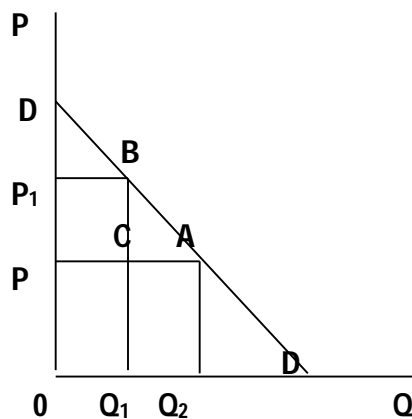


Fig 5.8: Third Degree Price Discrimination

If the total output Q is sold at a uniform price P , total revenue will be $R = OPAQ$. If the firm sells the first OQ_1 units at P_1 and Q_1Q units at P , the total revenue will be greater by P_1BC . At uniform price P , $PDBA$ was consumer surplus. Because of price discrimination the additional revenue is obtained by extracting the part of the consumer surplus (PP_1BC).

Second Degree Price Discrimination:

If the firm negotiates at more than two prices more of the consumers' surplus can be extracted and revenue can be further increased. This way of increasing revenue is called second degree price discrimination. By practicing price discrimination the firm's revenue has increased by $PP1Ah+ehiB+efcg$, which was a part of consumers' surplus.

First Degree Price Discrimination:

In the extreme case, the firm might negotiate price with every consumer to change his/her the maximum price. He/she is willing to pay (reservation price). It extracts the entire consumer's surplus and it is called first degree price discrimination. In this case the MR is the same as the price. The contribution of every unit of output sold at its reservation price is MR.

Exercise:

Consider a monopolist that takes a market which can be divided into two submarkets with demand functions.

$$\begin{aligned} Q_1 &= 100 - P_1 & Q &= Q_1 + Q_2 \\ Q_2 &= 100 - 2P_2 & &= 200 - 3P \end{aligned}$$

If MC is constant at \$10 calculate the prices that must be charged in the two markets and quantities if the firm practices price discrimination.

Solution:

First change the direct demand functions in to inverse demand functions.

$$\begin{aligned} Q_1 &= 100 - P_1 & Q_2 &= 100 - 2P_2 \\ P_1 &= 100 - Q_1 & P_2 &= 50 - \frac{1}{2} Q_2 \\ R_1 &= P_1 Q_1 & R_2 &= P_2 \cdot Q_2 \\ Q_1[100 - Q_1] & & Q_2[50 - \frac{1}{2} Q_2] \\ 100Q_1 - Q_1^2 & & 50Q_2 - \frac{1}{2} Q_2^2 \\ MR_1 &= 100 - 2Q_1 & MR_2 &= 50 - Q_2 \end{aligned}$$

Set MR in each market with MC

$$MR_1 = MR_2 = MC$$

$$\begin{aligned} 100 - 2Q_1 &= 10 & 50 - Q_2 &= 10 \\ 100 - 10 &= 2Q_1 & 50 - 10 &= Q_2 \\ Q_1 &= 90/2 = 45 & 40 &= Q_2 \end{aligned}$$

$$Q_1 = 100 - P_1 = 45$$

$$Q_2 = 100 - 2P_2 = 40$$

$$P_1 = 100 - 45 = 55$$

$$= 100 - 40 = 2P_2$$

$$P_2 = 60/2 = 30$$

5.4. Multi plant Monopolist

A monopolist can produce identical product in different plants. For simplicity we assume the firm has only two plants, Plant A and Plant B, each with different cost structures. In this case the monopolist has to make two decisions.

- Price and output levels.
- How much to produce in the first plant and how much in the second plant.

The monopolist should know the market demand curve the corresponding MR curve and cost structure of those plants.

$$MC = MC_1 + MC_2$$

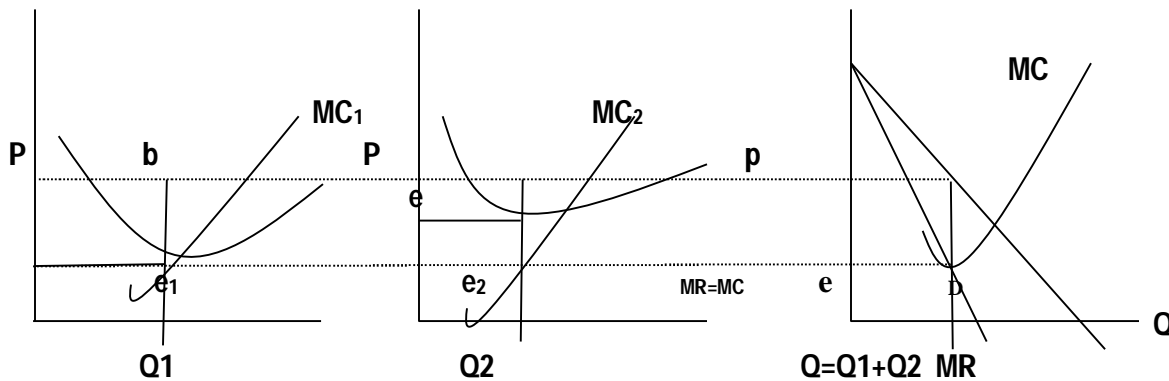


Fig 5.9: Multi Plant monopolist with same Price

Optimum point is obtained by the equality point of MC_1 , MC_2 and MR .

In other words, the monopolist maximizes his profit by utilizing each plant up to the level at which the marginal costs are equal to each other and to the common marginal revenue. This is because if the MC on one plant, say plant A, is lower than the marginal cost of plant B, the monopolist would increase his profits by increasing the production in A and decreasing it in B, until the condition $MC_1 = MC_2 = MR$ is fulfilled.

Graphically the equilibrium of the multi-plant monopolist may be defined as follows. The total profit-maximizing output and its price is defined by the intersection of MC and MR curves Point E in the diagram. From the point of intersection we draw a line, parallel to the X-axis, until it intersects the individual MC_1 and MC_2 curves of the two plants. At these points the equilibrium

condition ($MC = MR = MC_1 = MC_2$) is satisfied. If from these points (E1 and E2) we draw perpendiculars to the X-axis of plant A and plant B, We find the level of output that will be produced in each plant. Clearly $Q_1 + Q_2$ must be equal to the profit maximizing output Q. The total profit is the sum of profits from products of the two plants. The profit from plant A is the shaded area **abcd** and the profit from plant B is the shaded **efih**.

Numerical Example: Given the monopolist's cost and demand curve.

$$Q = 200 - 2P \quad \text{or } P = 100 - 0.5Q$$

$$C_1 = 10X_1 \quad C_2 = 0.25X_2^2.$$

Find Q, Q1, and Q2, P Where $Q = Q_1 + Q_2$.

$$P = 100 - 0.5Q$$

$$TR = P \cdot Q = 100 \cdot Q - 0.5Q^2$$

$$\begin{aligned} MR &= 100 - Q \quad Q = Q_1 + Q_2 \\ &= 100 - Q_1 - Q_2 \end{aligned}$$

$$TC_1 = 10X_1$$

$$MC_1 = 10$$

$$TC_2 = 0.25 Q_2^2$$

$$MC_2 = 0.5Q_2$$

$$MC_1 = MR \quad 10 = 100 - Q_1 - Q_2$$

$$MC_2 = MR \quad 0.5Q_2 = 100 - Q_1 - Q_2$$

$$Q_1 + Q_2 = 90$$

$$1.5Q_2 + Q_1 = 100$$

$$-Q_1 - Q_2 = -90$$

$$1.5Q_2 + Q_1 = 100$$

$$Q_1 + Q_2 = 90$$

$$0.5Q_2 = 10 \quad Q_1 = 90 - 20 = 70$$

$$Q_2 = 20$$

$$P = 100 - 0.5(90) = 100 - 45 = 55$$

$$\text{Monopolist profit } \Pi = R - C_1 - C_2$$

$$= 4950 - 10(20) - 0.25(4,900) = 4150$$

5.5. Social Costs Of Monopoly power

Price is higher and output is lower in the monopoly market model than the competitive market model. Because of these monopoly is said to be socially inefficient in allocating factors of production. In Competitive Market $P = MC$

Monopoly Market $P > MC$

To calculate the degree of inefficiency due to monopoly we can use the concepts of producer's surplus and consumer's surplus.

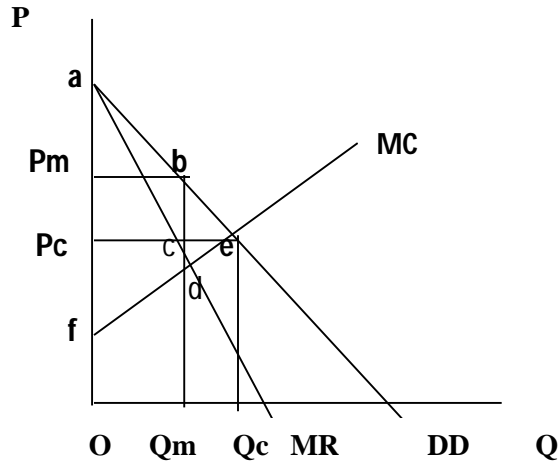


Fig 5.10: Producer and consumer Surplus

Under Competition the net welfare gained by the consumers and producers is as follows:

$$\text{Net Welfare} = \underbrace{apce}_{\text{Consumer's Surplus}} + \underbrace{Pcef}_{\text{Producer's Surplus}}$$

Under Monopoly the net welfare gained by the consumers in $aPmb$ which is less than net welfare gained under competitive ($aePc$). $PmbcPc$ is taken by producers. But the area bed is totally lost. (Which is not consumer surplus & Producers surplus). Area bed is dead weight loss due to monopoly allocation as opposed to competitive market.

Chapter –Five Review Questions

Part I: Read each expression and choose the most appropriate answer.

- The best level of output for the pure monopolist occurs at the point where
 - TC is minimum
 - $TR = TC$

- C. $MR = MC$
 - D. TR and TC curves are parallel
2. Price discrimination will always lead to
 - A. Increase in output
 - B. Decrease in output
 - C. no change in output
 - D. Increase in TR
 3. Discriminating monopoly is possible if two markets have
 - A. Rising cost curves
 - B. Rising and declining cost curves
 - C. Different elasticity's of demand
 - D. Equal elasticity's of demand
 4. Which of the following statements is not true? A discriminating monopolist
 - A. Operates in more than one market
 - B. Makes more profit because he discriminates
 - C. Maximizes his profits in each market
 - D. Charges same prices in different markets
 5. If a profit maximizing monopoly's MR exceeds its MC, then it should
 - A. Raise its price
 - B. Rise its output
 - C. lower its output
 - D. lower its price
 6. One of the following characterizes monopoly market structure:
 - A. Only a single seller of a product that have large number of buyer
 - B. Market price set by a producer
 - C. Barrier to entry
 - D. All of the above

Part Two: Work Out and Discussion Questions.

1. Suppose a monopolist faces a market demand curve given by $P = 55 - 2Q$ and its total costs of production given by $TC = 100 - 5Q + Q^2$
 - a) Determine the profit maximizing price and output.
 - b) Calculate the dead weight loss from the monopoly power.
2. Explain and Show graphically the multi plant monopolist marketing situation.

CHAPTER SIX

MONOPOLISTIC COMPETITION

Introduction

Dear learner! In this chapter we would like to initiate you with some of the basic concepts and principles in the monopolistic competitive market structure. We start with monopolistic competition market definition, discussing its basic assumptions and broaden our scope on gradual basis towards the discussion of short run and long run equilibrium of the market.

Chapter Objectives: Generally speaking, the learner will be expected to get familiar with the following key issues:

- What a monopolistic competitive market is all about;
- The main marketing principles that are accomplished while working on monopolistic competitive market and its equilibrium positions, and;
- Social cost of monopolistic competitive market

6.1. The Concept of Monopolistic Competition Market

Definition: Monopolistic competition is a market structure with many buyers and sellers in which product differentiation exists and there are elements of both monopoly and perfect competition. Characterizes an industry in which many firms offer products or services that are similar, but not perfect substitutes. Barriers to entry and exit in the industry are low, and the decisions of any one firm do not directly affect those of its competitors. All firms have the same, relatively low degree of market power; they are all price makers. It is a form of competition that characterizes a number of industries that are familiar to consumers in their day-to-day lives. Examples include restaurants, hair salons, clothing and consumer electronics. To illustrate the characteristics of monopolistic competition, we'll use the example of household cleaning products. Due to the range of similar offerings, demand is highly elastic in monopolistic competition. In other words, demand is very responsive to price changes.

▪ **Assumptions**

Dear learner! Chamberlin's model of monopolistic competition works under many of the assumptions of perfect competition, though there are few assumptions which enable a firm to

enjoy a certain degree of monopoly power. The following are the assumptions of Chamberlin's model of monopolistic competition.

- The firm is assumed to have profit maximization goal. Though a firm can have different alternative objectives such as sales maximization, growth, mergers, and profit maximization, the only goal of the firm is assumed to be profit maximization.
- The prices of factors of production and technology are assumed to be constant.
- The firm is assumed to behave as if it knew its demand and cost curves with certainty.
- The long run is supposed to be a series of a number of identical short run periods, which are assumed to be independent of one another, in the sense that decisions in one period do not affect future periods and will not be affected by past periods.
- The myopia assumption: firms are assumed not to learn from their past experience.
- Heroic assumption. Chamberlin assumed that both demand and cost curves for all the products of the firms in the same product group, under monopolistic competition can be taken to be identical or uniform. The identity of demand and curves in a given product group across all firms is also called as the uniformity assumption.
- Thus, we can proceed under the uniformity assumption that both demand and cost curves of all products are uniform throughout the group. The identity of demand and costs leads us to the conclusion that prices of the products of various firms are identical. This requires that consumer preference be evenly distributed among the different sellers, and the differences in costs. This assumption is made in order to be able to show the equilibrium of the firm and the group on the same diagram. Besides the assumption of identical costs and prices for all products in a group, it is also assumed that buyers have perfect knowledge.

▪ **Characteristics of Monopolistic Competition**

Dear learner! The following points are common and worth mentioning while discussing on the inherent characteristics of a monopolistic competitive market structure in a given marketing situation. In general, monopolistically competitive markets exhibit the following characteristics:

1. Each firm makes independent decisions about price and output, based on its product, its market, and its costs of production.
2. Knowledge is widely spread between participants, but it is unlikely to be perfect. For example, diners can review all the menus available from restaurants in a town, before they

make their choice. Once inside the restaurant, they can view the menu again, before ordering. However, they cannot fully appreciate the restaurant or the meal until after they have dined.

3. The entrepreneur has a more significant role than in firms that are perfectly competitive because of the increased risks associated with decision making.
4. There is freedom to enter or leave the market, as there are no major barriers to entry or exit.
5. A central feature of monopolistic competition is that products are differentiated. There are four main types of differentiation:

Physical product differentiation: where firms use size, design, color, shape, performance, and features to make their products different. For example, consumer electronics can easily be physically differentiated.

Marketing differentiation: where firms try to differentiate their product by distinctive packaging and other promotional techniques. For example, breakfast cereals can easily be differentiated through packaging.

Human capital differentiation: where the firm creates differences through the skill of its employees, the level of training received, distinctive uniforms, and so on.

Differentiation through distribution: which include distribution via mail order or through internet shopping, such as Amazon.com, which differentiates itself from traditional bookstores by selling online.

6. Firms are price makers and are faced with a downward sloping demand curve. Because each firm makes a unique product, it can charge a higher or lower price than its rivals. The firm can set its own price and does not have to 'take' it from the industry as a whole, though the industry price may be a guideline, or becomes a constraint. This also means that the demand curve will slope downwards.
7. Firms operating under monopolistic competition usually have to engage in advertising. Firms are often in fierce competition with other (local) firms offering a similar product or service, and may need to advertise on a local basis, to let customers know their differences. Common methods of advertising for these firms are through local press and radio, local cinema, posters, leaflets and special promotions.
8. Monopolistically competitive firms are assumed to be profit maximisers because firms tend to be small with entrepreneurs actively involved in managing the business.
9. There are usually a large numbers of independent firms competing in the market.

Dear learner, given the above characteristics of a monopoly market structure, let you reflect on your views on the following lines.

- ① *Define the monopolistic competitive market structure as a working concept in your day to day life. It would be appreciated if you substantiate your definition with real world examples.*
- ② *What do you think is the basic difference between perfect competition, monopoly and monopolistic competitive market structures [in the context of microeconomics]?*

6.2. Product Differentiation, the Demand Curve and Cost of the Firm

The distinguishing feature of monopolistic competition which makes it as a blending of competition and monopoly is the differentiation of the products. Product differentiation does not mean that the products of various firms are not homogenous but different though they are closely related to each other. The products of firms are only slightly different so that they are quite similar and serve as close substitutes of each other.

When there is any degree of differentiation of products monopoly element enters into the market situation. The greater the differentiation of the products the greater will be the monopoly element involved. When there are a large number of firms producing differentiated products, each firm has a monopoly power over its own product, but is subjects to the competition of close substitutes. Since each is a monopolist and yet has competitors, the market structure is called as 'Monopolistic competition'. Product differentiation is any feature of a product of sellers that makes buyers to prefer one product or seller to that of another. It is done to make a firm product unique in the minds of buyers.

It leads to different consumer's preference. It is also the basis for establishing a downward sloping demand curve. Chamberlain suggested that the demand for a product is not only determined by the price, but also by the style of the product, the services associated with it and the selling activities of the firm. Thus, Chamberlain introduced two additional policy variables in the theory of the firm: the product itself and selling costs. Hence, the demand curve shifts if:

- The style, services, or the selling strategy of the firm changes,
- Competitors change their price, output, services or selling policies of a product;
- Tastes, incomes, prices or selling policies of products from other industries change.

Product differentiation is intended to distinguish the product of one producer from that of the other producer in the industry (in the group). It can be real differentiation or fancied (artificial) differentiation.

Real differentiation: exists when the inherent characteristics of the products have slight differences (slight differences in the quality and durability), in the specification of products, difference in factor inputs, (terms of credit, transportation, guarantee, location of the firm), which determine the convenience with which a product is accessible to the consumer. Example: chemical differences existing in shampoos or conditioners. On the other hand, fancied differentiation is established by advertising or differences in packaging, in design (color or shape) or simply by brand name.

In any case, the aim of product differentiation is to make the product unique in the mind of the consumers. Yet, differentiation must leave the products closely related if they are to be included in the same group. And the effect of product differentiation leaves firms under monopolistic competition with some degree of monopoly power. Because of this the firm is not a price – taker. But the power of the firm over price is limited because of the existence of other competitors. Product differentiation creates brand loyalty and gives rise to a negatively sloped demand curve. A firm can try to make its products different from those of its competitors in several ways: physical aspects of the product, selling location, intangible aspects of the product, and perceptions of the product. Products that are distinctive in one of these four ways are called **differentiated products**.

Physical aspects of a product include all the phrases you hear in advertisements: such as an unbreakable bottle, nonstick surface, freezer-to-microwave, non-shrink, extra spicy, newly redesigned for your comfort. The location of a firm can also create a difference between producers. For example, a gas station located at a busy intersection can probably sell more gas than one located on a small side-road. A supplier to an automobile manufacturer may find that it is advantageous to locate near the car factory.

Intangible aspects can differentiate a product, too. Some intangible aspects may be promises like a guarantee of satisfaction or money back, a reputation for high-quality services like free delivery, or a loan to purchase the product. Finally, **product perception** may occur in the minds

of the buyers. For example, many people could not tell the difference in taste between common varieties of beer or cigarettes if they were blindfolded, but because of past habits and advertising, they have strong preferences for certain brands. Advertising can play a role in shaping these intangible preferences.

The concept of differentiated products is closely related to the degree of variety that is available. If everyone in the economy wore only blue jeans, ate only white bread, and drank only tap water, then the markets for clothing, food, and drink would be much closer to perfectly competitive. The variety of styles, flavors, locations, and characteristics creates product differentiation and monopolistic competition.

The demand curve as faced by a monopolistic competitor is not flat, but rather downward-sloping, meaning that the monopolistic competitor, like the monopoly, can raise its price without losing all of its customers or lower its price and gain more customers. Since there are substitutes, the demand curve for a monopolistically competitive firm is relatively more elastic than that of a monopoly, where there are no close substitutes.

If a monopolist raises its price, some consumers will choose not to purchase its product—but they will then need to buy a completely different product. However, when a monopolistic competitor raises its price, consumers can choose to buy a similar product from another firm. If a monopolistic competitor raises its price, it will not lose as many customers as would a perfectly competitive firm, but it will lose more customers than a monopoly would.

- **Cost of the Firm:**

Cost structure of the firm under monopolistic competition is similar with that of any other firm (perfectly competitive and monopoly firms). The average variable cost, average total cost and marginal cost curves are all U shaped implying that there is only a unit of output which can be optimally produced. Apart from the production cost a firm under monopolistic competition incurs selling costs. The rationale for selling costs arises from the differentiation of products. The total costs, in this case, include both the selling costs and the production costs. Costs of production include manufacturing costs, transportation costs, and costs of hauling, storing and delivering a product to the customers: costs on activities which add utilities to the product. On

the other hand, selling costs include that costs which will be incurred to increase the demand or the market for the firm's product.

Selling costs include expenditure on advertising, salaries for salesmen and other expenses on selling activities. While increasing demand, effective selling costs, shifted the demand curve right ward making it less elastic. Selling costs are subject to varying returns. Initially increments in selling costs results in more than proportionate increase in the quantity demanded of the product. This leads to a falling per unit cost of selling. Average selling cost curve does not fall continuously. Eventually a stage will reach where the average selling cost curve attains its minimum point. Increments in selling costs beyond this level brings about less than proportionate increase in the quantity demanded of the product. In other words, the average selling costs (ASC) will increase. The following figure illustrates the economies and diseconomies of selling costs as output increase.

Initially, expansion of output will not require an equi-proportional increase in selling costs, and this leads to a fall in the average selling expenditure. However, beyond a certain level of output, the firm will have to spend more per unit in order to attract customers from other firms. Together with the U shaped average production cost, the U shaped ASC curve a U shaped average total cost curve. Chamberlain assumes that advertising will shift the demand and will make the demand less elastic by strengthening the preferences of the consumers for the advertised product. $\text{Total cost} = \text{Production cost} + \text{Selling cost}$. Like any other costs the average selling cost is 'U' shaped. That means there is economies and diseconomies of selling cost as output increases. The U shaped average selling cost, added to U shaped average production cost, yields a 'U' shaped ATC curve.

6.3. The Concept of Industry and Product Group


Strictly speaking, an industry is a collection of firms producing homogeneous product. The concept of an industry holds in a perfect competition where in there is product homogeneity. But product differentiation creates ambiguity in defining the concept of an industry and its precise boundaries in monopolistic competition. The urge to redefine this concept might have led Chamberlin to use the term product group. According to Chamberlin a product group (simply 'group' hence forward) is a collection of producers of fairly close substitutes.


A group can also be defined as a collection of firms whose cross price elasticity of demand exceeds some predetermined value. The products should be close technological and economic substitutes. Technological substitutes are products which can technically cover the same want. For example, all bathing soaps are used for bathing; motor cars are all used for transpiration. On the other hand, economic substitutes are products which cover the same want and have similar prices. Products with different cost structure are not economic substitutes.


Product differentiation allows each firm to charge different prices and practically there will not be unique equilibrium price but an equilibrium cluster of prices, reflecting the preferences of customers for the products of the various firms in the group. When the market demand shifts or cost conditions change in a way affecting all firms, then the entire cluster of prices will rise or fall simultaneously. It is only after Chamberlin's relaxation of the heroic assumption that the realistic market situation emerged.

6.4. Equilibrium of the Firm

Product differentiation gives rise to a negatively sloped demand curve. The demand curve is more elastic because of the assumption of large number of firms. In the short run supernormal profits are possible, but in the long run new firms are attracted into the industry, because of low barriers to entry, good knowledge and an opportunity to differentiate.

 *Define the concept of product differentiation in monopolistic competitive market structure as a working concept in your day to day life. It would be appreciated if you validate your definition with real world examples.*

 *How can we derive the demand curve and marginal revenue curve for monopolistic competitive firm?*

 *Can you mention different types of costs in the monopolistic competitive market structure?*

6.4.1. Short Run Equilibrium of the Firm

A firm is considered to be at its short run if it operates at a profit maximizing situation. In the short run, the monopolistically competitive firm faces limited competition. There are other firms that sell products that are good, but not perfect substitutes for the firm's own product. In other words, every firm has a monopoly of its own product and allows it to set its own price on which

profit is maximized. In order to maximize its profit, the firm should operate at the level of output in which its marginal cost of production is equal to its marginal revenue.

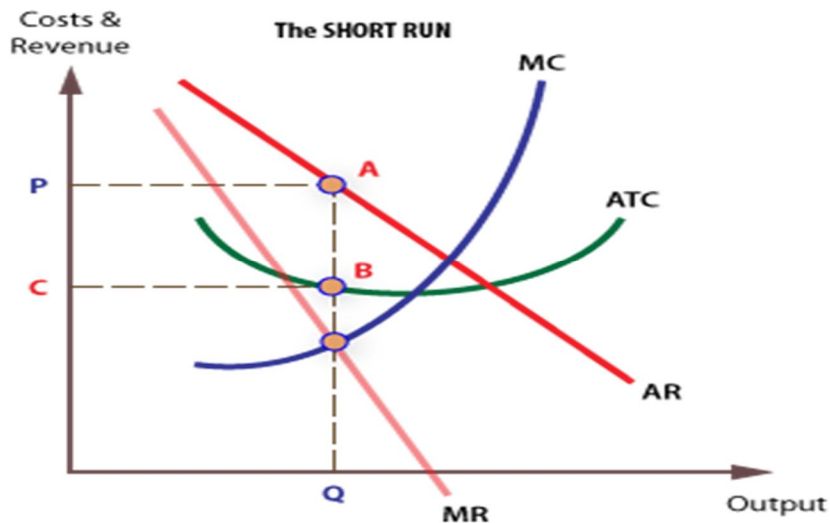


Fig.6.1. Short run equilibrium

At profit maximization, $MC = MR$, and output is Q and price P . Given that price (AR) is above ATC at Q , supernormal profits are possible (area $PABC$). As new firms enter the market, demand for the existing firm's products becomes more elastic and the demand curve shifts to the left, driving down price. Eventually, all super-normal profits are eroded away.

6.4.2. Long Run Equilibrium of the Firm

Chamberlain Heroic assumptions

- Since the firm is one of the very large numbers of sellers if it reduces its price, the increase in its sales will produce loss of sales distributed more or less equally over all the other firms, so that each one of them will suffer a negligible loss in customers, not sufficient to induce them to change their own price.
- Firms have identical costs, and consumers' preferences are evenly distributed among the different products. That is, although the products are differentiated, all firms have identical demand and cost curves. Under these assumptions the price in the market will be unique.

Model 1: Equilibrium with new firms entering the industry

Assumption: Each firm is in short run equilibrium with excess profit.

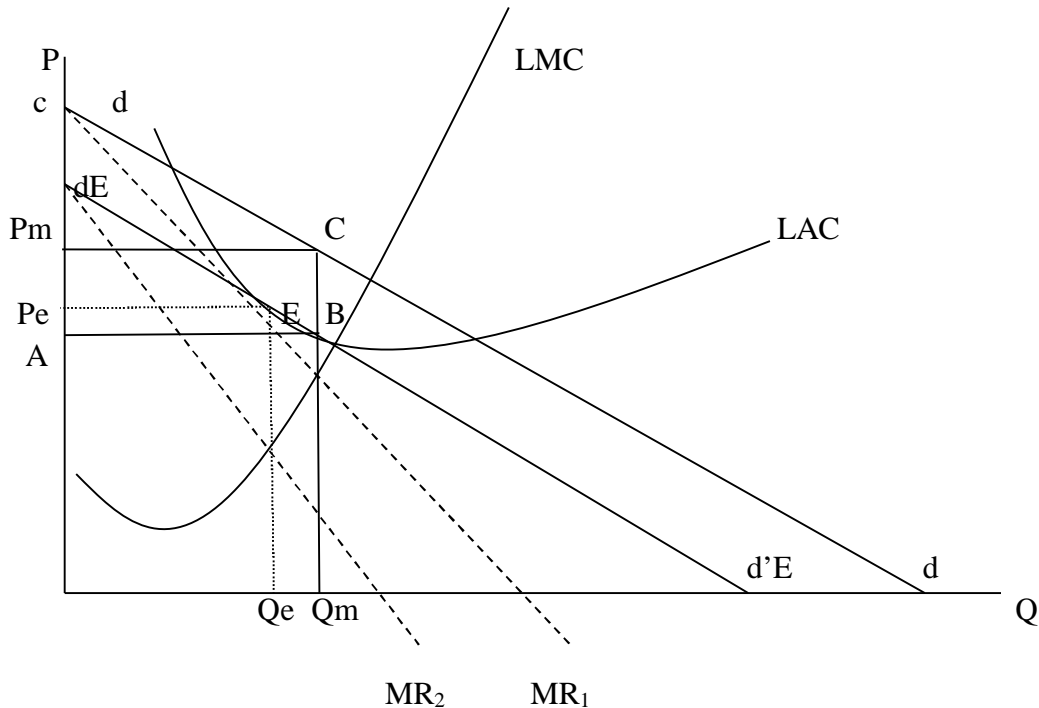


Fig 6.2: Equilibrium of a firm when new firms entering to the

The firm in the short run is in equilibrium at point C where $MC = MR$. At equilibrium point a given firm attains abnormal profit, area of P_mCBA . The excess profit attracts firms to come in to the market with competing brands. The result of new entry is a downward shift of the demand curve dd' , since the market is shared by a larger number of sellers. The process will continue until the dd' curve is tangent to the average cost curve at its equilibrium. i.e. until the abnormal profit is eliminated and excess profit is wiped out. In the final equilibrium of the firm, the price will be P_e and the ultimate demand curve will be $dEdE$. In the long run the equilibrium occurs at $P=LAC$, at this point there will be neither entry nor exit, and the equilibrium is stable.

Model 2: Equilibrium with price competition

In this model, the number of firms in the industry is assumed to be compatible with long run equilibrium, so that neither entry nor exit will take place. But the ruling price in the short run is assumed to be higher than the equilibrium price.

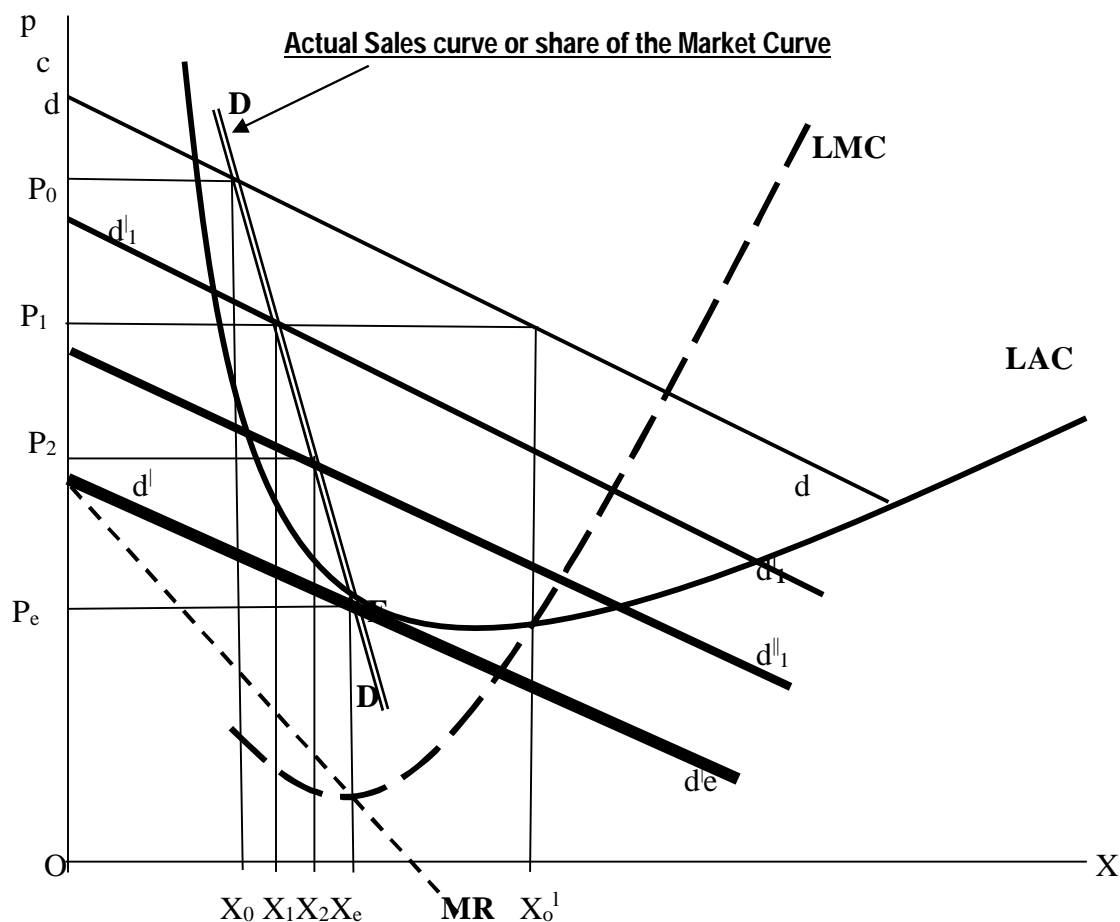


FIG 6.3: Equilibrium of a firm with price competition

The analysis of this case is done by the introduction of a second demand curve, labeled DD' , which shows the actual sales of the firm at each price after accounting for the adjustments of the prices of other firms in the group. DD' is sometimes called actual sales curve or share of the market curve. It is a locus of points of shifting dd curves as competitors change their price. Assume the firm is at a non-equilibrium position P_0 and X_0 . The firm, in an attempt to maximize its profit, lower the price to P_1 expecting to sell X'_0 . This level of sales is not actually realized because all other firms faced by the same demand and cost condition have an incentive to act in the same way simultaneously. Thus, all firms acting independently reduce their price simultaneously to P_1 . As a result, the dd curve shifts downward and the firm instead of selling expected quantity X'_0 sells actual quantity X_1 (which is less than the expected quantity) on the shifted dd curve dd' along the share curve DD' . According to Chamberlin, the firm suffers from myopia and does not learn from past experience and may further reduce price expecting that the

others will not react. Thus, the firm lowers its price again in an attempt to reach equilibrium, but instead of the expected sales X_0 the firm achieves actual sales of X_2 , because all other firms act identically, though independently. The process stops when the dd' curve has shifted so far to the left as to be tangent to the LAC curve. Equilibrium is determined by the tangency of dd' and the LAC. At the point of tangency the DD^l curve cuts the dd^l curve. Obviously it will benefit no one firm to cut the price beyond that point, because its costs of producing the larger output would exceed the price at which this output could be sold in the market.

Model 3: Equilibrium through Entry and Price Competition.

Chamberlin suggests that in the real world adjustment towards long run equilibrium takes place through both entry/exit and price competition. Price adjustments are shown along the dd^l curve while entry/exit cause shifts in the DD' curve. Equilibrium is stable if the dd^l curve is tangent to the AC curve and expected sales are equal to actual sales, i.e., DD^l curve cuts dd^l curve at the point of tangency of dd' & LAC.

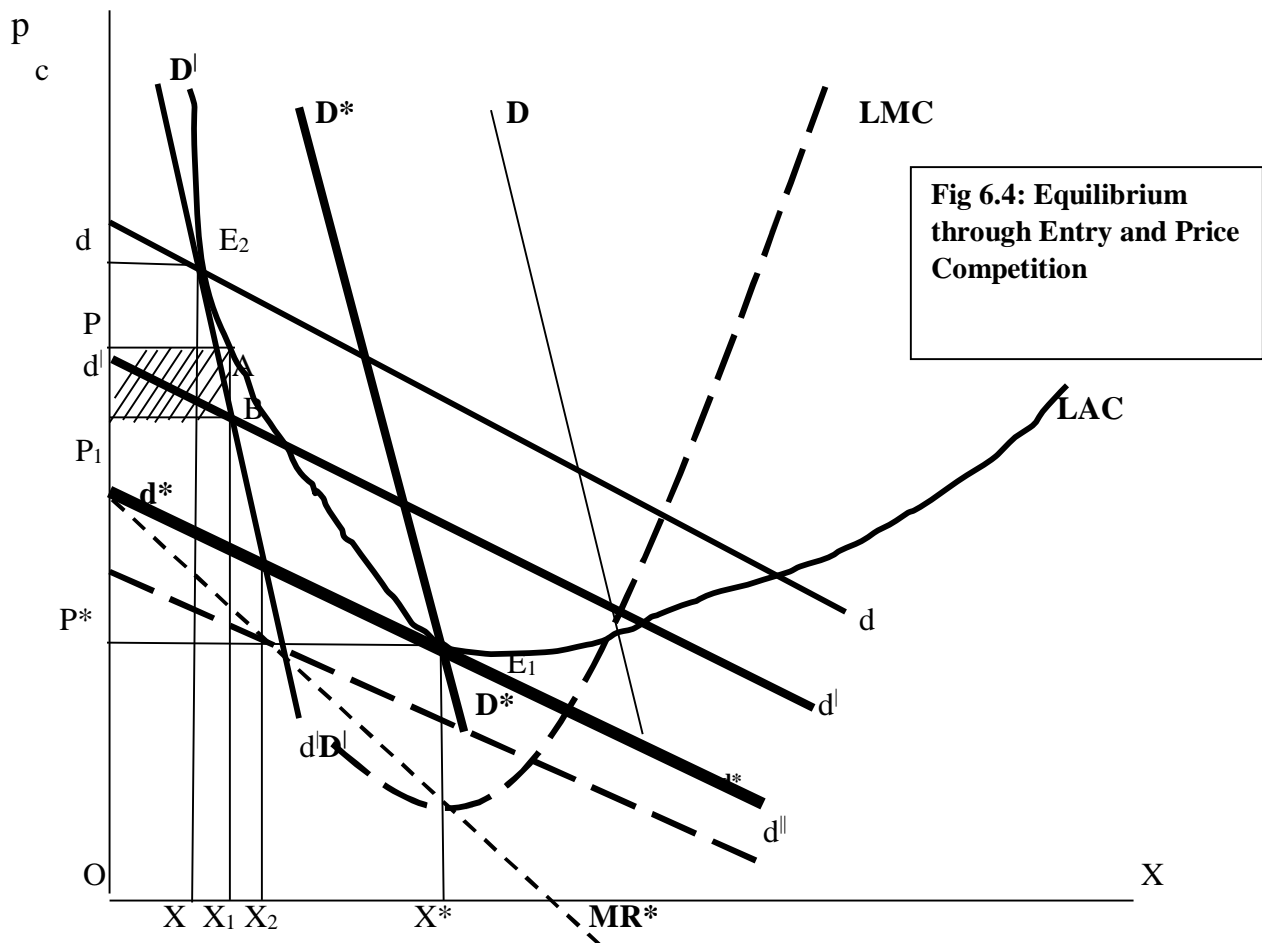


Fig 6.4: Equilibrium through Entry and Price Competition

Let's start from e_1 where there is an abnormal profit. This excess profit attracts other firms to enter into the market. When they enter into the market, the market will be shared by larger number of firms then DD (market share curve) keeps on shifting left ward until it becomes tangent to LAC , DD^1 . Although, firms earn normal profit, e_2 does not constitute stable equilibrium, because the firm believes that dd is its demand curve.

By taking dd as its sales planning function the firm will feel that it can expand sales and earn excess profit by reducing price to P_1 . But all the firms will be doing the same thing simultaneously. As price is reduced by all firms dd shifts down to dd^1 and each firm realizes a loss of area $CABP_1$ instead of positive profit.

The firm is still in myopia assumption, now also it believes that it can obtain positive profit by cutting its price. However, all the firms do the same. One might think that the process would stop when dd becomes tangent to the LAC , dd^* . This would be so if the firm could produce X^* . However, there are so many firms and the share of the firm is only X_2 . The firm still on the myopia assumption believes that it can reach X^* if it reduces to P^* .

However, all firms do the same and dd^* falls below the LAC with ever increasing losses. At this time, the financially weakest firms will leave the market. So that the surviving firms will have a higher market share then DD^1 will move to the right with dd^1 . Exit will continue until the dd becomes tangent to the LAC curve and the market share curve, DD , cuts the dd curve at the point of tangency, point E . Equilibrium is then stable at point E with normal profits earned by all firms and no entry or exit taking place.

The equilibrium price is P^* , which is unique and each firm have a share equal to OX^* at E , expected share is equal to actual sale. Super-normal profits attract in new entrants, which shifts the demand curve for existing firm to the left. New entrants continue until only normal profit is available. At this point, firms have reached their long run equilibrium.

Clearly, the firm benefits most when it is in its short run and will try to stay in the short run by innovating, and further product differentiation.

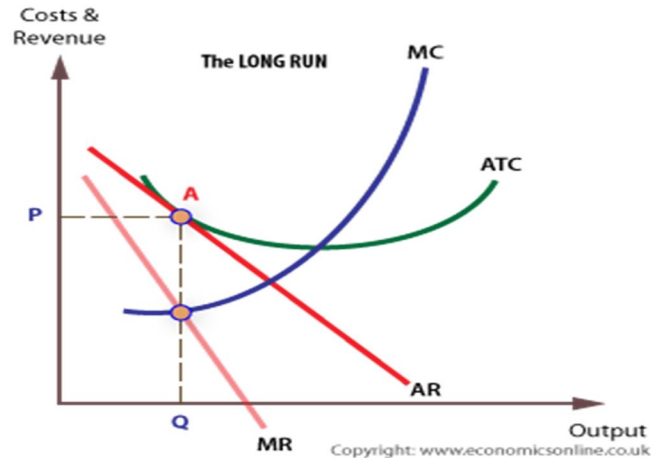


Fig 6.5: Equilibrium of the firm

6.5. Excess Capacity and Welfare Loss

Under perfectly competitive firm $MC = MR = LAC = P = AC$ at the minimum point of LAC and resources are efficiently allocated. On the other hand, under monopolistic competition $MC = MR$ and $P = AC$, but $P > MC$ (because $P > MR$). As a result price will be higher and output will be lower in monopolistic competition as compared to the perfectly competitive market.

In monopolistically competitive market structure there are too many firms in the industry each producing less than the optimal (at a higher cost). The tangency of the long run average cost and demand occurs at the falling point of the average cost curve. Firms incur selling cost which is not presented in perfectly competitive market structure.

Therefore, firms in monopolistically competitive market structure have an excess capacity measured by the difference between the ideal output (Y_F) corresponding to the minimum cost level on the LAC curve and the output actually obtained in the long run (Y_E)

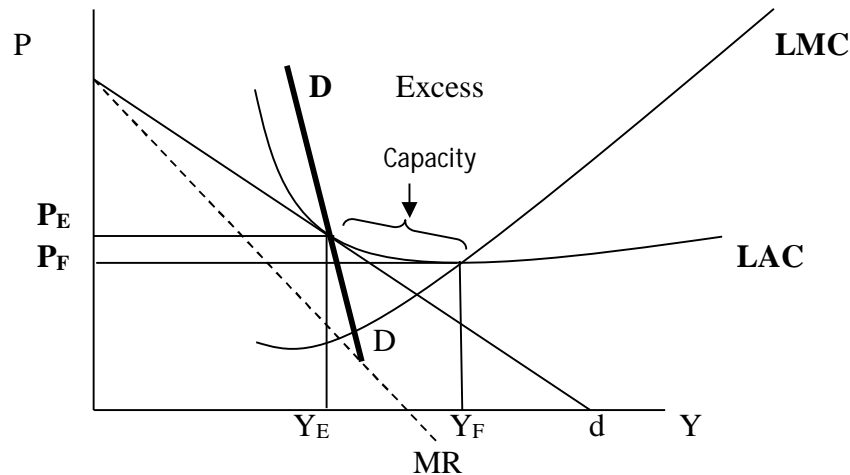


Fig 6.7: Excess capacity and welfare loss

Chamberlain argues that the excess capacity and misallocation of resources is valid only if one assumes that the demand curve of each individual firm is horizontal. If demand is downward sloping and firms enter into active price competition and entry is free in the industry. Y_F cannot be considered as a socially optimal level of output. Consumers desire a variety of products. And product differentiation reflects the desire of consumers to pay higher price for differentiated product. Therefore, the difference between the actual output Y_E and the minimum cost output Y_F is not a measure of excess capacity but rather a measure of the “social cost of producing and offering the consumers a greater variety of output.

”Chamberlain’s argument is based on the assumption of active price competition and free entry. He argues that the equilibrium output will be very close to the minimum cost output, because firms will be competing along their individual dd curves which are very elastic. Chamberlain divides the competition into two, price and non-price competition. If firms avoid price competition and enter into a non price competition there will be an excess capacity in each firm and inefficient product capacity in the industry and that is an inexhaustible economy of scale for the firms in the industry.

Chapter-Six: Review Questions

Part I: Read each expression and choose the most appropriate answer.

7. According to Chamberlin, two products are closely substitutes if
- A. they are sold at same price
 - B. they serve same purpose
 - C. their color is the same
 - D. All except C
8. One of the following is **wrong** about monopolistically competitive market:
- A. The equilibrium output is less than the perfectly competitive equilibrium output.
 - B. The equilibrium price is less than the perfectly competitive equilibrium price.
 - C. Entry and exit is free in the market
 - D. The cost of the firm holds selling costs in addition to production costs
9. The competitive nature of monopolistically competitive market arises from:
- A. The existence of differentiated and close substitute products.
 - B. The existence of large number of sellers.
 - C. The existence of homogenous products
 - D. A & B
10. One of the following is a necessary condition for short run equilibrium of monopolistically competitive firm.
- A. $MC=LAC$
 - B. $MC>MR$
 - C. $MC<MR$
 - D. $MR=MC$
11. A monopolistically competitive market is distinguished from a perfectly competitive market by the fact that.
- A. It contains few buyers
 - B. It contains few sellers
 - C. It deals in a differentiated products
 - D. All of the above
12. One of the following is **wrong** about monopolistically competitive market:
- A. Firms have monopoly power over their specific product
 - B. Firms faced more elastic demand curve than pure monopoly.
 - C. Large number of sellers is found in the market.
 - D. In the long run firms may obtain abnormal profits.
13. One of the following is considered as the heart of Chamberlin's monopolistic model.
- A. Advertising
 - B. Product Differentiation
 - C. Free Entry
 - D. All
14. Which one of the following condition is not fulfilled when monopolistic competitive firm occurred at long run equilibrium with price competition?

B. $MR = MC$

C. Equilibrium price = LAC

C. Market demand = Actual sales

D. None

15. A firm expects a 10% increase in sales for a 1% fall in its product price. The firm's expectation is based on its assumption that all firms keep their prices constant following its action. Accompanying a 1% fall in a firm's product price, if all firms match price reduction, each firm will move along its:

A. Perceived Demand Curve

C. Proportionate Demand Curve

B. Marginal Cost Curve

D. Average Cost Curve

16. A market structure characterized by the existence of large number of sellers with differentiated products is called:

A. Perfect Competition

C. Pure oligopoly

B. Monopolistically competitive market

D. Duopoly

Part Two: Work Out and Discussion Questions.

1. Suppose a monopolistic competitive firm faces a market demand curve given by $P = 40 - 2Q$ and its total costs of production given by $TC = 80 - 6Q + Q^2$
 - c) Determine the profit maximizing price and output.
 - d) Calculate the total revenue and profit of the firm.
2. Explain and Show graphically the long run equilibrium condition of monopolistic competition when there are new firms entering to the industry

CHAPTER SEVEN

OLIGOPOLY MARKET

Introduction

Dear learner! In this chapter we would like to commence you with some of the basic concepts and principles in the oligopoly market structure. We start oligopoly market definition, discussing its basic characteristics and broaden our scope on gradual basis towards the discussion of types of oligopoly markets, and short run and long run equilibrium of the market.

Chapter Objectives: Generally speaking, the learner will be expected to get familiar with the following key issues:

- What an oligopoly market is all about and its characteristics;
- The main marketing principles that are accomplished while working on oligopoly market and its equilibrium positions, and;
- Realizing the difference between collusive and non-collusive oligopoly markets
- Recognize why oligopoly firms are mutually interdependent.

7.1. The Concept of Oligopoly Market Structure


Definition: Oligopoly is a market structure characterized by a small number of dominant firms and a great deal of interdependence among them. Since oligopoly contains small number of firms any change in firm's price or output influences the sales and profit of competitors. Thus, oligopolists face a situation in which the optimal decision of one firm depends on what other firms decide to do.


▪ Characteristics of Oligopoly

Dear learner! The following points are common and worth mentioning while discussing on the inherent characteristics of a monopolistic competitive market structure in a given marketing situation. In general, monopolistically competitive markets exhibit the following characteristics:

1. A few large producers: firms are few in number but large on their capacity to share the market.
2. Produce homogeneous or differentiated products:

- Homogeneous products: standardized products that are produced in oligopoly. Example steel, Zink, cooper, cement, industrial Alcohol etc.
 - Differentiated products: products with different features example automobiles, tires, household appliances, electric equipment's, cigarettes etc.
3. Control over price, but mutual interdependence: Each firm set its price and output levels to maximize profit. But the oligopolist considers how its rivals will react to any change in its price, output, product features or advertising. Hence price is sticky to avoid price war between firms.
 4. Entry barriers: The main barriers to entry are the large expenditure for capital, ownership and control of raw material, patent right and, the existing firms prohibit new entrants through pricing and advertising strategies.
 5. Firms are interdependent
 6. Existence of price rigidity – by fearing price war firms mostly stick to the prevailing market price.
 7. Excessive expenditure on Advertisement: If there is price rigidity and if firms have to stick to the prevailing price, the only way to increase the sales is through the advertisement or improvement of the design or quality of the product.

 *Define the oligopoly market structure as a working concept in your day to day life. It would be esteemed if you substantiate your definition with real world examples.*

 *What do you think is the basic difference of oligopoly market with other market structures like perfect competition, monopoly and monopolistic competitive market structures [in the context of microeconomics]?*

7.2. Types of Oligopoly Market Models

Dear learner! The classification of oligopoly firms as collusive or non-collusive is based up on whether there exist some agreements between firms or not.

7.2.1. Non Collusive Oligopoly

The common feature of non-collusive oligopoly models is there is no cooperation among rival firms. But each firm develops an expectation about what the other firms are likely to do. Since

Firm B reacts on the Cournot assumption and will produce one-half of the unsupplied section of the market i.e., $\frac{1}{2} [1-3/8] = 5/16$. This action and reaction continues, since firms in this model are assumed not to Learn from past patterns of reaction of their rival, however equilibrium will be reached in which each firm produces one third of the total market. In this case, each firm maximizes its profit in each period, but the industry profits are not maximized. The equilibrium of the Cournot firms may be obtained as follows:

The product of firm A in successive periods.

$$\text{Period } 1 = \frac{1}{2}$$

$$\text{Period } 2 = \frac{1}{2} \left[1 - \frac{1}{4} \right] = \frac{3}{8} = \frac{1}{2} - \frac{1}{8}$$

$$\text{Period } 3 = \frac{1}{2} \left[1 - \frac{5}{16} \right] = \frac{11}{32} = \frac{1}{2} - \frac{1}{8} - \frac{1}{32}$$

$$\text{Period } 4 = \frac{1}{2} \left[1 - \frac{42}{128} \right] = \frac{43}{128} = \frac{1}{2} - \frac{1}{8} - \frac{1}{32} - \frac{1}{128}$$

Output of A declines gradually

$$[\text{Product of A in equilibrium}] = \frac{1}{2} - \left[\frac{1}{8} + \frac{1}{8} \left(\frac{1}{4} \right) + \frac{1}{8} \times \left(\frac{1}{4} \right)^2 + \frac{1}{8} \left(\frac{1}{4} \right)^3 + \dots \right]$$

The expression in parenthesis is a declining geometric progression with ratio $r=1/4$. Applying the summation formula for an infinite geometric series

$$\sum = \frac{a}{1-r}$$

\sum = sum, a = first term of series, r = ratio.

$$\text{Product of A in equilibrium} = \frac{1}{2} - \frac{\frac{1}{8}}{1 - \frac{1}{4}} = \frac{1}{2} - \frac{\frac{1}{8}}{\frac{3}{4}} = \frac{1}{2} - \frac{4}{24} = \frac{8}{24} = \frac{1}{3}$$

The products of firm B in successive periods is

$$\text{Period } 2 = \frac{1}{2} \left[1 - \frac{1}{2} \right] = \frac{1}{4}$$

$$\text{Period } 3 = \frac{1}{2} \left[1 - \frac{3}{8} \right] = \frac{5}{16} = \frac{1}{4} + \frac{1}{16}$$

$$\text{Period } 4 = \frac{1}{2} \left[1 - \frac{11}{32} \right] = \frac{21}{64} = \frac{1}{4} + \frac{1}{16}$$

$$\text{Period } 5 = \frac{1}{2} \left[1 - \frac{43}{128} \right] = \frac{85}{256} = \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \frac{1}{256}$$

The output of B increases gradually but at a declining rate.

$$[\text{Product of B in Equilibrium}] = \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \frac{1}{256} + \dots$$

$$\frac{1}{4} + \frac{1}{4} \left(\frac{1}{4} \right) + \frac{1}{4} \left(\frac{1}{4} \right)^2 + \frac{1}{4} \left(\frac{1}{4} \right)^3 + \dots$$

$$\Sigma = \frac{a}{1-r} = \frac{1/4}{1-\frac{1}{4}} = \frac{\frac{1}{4}}{\frac{3}{4}} = \frac{1}{3}$$

Thus the Cournot Solution is stable. If there are n firms in the industry, each firm will provide $\frac{1}{n+1}$ of the market and the industry output will be $\frac{n}{n+1}$. As more firms are assumed to exist in the industry, the higher the total quantity supplied and hence the lower the price. The larger the number of firms, the closer the output and price to the competitive level is. Firm A chooses its output Q_A on the assumption that the output level of firm B is fixed at Q_B .

Similarly, Q_B is chosen on the assumption that Q_A can be treated as fixed by firm B. Cournot's model can best be explained by using isoprofit curves and reaction curves. Suppose total market supply is Q . Where $Q = Q_A + Q_B$ and $P = f(Q_A + Q_B)$. The profit maximization problem of firm A, $\text{Max } \Pi_A = PQ_A - C_A$ given Q_B . This implies that given any belief about firm B's output, Q_B , there will be a specific optimal output for firm A. This means there is a functional relationship between Q_B & the optimal output of firm A.

$Q_A = f_A(Q_B) \Rightarrow$ a reaction function of firm A. This function shows how firm A reacts to its expectation about firm B's output. $Q_B = f_B(Q_A) \Rightarrow$ a reaction function of firm B. The reaction function can be derived from isoprofit functions containing Q_A & Q_B . An isoprofit curve of firm A is the locus of points defined by the level of output of A and his rival B which yields to firm A the same level of profit. Similarly, an isoprofit curve of firm B is the locus of points of different levels of output of his competitor and his own, which yields to B the same level of profit. For substitute commodities, isoprofit curves are concave to the axis of the firm to which it relates. The level of profit declines as we move away from horizontal axis for firm A and from the vertical axis for firm B.

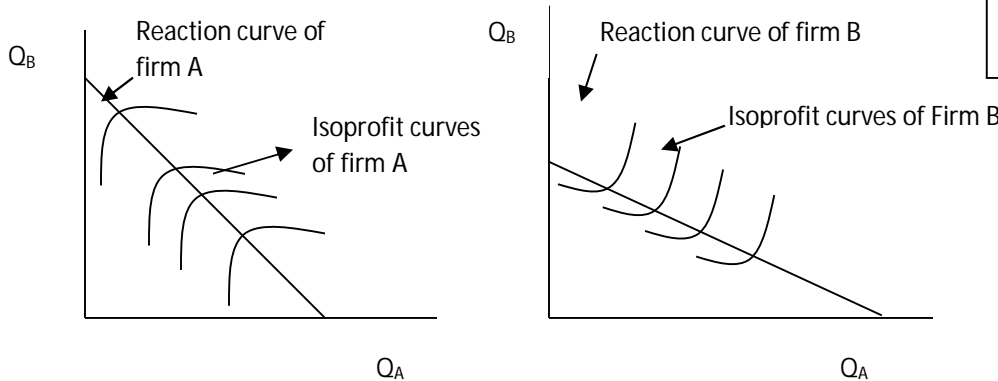
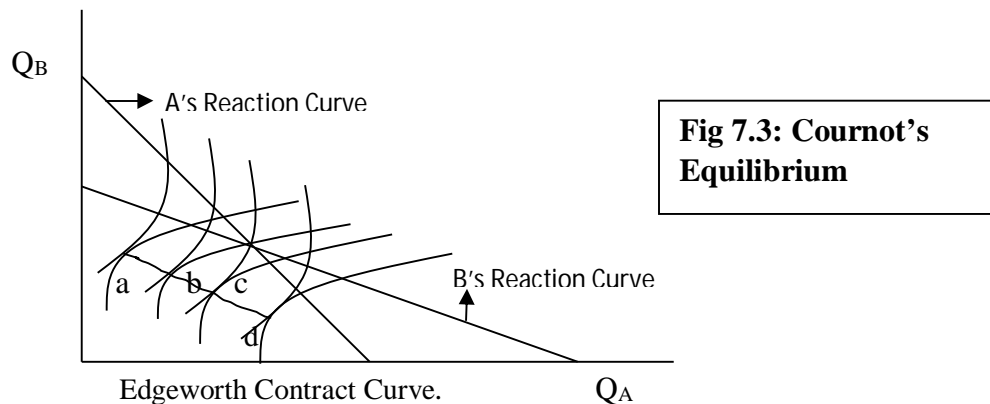


Fig 7.2: Action and reaction curves

The shape of the isoprofit curve (concavity) shows how firm A (B) reacts to firm B(A). For firm A the highest points of successive isoprofit curves lie to the left of each other & for firm B the highest point of the isoprofit curves of firm B lie to the right of each other as we move to curves further away from the QB axis. If we join the highest point of isoprofit curves, we obtain firms reaction curve. The reaction curve of firm A(B) is the locus of points of highest point that firm A(B) can attain given the level of output of rival firm B (A). It is called reaction curve because it shows how firm A (B) will determine its output as a reaction to B's (A's) decision to produce certain level of output.

Cournot's Equilibrium

In Cournot's model it is assumed that the firm expects the other firm to keep its output at the current level while making decisions regarding its own output. At equilibrium each firm acts independently on the assumption that the other firm will not be acting under similar behavioral pattern. Given these assumptions, stable equilibrium in this model is attained at the intersection of the two reaction curves. This adjustment will continue until point e is reached. Thus e is stable equilibrium. Each firm maximizes its own profit. But the industry profit or the joint profit is not maximized. This can be seen by Edgeworth contract curve which traces the point of tangencies of the two firms' iso profit curve.



Point e is sub optimal and total industry profit will be higher if firms move away from it on any point between a and b on the contract curve. Mathematical Version of Cournot's Model: Assume that the inverse demand facing the duopolist is $P=100 - 0.5Q$ and cost functions of each are $C1 = 5Q1$ & $C2 = 0.5Q2^2$. Find the optimal levels of output, $Q1^*$ & $Q2^*$.

SOLUTION

$$\text{Given } P = 100 - 0.5Q \quad Q = Q_1 + Q_2$$

$$C_1 = 5Q_1$$

$$C_2 = 0.5Q_2^2$$

$$\Pi_1 = R_1 - C_1$$

$$R_1 = P \cdot Q_1$$

$$\begin{aligned} \Pi_1 &= [100 - 0.5(Q_1 + Q_2)]Q_1 - 5Q_1 \\ &= 100Q_1 - 0.5Q_1^2 - 0.5Q_1Q_2 - 5Q_1 \\ &= 95Q_1 - 0.5Q_1^2 - 0.5Q_1Q_2 \end{aligned}$$

F.O.C

$$\frac{d\Pi_1}{dQ_1} = 0$$

$$95 - Q_1 - 0.5Q_2 = 0$$

Solving for Q_1 . We get reaction curve for firm 1.

$$Q_1 = 95 - 0.5Q_2$$

$$\Pi_2 = R_2 - C_2$$

$$= P \cdot Q_2 - C_2$$

$$= [100 - 0.5(Q_1 + Q_2)] Q_2 - 0.5Q_2^2$$

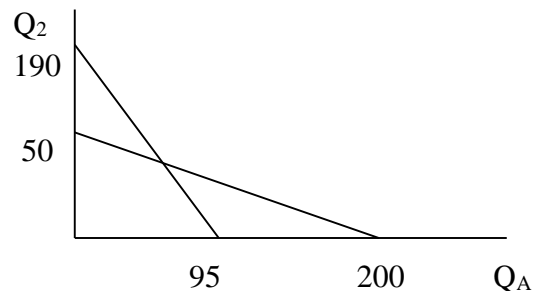
F.O.C.

$$\frac{d\Pi_2}{dQ_2} = 0 \quad 100 - 0.5Q_1 - 2Q_2 = 0$$

Solving for Q_2 gives us reaction curve for firm 2.

$$Q_2 = 50 - 0.25Q_1$$

By drawing the two reaction curves we can get Cournot's equilibrium.



Equilibrium quantities for firm 1 and firm 2 are created by solving simultaneously the two reaction curves (functions).

$$Q_1 = 95 - 0.5Q_2$$

$$Q_2 = 50 - 0.25Q_1$$

$$Q_1 + 0.5Q_2 = 95$$

$$Q_2 + 0.25Q_1 = 50$$

$$Q_1 + 0.5Q_2 = 95$$

$$\underline{-4Q_2 - Q_1 = -200}$$

$$-7/2 Q_2 = -105$$

$$Q_2 = -105 \times -2/7 = 30$$

$$Q_1 = 95 - 0.5(30)$$

$$Q_1 = 95 - 15 = 80$$

$$\text{Total output} = Q_1 + Q_2 = 80 + 30 = 110$$

$$\text{Price } P = 100 - 0.5Q$$

$$P = 100 - 0.5(110)$$

$$P = 100 - 55 = 45$$

$$\begin{aligned} MR_1 &= \frac{dTR_1}{dQ_1} = \frac{d(100Q_1 - 0.5Q_1^2 - 0.5Q_1Q_2)}{dQ_1} \\ &= 100 - Q_1 - 0.5Q_2 \\ &= 100 - 80 - 15 = 5 \end{aligned}$$

$$\begin{aligned} MR_2 &= \frac{dTR_2}{dQ_2} = \frac{d[100Q_2 - 0.5Q_1 - 0.5Q_2^2]}{dQ_2} \\ &= 100 - 0.5Q_1 - Q_2 \\ &= 100 - 40 - 30 = 30 \end{aligned}$$

$$MR_1 = 5 \text{ and } MR_2 = 30$$

That is the firm with the larger output has the smaller marginal revenue.

Profits of the duopolists are

$$\begin{aligned} \Pi_1 &= TR_1 - C_1 \\ &= P_1Q_1 - C = 45(80) - 5(8) = 3200 \end{aligned}$$

$$\begin{aligned} \Pi_2 &= TR_2 - C_2 \\ &= P_2Q_2 - C_2 = 45(30) - 0.5(30)^2 = 900 \end{aligned}$$

relevant demand for the firm for prices above P is the Ed segment of the expected sales curve. The upper part of the demand curve has high price elasticity while the lower part has lower price elasticity. The marginal revenue is discontinuous at E . The MR has two segments, segment dA corresponds to the upper part of the demand curve, while the segment from point B corresponds to the lower part of the kinked demand curve.

According to this theory MC usually passes through the discontinuous part of the MR. The equilibrium of the firm is defined by the point of the kink because at any point to the left of the kink, MC is below the MR, while to the right of the kink MC is larger than the MR. Thus the total profit is maximized at the point of the kink. This model explains why price and quantity sometimes remain 'sticky' while costs (demand) are changing.

C. Bertrand's Duopoly Model

Bertrand developed his duopoly model in 1883. He assumes that each firm expects that the rival will keep price constant irrespective of his own decision about price. Given the expected price of its rival, the firm chooses a profit maximizing price for itself. Firms are assumed to produce a homogeneous product and the two firms compete over price. The reaction curves, in this model, are derived from the isoprofit curves representing different combinations of prices of the two firms yielding the same profit for the firms.

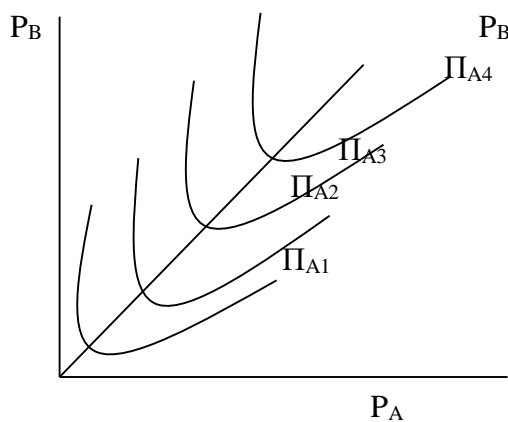


Fig 7.5.a: Bertrand's reaction curve of firm A

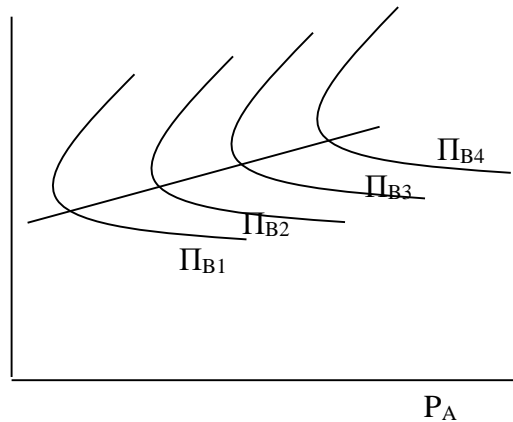


Fig7.5.b: Bertrand's reaction curve of firm B

Bertrand Equilibrium

The isoprofit curves are convex to the price axis of the firm. This is so because to maintain the certain level of its profit the firm has to reduce price up to a certain level and expand sales if the other firm is reducing. The lower the isoprofit curves, the lower the level of profits. The minimum points of the isoprofit curves of A lie to the right of each other, reflecting the fact that as firm A moves to a higher level of profit, it gains some of the customers of B, when the latter increases its price even if A also raises its prices. The reaction curve of the firm is derived by joining the lowest points of its isoprofit curves.

The reaction curves show how firms under Bertrand model react to each other's price choices. Stable equilibrium will be established when the firms find their expectations about each other's price correct. This occurs at the intersection of the reaction curves. For example, if firm A charges price P_{A1} , firm B will change B_1 , because on the Bertrand assumption, this price will maximize B's profit (given P_{A1}). Firm A will react to this decision of its rival by charging a higher price P_{A2} . This action and reaction continues until point e is reached. The same equilibrium will be reached if firms started by charging a price higher than B_e or A_e .

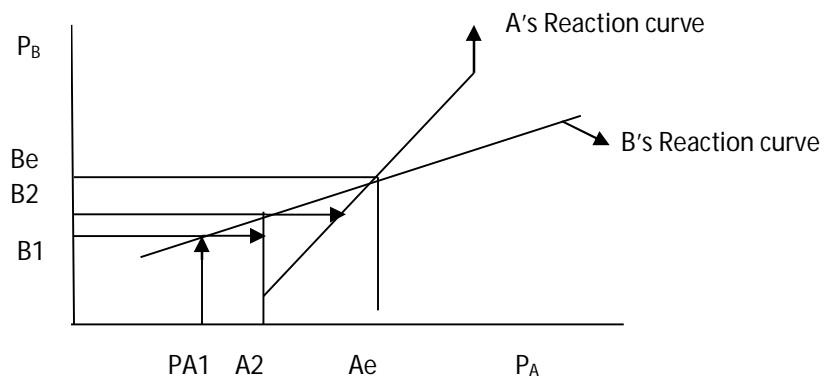


Fig 7.6: Bertrand's firm equilibrium

Bertrand model also does not lead to maximization of the industry (joint) profit, due to the fact that firms behave naively, by always assuming that their rival will keep its price fixed, and they never learn from past experiences. Bertrand model leads to a stable equilibrium derived by the point of intersection of the two reaction curves. If their products are assumed to be homogeneous each firm must charge the same price in equilibrium. If they do not, the one

offering the lower price would actually get the whole demand. Then, equilibrium is likely to be established where $P = MC$.

This is so because if the equilibrium price is greater than MC , then each firm will have an incentive to undercut the price and take all the customers away. This incentive to cut prices is eliminated when the two firms charge an identical price equal to the MC , similar price to the competitive equilibrium, and the industry profit will be zero.

D. Stackleberg Duopoly Model

This model was developed by German economist Heinrich Von Stackleberg and it is an extension of Cournot's Model. This model refers to a situation where one of the two firms is a sophisticated leader and the other is follower. The leader recognizes that his competitor acts on the Cournot assumption. This recognition allows the leader to determine the reaction function of the follower firm and incorporate it into its optimization problem. Given the reaction function of the follower, the leader tries to maximize its profit operating on the isoprofit curve that is closest to its quantity axis. This is attained when the reaction function of the follower is tangent to the isoprofit curve of the leader.

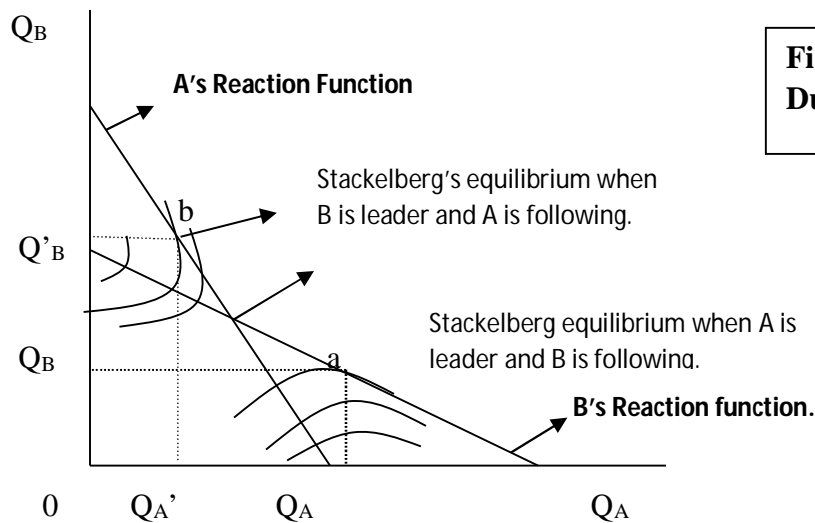


Fig 7.7: Stackleberg Duopoly

When firm A (B) is leader, it chooses to set its output at the level which maximizes its profit given B's (A's) reaction curve. Firm A(B) acting as a monopolist will produce $Q_A(Q_B)$ and firm B(A) will react by producing $Q_B(Q_A)$ according to its own reaction curve. In such situation stable equilibrium will be attained if and only if there is a dominant firm and if the rival accepts its leadership. However, if both firms feel that they are dominant there will not be stable

equilibrium. The situation is known as Stackelberg's disequilibrium and the effect is price war until one of the firm surrenders and acts or agrees to act, as a follower. Or most firms learn and collusion is reached. If both feel they are dominant, both produce too much output → continuous price fall (price war) → both will lose.

Numerical Example.

$$P = 100 - 0.5Q \text{ where } Q = Q_1 + Q_2$$

$$C_1 = 5Q_1 \quad c_2 = 0.5Q_2^2.$$

1. Calculate Q_1 , Q_2 , Π_1 , Π_2 at Stackelberg's equilibrium when firm 1 is a dominant leader, and firm 2 is a follower.
2. Do the exercise again when firm 2 is a leader and when firm 2 is a leader and firm 1 is a follower.
3. Compare the profit with Cournot's profit.

$$\text{Given } P = 100 - 0.5(Q_1 + Q_2) \quad C_1 = 5Q_1 \quad C_2 = 0.5Q_2^2$$

Find the isoprofit function of firm 1 (The leader)

$$\begin{aligned} \Pi_1 &= P \cdot Q_1 - TC_1 \\ &= [100 - 0.5Q_1 - 0.5Q_2] Q_1 - 5Q_1 \\ &= 100 Q_1 - 0.5Q_1^2 - 0.5Q_2 Q_1 - 5Q_1 \\ &= 95Q_1 - 0.5Q_1^2 - 0.5Q_2 Q_1 \text{ (17 isoprofit function of firm 1).} \end{aligned}$$

Find reaction function of firm 2 (follower)

$$\begin{aligned} \Pi_2 &= P \cdot Q_2 - TC_2 \\ &= (100 - 0.5Q_1 - 0.5Q_2)Q_2 - 0.5Q_2^2 \\ &= 100 Q_2 - 0.5 Q_1 Q_2 - 0.5 Q_2^2 - 0.5Q_2^2 \\ &= 100 Q_2 - 0.5Q_1 Q_2 - Q_2^2 \end{aligned}$$

The reaction function is found by taking the partial derivatives of the profit function and equate it to zero.

$$\frac{\partial \Pi_2}{\partial Q_2} = 100 - 0.5Q_1 - 2Q_2 = 0$$

$$Q_2 = 50 - 0.25Q_1 \longrightarrow [2]$$

Substitute [2] into [1].

$$\Pi_1 = 95Q_1 - 0.5Q_1^2 - 0.5Q_1 [50 - 0.25Q_1]$$

$$\Pi_1 = 95Q_1 - 0.5Q_1^2 - 25Q_1 + 0.125Q_1^2$$

$$\Pi_1 = 70Q_1 - 0.375Q_1^2$$

Find first order condition.

$$\frac{\partial \Pi_1}{\partial Q_1} = 70 - 0.75Q_1 = 0$$

$$70 = 0.75Q_1, \quad Q_1 = 93.33$$

$$\Pi_1 = 70 \times 93.33 - 0.375 [93.33]^2$$

$$\Pi_2 = 100Q_2 - 0.5Q_1Q_2 - Q_2^2 = 6531 - 3264.33 = 3266.67 \approx 3267$$

$$= 100[26.7] - 0.5 [93.33][26.7] - 26.7]^2 = 2670 - 1245.955 - 712.89 = 711.155$$

7.2.2. Collusive Oligopoly

To avoid the possible consequences of oligopolistic rivalry (price war) firms sometimes decide to co-operate in their decision – enter in to collusive agreements. This collusive agreement has two different forms.

7.2.2.1. Cartel

A Cartel is a formal organization of producers within an industry that determines policies for all firms in the cartel with a view of increasing total profit of the cartel. We have two types of Cartel:

A. Cartel Aiming at Joint Profit Maximization

It is also called a centralized cartel. This type of cartel may imply a direct argument among firms with the aim of reducing uncertainty arising from their mutual interdependence. In this case, the aim of the cartel is joint profit maximization which is similar to that of multi-plant monopoly (a monopoly with several plants). We concentrate on pure oligopoly where all firms produce homogeneous products. The members of the cartel appoint a central agency to which they delegate authority to decide not only total quantity and optimal price but also the allocation of production and distribution of the maximum joint profit among members of the cartel.

The central agency, in order to determine the optimal output and price level, has to assess the market. It should know the cost figures of each firm and the market demand curve with the corresponding MR curve. Then, the central agency, set price and output by marginalist law, i.e., $MR = MC$ (equate MC, which is obtained through horizontal summation of the MCs of the

individual members, with the industry MR). And they allocate production among firms in such a way $MR = MC_1 = MC_2 \dots MC_n$ (The rule for multi-plant monopoly). For simplicity assume that there are only two firms in the cartel (firm 1 and firm 2).

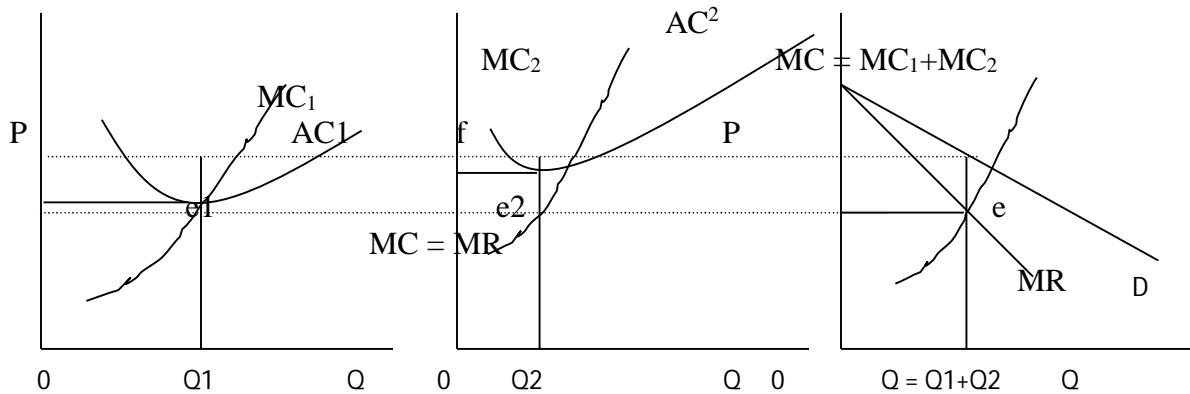


Fig 7.8: Equilibrium of joint profit maximization

Joint profit is maximized at point e, total output Q, and price P. Then the central agency allocates the production among the two firms by equating the MR to the individual MCs. Thus firm 1 produce Q₁, and firm 2 produces Q₂, and total output is the sum of the two.

Exercise: Assume there are two firms in the cartel market aiming to maximize the joint profit. The marked dd curve is $P = 100 - 0.5Q$. Where $Q = Q_1 + Q_2$ and have the following cost structure. $C_1 = 5 Q_1$ and $C_2 = 0.5Q_2^2$. Find Q₁, Q₂, Π_1 and Π_2 .

In practice cartel may not achieve the maximum profit.

1. They might make a mistake in estimation of the demand and MC. If they under estimate the elasticity, price will be set higher. This benefits the high cost firm.
2. Slow process of cartel negotiation. Cartel agreements take a long time to negotiate due to the differences in size, costs & markets of the individual firms. During the negotiation period the actual market condition might be changed when they reach at agreement.
3. Stickiness of negotiated price. They will take longer time until the prices are revised to the existing conditions. Because of this, profit may not be maximized all the time. There is always a time lag between the market condition and the price setting.
4. Bluffing attitude of some members of the cartel during the negotiation process. Some members reduce price to expand their sale and attain larger market share before the final arrangement. This leads to miscalculations of the real monopoly equilibrium price and output.

5. The existence of high cost firms. Some firms might have very high cost so that they can not survive with low price. Due to this reason they may refuse to be a member of a cartel. And for the sake of these firms, price can be set higher than does not maximize cartels profit.
6. Fear of entry. If cartel gets higher profit, new firms might enter into the industry and drive the market price lower.

B. Market Sharing Cartel

Dear learner! This form of collusion is very common. The firms agree to have same price and share the market. They share the market in two different ways.

▪ Non- Price Competition Agreement

They agree to charge same price and not to sell at a price below the cartel price but keep a considerable degree of freedom to vary the style of their products and selling activities. The price is negotiated by bargaining with low cost firms pressing for a lower price and the high cost firms for a higher price. The agree price must be such as to allow some profit to all members. In this case firms are allowed to compete on a non-price basis. This form of Cartel is unstable or loose cartel.

If firms have the same costs, it will be relatively easy to come to agreement on one particular price, such as monopoly price. However, if members have differential cost conditions, there exists strong incentive for low cost members to break away from the cartel openly and charge a lower price Or through secret price discount to the buyers. When other members comes to know their loss of customers, they may go out of the cartel, and a price war and instability may develop until only the fittest low cost firms survive.

*Huge cost differentiation leads to price war and the cartel becomes unstable.

▪ Sharing the Market by Agreement on Quota

Firms decide a fixed amount each member may sell on the agreed price. If they have similar costs a monopoly solution will be reached with the market being shared equally among member firms. However, if they have differential cost condition quotas and shares of the market will differ. And it is determined through bargaining on Past levels of sales, Productive Capacity, Cost difference and Geographical differences. Most of the decisions are easily violated and cartel agreements, in the case of cost differences, are highly unstable. It should be obvious that the

cartel models collusive oligopoly closed models. The instability of cartels is intensified if new firms can enter the market, because the new entrant may not want to join the cartel and compete the cartel members from outside by lowering the price level.

7.2.2.2. Price Leadership

It is a coordinated behavior of oligopolists, where one firm sets the price and the other firms follow because it is an advantage for them or because they prefer to avoid uncertainty about their competitors' reaction even if it is a departure of the followers from their profit maximizing position.

A. The Low Cost Price Leadership

Assumption – there are two firms producing homogeneous product at different cost. In the case of cost differences the high cost firms may agree to adopt whatever price the lowest cost firm sets in the market, in order to avoid price war that will be to their disadvantage. The low cost firm sets price at $MR = MC$ level for it self and the high cost firm adopts it even if it doesn't maximize its profit. For two firms, firm 1 having lower cost than firm 2, costs and market demand are given as $C_1 = 5Q_1$, $C_2 = 15Q_2$, $P = 105 - 2.5Q$ where $Q = Q_1 + Q_2$. Derive the equilibrium under the assumption of the low cost price leadership.

SOLUTION

$$P = 105 - 2.5 (Q_1 + Q_2)$$

$$P = 105 - 2.5 (Q_1 + Q_1) \quad \text{Because} \quad Q_1 = Q_2$$

$$P = 105 - 5 Q_1$$

$$\Pi_1 = P \cdot Q_1 - C_1 = (105 - 5Q_1)Q_1 - 5Q_1 = 100 Q_1 - 5Q_1^2$$

$$\text{F.O.C.} \quad P = 105 - 5Q_1$$

$$\frac{d\Pi}{dQ_1} = 0 \quad P = 105 - 5(10) \quad P = 45$$

$$100 - 10Q_1 = 0 \quad 100 = 10Q_1 \quad Q_1 = 10$$

Firm 2 also produces 10 at $P = 45$, which is not profit maximizing level. Compare the profit of firm 2 when it adopts the price of the leader and when it charges price which is determined by the equality of MR_2 & MC_2 .

Solution

$$P = 105 - 5Q_2$$

$$TR_2 = P \cdot Q_2 = 105Q_2 - 5Q_2^2$$

$$MR_2 = MC_2$$

$$105 - 10Q_2 = 15 \quad P = 105 - 5(9)$$

$$\begin{aligned}
 105 - 15 &= 10 Q_2 & = 105 - 45 &= 60 & 90 &= 10 Q_2 & Q_2 &= 9 \\
 \Pi Q_2 &= \text{at } P = 55 & Q_2 &= 10 & \Pi Q_2 &= \text{at } P = 60 & Q_2 &= 9 \\
 \Pi &= TR - TC & & & \Pi &= TR - TC & & \\
 55 * 10 - 15 * 10 & & & & 60 * 9 - 15 * 9 & & & \\
 550 - 150 &= 400 & & & 540 - 135 &= 405 & &
 \end{aligned}$$

B. The Dominant Firm Price Leader

The model is appropriate when there exists one large dominant firm with a considerable market share and some other firms with small market share. The small firms may feel that it is difficult to compete with the dominant firm and may simply adopt whatever price it is set in the market by the dominant firm and adjust their output levels to maximize profit like perfectly competitive firms. The dominant firm is assumed to know the MC curves of the smaller firms, which he can add horizontally and find the total supply by the small firms at each price.

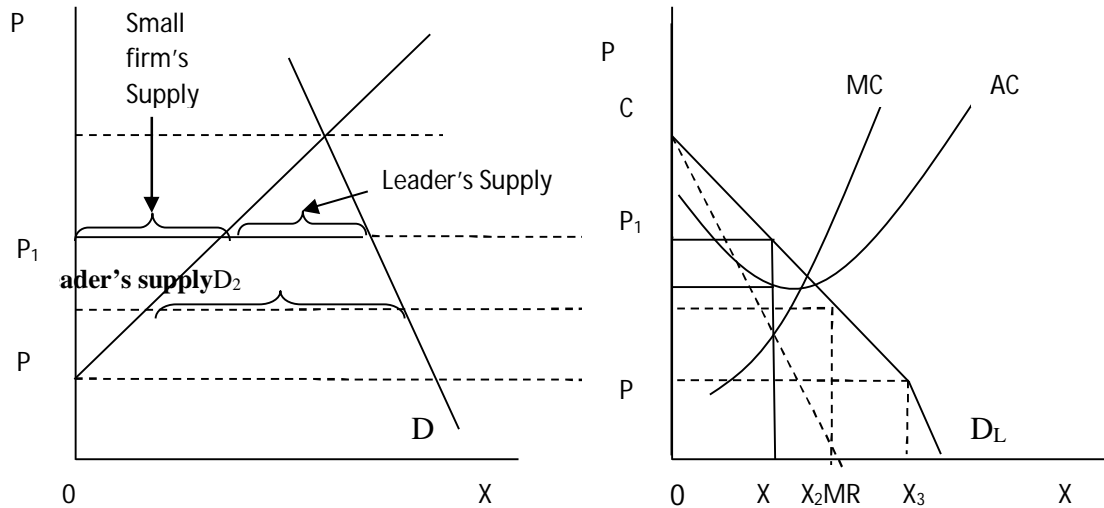


Fig 7.9: Equilibrium of dominant firm price leadership

With this knowledge the leader can obtain his demand curve. At each price, the dominant firm can sell the part of the market demand that could not be satisfied by the small firms. The demand for dominant firm is the difference between market demand and supply of the smaller firms. For example, at price P1, the demand for the leader's product is zero, because the total quantity demanded (D1) is supplied by the small firms. As price falls below P1 the demand for the leader's product increases.

At P2 the total demand is D2; the part P2A is supplied by the small firms and the remaining AD2 is supplied by the leader. At P3 total demand is D3 and the total quantity is supplied by the leader

since at that price the small firms do not supply any quantity. Below P_3 the market demand coincides with the leader's demand curve.

The dominant firm maximizes its profit by equating its MC to MR, while the smaller firms are price-takers, & may or may not maximize their profit, depending on their cost structure. However for the leader to maximize profit, he has to be sure that the small firms follow his price and also they are supplying (producing) the right quantity.

$$D_L = D - S_f \quad D_L = \text{Demand for the dominant (Leader)}$$

$$C_L = \text{Leader's Cost} \quad D_m = \text{Market Demand} \quad S_f = \text{Total supply of the followers}$$

This model is called partial monopoly because the larger firm acts as a monopoly and the smaller firms are price takers and act like the firm in pure competition and hence the model is a combination of the theory of pure competition and the theory of monopoly.

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$$C_L = \text{Leader's Cost} \quad D_m = \text{Market Demand} \quad S_f = \text{Total supply of the followers}$$

Example:

$$D_m = 50 - 0.3p \quad C_L = 4Q_L$$

$$S_f = 0.2p$$

$$D_L = D_m - S_f = 50 - 0.5p \quad 0.5p = 50 - Q_L \quad p = 100 - 2Q_L^2$$

$$TR = 100Q_L - 2Q_L^2 \quad MR = 100 - 4Q_L$$

$$C_L = 2Q_L \quad MC = 2 \quad MR = MC \quad 100 - 4Q_L = 4$$

$$4Q_L = 100 - 4 = 96$$

$$Q_L = 96/4 = 28$$

$$p = 100 - 2Q_L = 100 - 2(28) \quad p = 100 - 56 = 44$$

$$D_m = 50 - 0.3(44) = 50 - 13.2 = 36.8$$

$$S_f = D_m - Q_L = 36.8 - 28 = 8.8$$

$$\text{Or } S_f = 0.2p = 0.2(44)$$

This model is called partial monopoly because the larger firm acts as a monopoly and the smaller firms are price takers and act like the firm in pure competition and hence the model is a combination of the theory of pure competition and the theory of monopoly.

Chapter Seven: Review questions

Part I: Choose the best answer from the given alternatives.

1. Reaction function of a firm tells us that:
 - A) The equilibrium output of a firm as a function of the equilibrium output of its competitor
 - B) The equilibrium price of a firm as a function of the equilibrium price of its competitor.
 - C) The equilibrium output of a firm as a function of the equilibrium price of its competitor.

- D) The output level that satisfies the market demand of a particular output.
 E) A&B F.C&D
2. One of the following **characterizes** oligopolistic market structure:
- A) Interdependency or rivalry among firms
 - B) Extreme competition between firms.
 - C) Few large firms in the market.
 - D) Barrier to entry.
 - E) all of the above
- 7) There is no widely accepted single model in oligopoly market because:
- A) Firms are interdependent and decision making is very complex.
 - B) There are various ways of reactions among competitors.
 - C) Uncertainty in the market.
 - D) The possibility to have homogenous or heterogeneous product.
 - E) all are correct
- 8) Which one of the following is **not true** about Kinked –demand model?
- A) It shows the phenomena of price rigidity in oligopolistic market.
 - B) Demand is less elastic for a change in price below the established price.
 - C) Price change is possible if the firm’s MC is equal to the discontinuous MR curve.
 - D) Demand is highly elastic for a change in price above the established price.
 - E) all of the above
- 9) According to Stckeleberg’s duopoly model:
- A. Both firms are naive.
 - B. The sophisticated leader achieves more profit than the cournot’s equilibrium.
 - C. The follower benefits at the expense of the leader.
 - D. None of the above
- 10) Let two firms X and Y in oligopolistic market agree, Firm Y to set the market price and then firm X to follow that price because of the fact that the total cost of X is greater than Y. this form of price leader ship is:
- A) Barometric price leader ship
 - B) Dominant firm price leader ship
 - C) Low cost firm price leader ship

D) None of the above

11) One is **wrong** about the objective of forming a cartel :

A) To reduce Uncertainty

C. To increase competition

B) To avoid uncertainty

D. None of the above

12) In a market sharing cartels through the determination of quota, the monopoly solution will emerge with the market being shared equally among the members, if

A) Firms have different costs

C. Prices are different

B) Firms have identical costs

D. None of the above

Part II: Work Out Questions

1) Suppose the market demand function for a certain product “X” in duopoly market is: $P=400-2X$, where $X=X_1+X_2$, and the cost functions of the two firms are $C_1= 20X_1$ and $C_2= 2X_2^2$ respectively. Based on the given data answer the following questions:

A. Find the reaction functions of both firms

B. Compute **cournot’s** equilibrium outputs (X_1 and X_2) and equilibrium price

C. Calculate the profit of each firm at equilibrium

CHAPTER EIGHT

INTRODUCTION TO ASYMMETRIC INFORMATION

Introduction

Dear learner! In this chapter we would like to instigate you with some of the basic concepts in the asymmetric information. We start with the definition of asymmetric information, discussing how it happen and broaden our scope on gradual basis towards the discussion of how asymmetric information leads to adverse selection and moral hazard.

Chapter objectives: Generally speaking, the learner will be expected to get familiar with the following key issues:

- What is asymmetric information, adverse selection and moral hazard all about;
- What is the main cause for asymmetric information and its consequences and;
- The problems associated with asymmetric information and the way to reduce it.

8.1. The Concept of Asymmetric Information

Dear learner! For most of the microeconomics course, we have assumed that consumers and producers have complete information about the economic variables that are relevant for the choice they face-in other words, we have assumed that the agents have perfect (symmetric) information. Now we will see what happens when some parties know more than others-i.e. when there is asymmetric information.


Definition: Asymmetric information is characteristic of many business situations. Frequently, a seller for a product knows more about its quality than the buyer does. Workers usually know their own skills and abilities better than employers. And business managers know more about their firm's costs, competitive position, and investment opportunities than-do the owners of the firm.

Asymmetric information explains many institutional arrangements in our society. It is a reason why automobile companies offer warranties on parts and services for new cars; why firms and employees sign contracts that include incentives and rewards; and why the shareholders of corporations need to monitor the behavior of the firm's managers. Therefore, asymmetric

information meant a situation in which different agents have different amounts of information about a good.

We begin by examining a situation or the problems in which the sellers of a product have better information about its quality than buyers have or buyers have better information than the sellers. We will see how this kind of asymmetric information can lead to market failure, and how buyers can avoid some of the problem associated with asymmetric information by giving potential buyers signals about the quality of their product. Finally, we will see that labor markets may operate inefficiently when employees have better information about their productivity than employers have.

Dear learner, given the above description of asymmetric information, let you reflect on your views on the following lines.

 *Define the asymmetric information as a working concept in your day to day life. It would be appreciated if you substantiate your definition with real world examples.*

8.2. Adverse Selection

Depending on the fact that one side in a contractual agreement, the buyers or the sellers, have information that the other part does not have, only some buyers or sellers will want to enter into the contract. Only the ones that will profit the most from the contract will do so. Moreover, those are, typically, the ones the other part wants to avoid. In other words adverse selection means, depending on asymmetric information, different agent act in different ways before agreeing on a contract.

Let's see two classical examples of adverse selection: the market for insurance and the market for used cars. Note, however, that the concept is possible to apply on many types of goods and services.

Example-1: Insurance Market

The price of insurance largely depends on the probability that the insurance firm will have to pay, for instance, on the probability that your bike is stolen. If there is a high probability, the price of insurance will also be high.

Different people differ in how well they keep after their belongings, and the risk that a careless person will get her bike stolen is much higher than that a careful person will get hers stolen. However, the insurance firm can't see a difference between careless and careful people, and therefore charges them the same price corresponding to an average of the risks.

This, however, makes the insurance a good deal for the careless people, but it might make it too expensive for the careful people. They will probably not lose their bikes anyway. Then only the careless people remain in the market; the ones that constitute a high risk for the insurer. When the insurer realizes that all people buying insurance are high-risk people, they will have to increase the price even more. The high-risk people will then have pushed the low-risk people out of the market, even though the latter might be fully willing to pay for insurance.

Example-2: Used Cars Market


Suppose there are 100 used cars in a market, and that they are of two different levels of quality: Half of them are of high quality (H-cars) and half are of low quality (L-cars). The seller wants at least 50,000 for an L-car and at least 100,000 for an H-car, whereas the buyers are prepared to pay at most 60,000 for an L-car and 110,000 for an H-car. There are consequently possibilities for trades that are beneficial for both sides. If there had been two submarkets, one for L-cars and one for H-cars, people could have negotiated prices between 50,000 and 60,000 for L-cars and between 100,000 and 110,000 for H-cars.

However, if they are sold in the same market, the buyers can't tell them apart. Neither can she ask the sellers, as all sellers would say that their car is an H-car. If the chance that she will get an L- or an H-car is 50% each, the buyer could think of this as a lottery. Suppose, for simplicity, that the buyer is risk neutral (so that she does not demand a risk premium for taking a risk). She would then be willing to pay the expected value of the car, i.e.

$$50\% * (60,000) + 50\% * (110,000) = 85,000$$

She will then maximally offer 85,000. However, at that price no seller is prepared to sell an H-car. Their lowest price for an H-car is 100,000. Consequently, they withdraw the H-cars from the market and only sell L-cars.

Then, however, the probability of getting an L-car is no longer 50%, but instead 100%. Since the buyer realizes this, she is prepared to pay a maximum of 60,000 for a used car, and the L-cars have pushed the H-cars out of the market. This outcome is not efficient, since there are cars that the buyers have a higher valuation for than the sellers do, but that are not traded.

 *Define adverse selection as a working concept in your day to day life. It would be appreciated if you substantiate your definition with real world examples.*

8.3. How to Reduce Problems with Adverse Selection?

Now we will examine another important mechanism through which sellers and buyers deal with the problem of asymmetric information: market signaling. The concept of market signaling was first developed by Michael Spence, who showed that in some markets sellers send buyers signals that convey information about a product quality.

Market Signaling is a behavior (sign) that makes it possible to distinguish an agent as being different from others. Indeed, there are several ways to reduce problems with adverse selection:

- ☞ Legislation: for instance, one could demand that sellers have to reveal the ingredients of (food) products. Thereby, buyers gain more information and we get less asymmetric information.
- ☞ Demand more information: insurers often demand, for instance, a medical examination before selling insurance.
- ☞ A firm could acquire a reputation for quality: the cost of selling an L-car as if it was an H-car, i.e. lying about the product, would then be too high, since that would damage the reputation. Therefore, the customer know that all the seller's cars are H-cars.
- ☞ One could also offer a warranty for the car's. since the probability that an L-car will break down is much higher than that an H-car will do that, a seller of L-cars cannot offer the guarantee. Thereby the sellers sort themselves into two groups, and for L-cars and one for H-cars.

The last two examples are variants of signaling. The idea with signaling is that the agents themselves signal to which group they belong. It is, of course, not enough that they say that they belong to a certain group. It must be a signal that the low-quality group cannot afford, so that truth telling is optimal.

Signaling in Labor Market

To see how market signaling works; let's look at a labour market, which is a good example of a market with asymmetric information. Suppose a firm is thinking about hiring some new people. The new workers (the sellers of labour) know much more about the quality of the labor they can provide than the firm (the buyers of labour). For example, they know how hard they tend to work, how responsible they are, what their skills are, and so forth. The firm will find these things out only after workers have been hired and have been working for some time. At the time they are hired, the firm knows little about how productive they will turn out to be.

Why don't firms hire workers, see how well they work, and then fire those with low productivity? Because this is often very costly. In many countries, and in many firms in the United States, it is difficult to fire someone who has been working more than a few months (the firm may have to show just cause or pay severance pay). Also, in many jobs workers do not become fully productive for at least six months. Before that time, considerable on-the-job training may be required, for which the firm must invest substantial resources. Thus the firm might not learn how good workers are for six months to a year. As a result, firms would be much better off if they knew how productive potential employees are before they hired them.

What characteristics can a firm examine to obtain information about people's productivity before it hires them? Can potential employees convey information about their productivity? Dressing well for the job interview might convey some information, but even unproductive people sometimes dress well to get a job. Dressing well is thus a weak signal-it doesn't do much to distinguish high productivity from low-productivity people. To be strong, a signal must be easier for high productivity people to give than for low-productivity people to give, so that high-productivity people are more likely to give it.

For example, education is a strong signal in labour markets. A person's education level can be measured by several things- the number of years of schooling, degrees obtained, the reputation of the university or college that granted the degrees, the person's grade point average, and so on. Of course, education can directly and indirectly improve a person's productivity by providing information, skills, and general knowledge that are helpful in work. But even if education didn't improve one's productivity, it would still be a useful signal of productivity because more productive people will find it easier to attain a high level of education (productive people tend to

be more intelligent, more motivated, and more energetic and hard-working characteristics that are also helpful in school). More productive people are therefore more likely to attain a high level of education to signal their productivity to firms and thereby obtain better paying jobs. And firms are correct in considering education a signal of productivity.

8.4. Moral Hazard

When one party is fully insured and cannot be accurately monitored by an insurance company with limited information, its behavior may change after the insurance has been purchased. This is the problem of moral hazard. Moral hazard occurs when the party to be insured can affect the probability or magnitude of the event that triggers payment. For example, if I have complete medical insurance coverage. I may visit the doctor more often than I would if my coverage were limited. If the insurance provider can monitor its insurees' behavior, it can charge higher fees for those who make more claims. But if the company cannot monitor behavior, it may find its payments to be larger than expected. With moral hazard, insurance companies may be forced to increase their premiums or even to refuse to sell insurance at all.

For more clarification, we can continue the insurance example from above in the following way: say that the careful person has managed to convince the insurance firm that she is, indeed, careful. Therefore, she constitutes a low-risk person, and she only has to pay a small premium to get the insurance. Say that she bought insurance for her bike, and that this guarantees her a new bike if the one she has is stolen. Before she bought insurance, she would have lost the full value of the bike if it had been stolen; now she will only lose the time it takes to get a new one. Consequently, there is much less reason for her to go through the trouble of taking good care of her bike. Therefore, the risk that the bike is stolen increases and she might now constitute a risk for the insurer that is as big as the careless people are.

Because she has insurance, her risk behavior has changed to the insurer's disadvantage. She only had to pay a low price since she is careful, but after she got insurance, she is no longer careful and should have had to pay a high price. Since the insurer cannot check if her risk-behavior has changed, she can take advantage of the firm and offload a larger share of the risk on them than she has paid for.

In summary, simply moral hazard means, depending on asymmetric information, when agents change their behavior after having agreed on a contract. That means one may be tempted to exploit the other's lack of knowledge. Note the difference between adverse selection and moral hazard: Adverse selection is about what happens before the agreement has been made. On the other hand, moral hazard is about what happens after it has been made.

8.5. How to Reduce Problems with Moral Hazard ?

The classical way to reduce problems with moral hazard in the insurance sector is to demand that the customer keeps a part of the risk. Usually, an insurer demands that the customer pays a certain amount herself, the so-called deductible. Thereby, the risk that she becomes overly careless is reduced.

Chapter – Eight Review Questions

- 1) Explain the difference between adverse selection and moral hazard in insurance markets. Can one exist without the other?
- 2) Why can asymmetric information between buyers and sellers lead to market failure when a market is otherwise perfectly competitive?
- 3) If the used car market is a “lemons” market, how would you expect the repair record of used cars that are sold to compare with the repair record of those not sold?

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- ❖ Robert H. Frank, Microeconomics and Behavior
- ❖ D.N.Dwivedi, 1997, Micro Economic Theory, 3rd Ed., Vikas Publishing
- ❖ C.L.Cole, Micro Economics: A Contemporary Approach.
- ❖ Ferguson & Gould's, 1989, Microeconomic Theory, 6th Ed.
- ❖ R.R. Barthwal, Microeconomic Analysis.
- ❖ D.S. Watson, Price Theory & Its Uses.
- ❖ Any other Intermediate Microeconomics book can also be used as a supplementary reading material.



ARBA MINCH UNIVERSITY

DISTANCE EDUCATION

ASSIGNMENT FOR MICROECONOMICS (ECON 1071)

Name:

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Date:

INSTRUCTIONS

- ✓ ***This assignment is to be completed and send to the University for Evaluation. Its maximum weight is 30%***
- ✓ ***Make sure that your exam contains seven (7) questions***
- ✓ ***Do not try to complete the assignment until you have covered all the lessons and reviewed the study guide and your exercises and activities.***
- ✓ ***Replication from other will result total cancellation of your marks***
- ✓ ***After successfully completing this assignment, be certain to write your name, ID.No and address on the cover page of your assignment.***

General instruction: Give the appropriate answer for the following questions

- 1) The production function for a firm is given by: $Q = 3K^2L^3$

Suppose that labor costs Birr 15 per unit and capital costs Birr 35 per unit. Then,

- A) Determine the quantity of labor and capital that the firm uses in order to maximize the output with total outlay of Birr 560? (3 points)
- B) Calculate maximum level of output? (1 point)
- C) Calculate MP_L and MP_K ? (1.5 points)
- D) Determine the factor intensity of the production process? And why? (0.5 point)
- E) State the returns to scale of the production process? (1 point)
- 2) Assume 'Timret Agro-Industry' using only labor and capital inputs for the production of *Teff*. In one production period they produced 400 quintals of *teff* by using 48 and 24, labor and capital respectively. But in the second production period they can produce 500 quintals of *teff* by using 60 and 30, labor and capital respectively. State the returns to scale of the above hypothetical production process? And briefly explain your reason? (3 points)
- 3) Suppose the utility function of a person consuming two commodities X and Y with income of 480 Birr is given by $U = 50X^{0.5}Y^{0.5}$. If the per unit price of X and Y is Birr 20 and 40 respectively. Then, find
- A) The utility maximizing level of consumption of X and Y ? (NB: use the Lagrangian Multiplier Method) (3 Points)
- B) The MRS_{XY} and MRS_{YX} at optimum & interpret the result? (1.5 Points)
- C) The maximum utility? (1 Points)
- D) The value of λ & interpret the value? (1.5 Points)
- 4) If the total quantity of the output of the factory changes from 200 to 400 units when the variable inputs (labor) changes from 9 to 25 units. Correspondingly, Total variable cost changes from Birr 600 to 1400, and the total fixed cost equals Birr 700. Calculate
- A) The marginal cost of producing the extra unit? (1 point)
- B) The total cost per unit output after the change? (1 point)
- C) The marginal product of the variable input? (1 point)

- 5) Fill in the following table about the summary characteristics of the four basic market models.
(4 points)

Characteristics	Market models			
	Pure competition	Pure Monopoly	Monopolistic competition	Oligopoly
Number of firms				
Type of product				
Control over price				
Conditions of entry				
Non - price competition				

- 6) In a perfectly competitive product and factor market, when labor is the only variable factor, the demand for labor for a firm is VMPL curve. But when labor is one of the several variable factors, the demand for labor for a firm is not simply the VMPL curve. For a two variable factor case (where the variable factors are labor and capital), explain, with the aid of graphs, how the demand for labor for a firm can be derived. (3 Points)
- 7) A health insurance company charging a single premium, for the company cannot distinguish between high risk and low risk individuals. High risk individuals may insure making it impossible to sell insurance. People who buy insurance know more about their general health than any insurance company can hope to know, even it insists on a medical examination. Because unhealthy people are more likely to want insurance, the proportion of unhealthy people in the pool of insured people increases. The asymmetric information between the insured people and the insurance company will result in a market failure. What is the form of market failure which will result from this information asymmetry? (3 points)