PG EC S2-01 (DSC)

TWO YEAR MASTER'S DEGREE COURSE

(CBCS in Accordance with NEP 2020)

SEMESTER - II

MICRO ECONOMIC THEORY - II

ECONOMICS

Surya Kumar Bhuyan School of Social Sciences

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

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COURSE INTRODUCTION

Micro Economics II is the first course of second semester of the M.A. in Economics programme of this University. This is the second course deals with Micro Economics as we have already studied about the Micro Economics in first semester of this programme as Micro Economics I.So this course basically covers the topics of Micro Economics which are not covered in the first semester course and enables the learners with various new knowledge and ideas of Micro Economics. This course comprises of 15 units and has been divided into two blocks. The first block comprises seven units and the second block comprises eight units.

The first and second unit shall discuss the markets and welfare.The first unit deals with first fundamental theorem of welfare economics,second theorem of welfare economics,concept of social optimum and equity-efficiency Trade-off. The second unit deals with market failure and the different causes of market failure, concepts of public good and externality. Apart from it this unit also explain the importance of property rights and how we can internalise externality through assigning property rights. The third unit deliberates on basic ideas and concepts of game theory to solve the problems occur frequently within economics.The fourth unit will introduce you about the concept of factor pricing, marginal productivity theory of distribution,equilibrium under perfect competition and imperfect competition in the factor market, modern theory of distribution and product exhaustion problem. The fifth unit explains the inter- temporal choice of investment decisions,computation of NPV and IRR and their relevance to choice of investment project, consumption as well as production decision under inter-temporal choice pattern.The sixth unit will help you to acquire knowlege about the individual behaviour towards risk, various types of risk an individual can possess, importance of the expected utility theorem,mean variance analysis and portfolio selection in the risk analysis. The seventh unit deals with the concept of real and nominal wages, marginal productivity theory of wages and determination of wages under imperfect market forms. This unit will also help you to understand the exploitation of labour and the role of trade union. The eight units will introduce you to the theory of rent. In this unit we will discuss the different types of rent, Ricardian theory of rent, modern theory of rent and rent element in other factors of production. The ninth unit deals with the theory of Interest. This unit will help you to understand the classical theory of interest, loanable funds theory of interest, liquidity preference theory and Hicks-Hansen synthesis to determine the rate of interest. This unit also discusses whether the Keynesian theory is an improvement over classical theory and loanable funds theory. The tenth unit outlines the theory of profit. This unit discusses the meaning of profit, how profit arises due to dynamic factors, the innovation theory of profit and the relation between uncertainty and profit. The eleventh unit of the

course discusses about the Economics of Insurance. This unit will help you to understand the concepts like Attitude towards risk, expected utility hypothesis, risk aversion and insurance, risk lover and gambling, measures for risk reduction, problems of insurance and risk pooling and spreading. The twelfth unit deals with the welfare economics. In this unit we will discuss the meaning of welfare economics, concept of social welfare, role of value judgment, Pareto optimality and economic efficiency and marginal condition of Pareto Optimun. The thirteenth unit discusses about the new welfare economics. This unit will make a comparative study of the Kaldor-Hicks welfare criterion and Scitovsky's double criterion of welfare. The fourteenth unit will help you acquire knowledge about the social welfare function. In this unit we will discuss Bergson-Samuelson social welfare function, grand utility possibility frontier and point of Constrained Bliss. The final unit deals with the major issues associated with economics of information like markets with asymmetric information, market failure and asymmetric information problem, quality uncertainty and the market for lemons, adverse selection problem and social insurance.

While going through a unit, you will notice some along-side boxes, which have been included to help you to know some of the difficult, unseen terms. Again, we have included some relevant concepts in "LET US KNOW" along with the text. And, at the end of each section, you will get "CHECK YOUR PROGRESS" questions. These have been designed to self-check your progress of study. It will be better if you solve the problems put in these boxes immediately after you go through the sections of the units and then match your answers with "ANSWERS TO CHECK YOUR PROGRESS" given at the end of each unit.

UNIT 1: MARKETS AND WELFARE-I

UNIT STRUCTURE

1.1 Learning Objectives

1.2 Introduction

1.3 First Fundamental Theorem of Welfare Economics

1.4 Second Theorem of Welfare Economics

1.5 Concept of Social Optimum

1.6 Equity-Efficiency Trade-off

1.7 Let Us Sum Up

1.8 Further Reading

1.9 Answers to Check Your Progress

1.10 Model Questions

1.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- learn how a general equilibrium attained in a perfectly competitive market can satisfy maximum social welfare or economic efficiency or Pareto optimality
- learn necessary or marginal conditions and total order conditions of Pareto optimality in lieu of perfect competition
- understand the concept of social optimum
- understand the concept of equity and efficiency
- find out why there exists a trade-off between equity and efficiency.

1.2 INTRODUCTION

Welfare economics is normative in nature. By evaluating social efficiency of a particular policy, normative economics or welfare economics prescribes a policy option which is economically as well as socially desirable. There is a possibility of welfare losses which is undesirable and desirable welfare gains due to allocation of resources or policy changes. This welfare losses or gain is the outcome of interdependence among various economic

agents of an economy. For example, a change in the price of one factor can easily change the price of other factors. This interrelationship among various parts of the economy means that certain particular change in one part of the economy affects the resource allocation in all other parts of it. Therefore, when one's welfare increases, it may decrease the welfare of others which leads to economic inefficiency in any change in allocation of resources or goods.

In this context, Italian economist Vilfredo Pareto (1848-1923) laid down three marginal conditions so that economic efficiency can be achieved. According to Pareto for the attainment of economic efficiency the marginal conditions to be satisfied in an economy are: (a) Efficiency in allocation of distribution of goods (Consumption efficiency); (b) Efficiency in allocation of resources (Product efficiency) and; (c) Efficiency in allocation of product mix (Simultaneous efficiency of production and consumption).

In this unit we will discuss how a general equilibrium attained in a perfectly competitive market forms can satisfy all the marginal conditions of Pareto optimality so that it can ensure economic efficiency. Further we will discuss the second welfare theorem and emphasize on the separation of the concept of issue of efficiency from issue of equity by redistributing the initial endowments. In this unit we will also discuss the concept of social optimum in terms of equality between Marginal Cost (MC) and Marginal Benefit (MB) and Marginal Social Cost (MSC) and Marginal Social Benefit (MSB).



CHECK YOUR PROGRESS

Q.1: Distinguish between positive and normative economics. (Answer in about 20 words)

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Q.2: What are the three marginal conditions of Pareto optimal? (Answer in about 10 words)

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Q.3: Define Pareto optimality. (Answer in about 20 words)

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1.3 THE FIRST THEOREM OF WELFARE ECONOMICS

We know that Pareto efficiency has three marginal conditions:

- Efficient allocation of distribution of goods (Consumption efficiency)
- Efficient allocation of resources (Product efficiency)
- Efficient allocation of product mix (Simultaneous efficiency of production and consumption)

To attain Pareto efficiency in an economy these basic conditions must be satisfied. The general equilibrium attained in perfectly competitive market is the most ideal condition in which the above mentioned marginal conditions are satisfied and lead to maximum social welfare or economic efficiency in the sense of Pareto optimality. This is known as first or fundamental theorem of welfare economics. By assuming perfect competition, where there is no individual influence in buyer and seller market, free play of self interest and without government intervention in economic activity we can discuss how perfectly competitive market equilibrium satisfy all basic conditions of Pareto optimality. Let us discuss how all marginal conditions of Pareto optimality that are fully satisfied by general equilibrium are attained under perfect competition.

- **Perfect Competition and Optimal Distribution of Goods or Efficiency in Consumption**

With regard to the distribution of goods among the consumers, one important marginal condition of Pareto efficiency is the marginal rate of substitution (MRS) which is equal for all the consumers. To prove it, let us assume an economy under the following conditions:

- Two consumers A and B along with their budget constraint/limit are always trying to maximize their level of satisfaction from consumption of goods X and Y.
- There exists perfect competition so that the price of goods X and Y are given and same for both consumer A and B.

Now, given the conditions mentioned above consumer A will maximize his satisfaction when:

$MRSxy^A = Px/Py$ ..... (i)

Similarly, consumer B will attain equilibrium or maximize satisfaction when:

$MRSxy^B = Px/Py$ ..... (ii)

Since we assumed that perfect competition is prevailing in the economy, the price ratio (Py/Px) must be equal for both individual A and B. Therefore, the MRS of individual A in equation (i) and MRS of individual B in equation (ii) can be written as:

$$MRSxy^A = MRSxy^B$$

This equation implies that there is efficiency in distribution of the goods X and Y between consumer A and B under perfect competition conditions. Here, MRS *x* for *y* is the same for consumer A and B. Thus, efficiency in consumption has been attained.

The condition of efficiency in consumption can be easily understood with the help of Edgeworth Box diagram. In Figure 1.1 OA and OB represents utility corner for consumer A and consumer B and they consumed goods X and Y. The consumers A and B have their own respective indifference curves which are convex to the origin. IA_1, IA_2, and IA_3 are the respective indifference curves for consumer A. The indifference curve IA_3 represents higher level of satisfaction over IA_1 and IA_2 indifference curves for consumer A. The indifference curves for consumer B is denoted by IB_1, IB_2, and IB_3. In case of the level of satisfaction for consumer B due to efficient distribution of goods, higher level indifference curve represents higher level of satisfaction. CC is the contract curve passing through points of tangency of the indifference curves of consumer A and B. On CC contract curve MRS between the two goods X and Y remain same for both the consumers A and B. In the figure

before distribution of the goods, the initial endowments of A and B is at point K. At point K, the MRS_{XY} for consumer A and B are not equal.

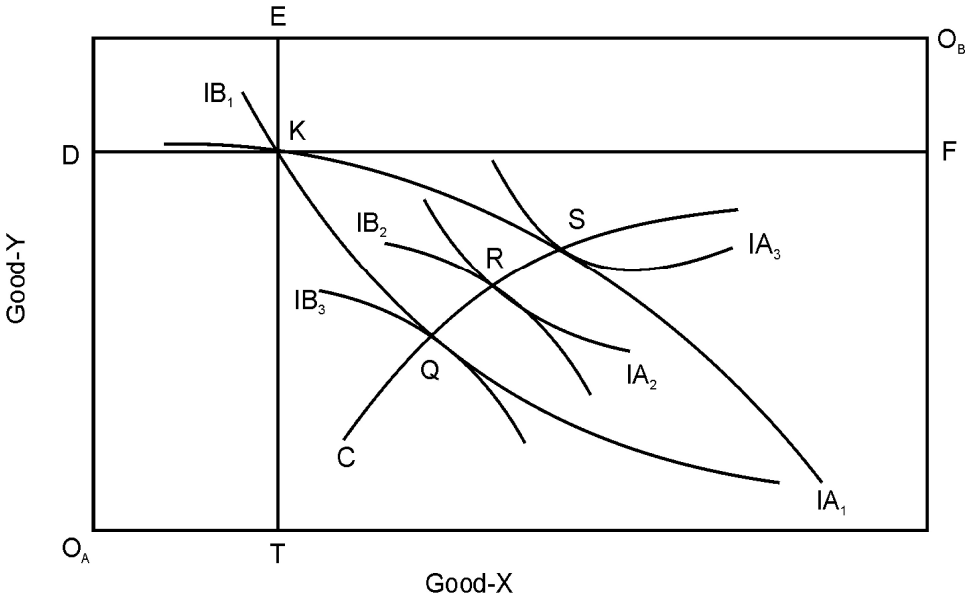


Fig. 1.1: Efficiency in Consumption

Now through exchange, the initial endowment is shifted from point K to point S on the contract curve CC. At point S, the indifference curve of consumer B remains the same IB_1 with initial endowment point K. In this distribution of goods, the movement from point K to S neither better off nor worse off. On the other hand, at point S, the indifference curve IA_1 of consumer A moves to IA_3 indifference curve. This movement from lower indifference curve to higher indifference curve that is point from K to S represents Pareto improvement. So, at point S, consumer A is better off without affecting consumer B's endowment. Similarly, the movement from initial endowment point K to Q implies consumer B is better off without affecting the endowments of consumer A.



ACTIVITY 1.1

Mr. X has 3 apples and 12 bananas. On the other hand, Mr. Y has 8 apples and 4 bananas. With these endowments, Mr. X's Marginal Rate of Substitution (MRS) of apple for banana is 5 and Mr. Y's MRS is equal to 3. If Mr.

X gives 4 bananas to Mr. Y for 1 apple then will Mr. Y get involved in this trade or not?

- **Perfect Competition and Optimal Allocation of Factors between Firms**

The marginal condition for Pareto optimality relates to optimal allocation of factors among the production of various goods. To achieve this condition, the marginal rate of technical substitution (MRTS) of factors must be equal among the firms.

Now, assume a firm working under perfect competition conditions will employ two factors labour (L) and capital (K) with given constant prices. The firm will attain equilibrium or able to minimize cost where the firm's given iso-quant is tangent to its corresponding iso-cost line. Here, the iso-quant represents MRTS between labour (L) and capital (K) and iso-cost line expresses the ratio of prices of L and K that is (P_L/P_K).

Thus, under perfect competition the firm/producer A will minimize cost where MRTS between labour and capital equate with the price ratio of both factors. It can be expressed as

$$MRTS_{LK}^{A} = P_L/P_K \text{ ——————————(i)}$$

Likewise, producer B will attain equilibrium or minimize cost at

$$MRTS_{LK}^{B} = P_L/P_K \text{ ——————————(ii)}$$

As we know both the producers are working under perfect competition, hence the price ratio (P_L/P_K) will be same. Thus, we ensure that the general equilibrium attend in perfect competition satisfy the marginal conditions of Pareto efficiency by proving equality between $MRTS_{LK}^{A} = MRTS_{LK}^{B}$.

As like efficiency in consumption we can explain efficiency in production with the help Edgeworth Box diagram. In panel A of the figure 1.2. we assume two goods X and Y that can be produced by two factors of production labour (L) and capital (K).

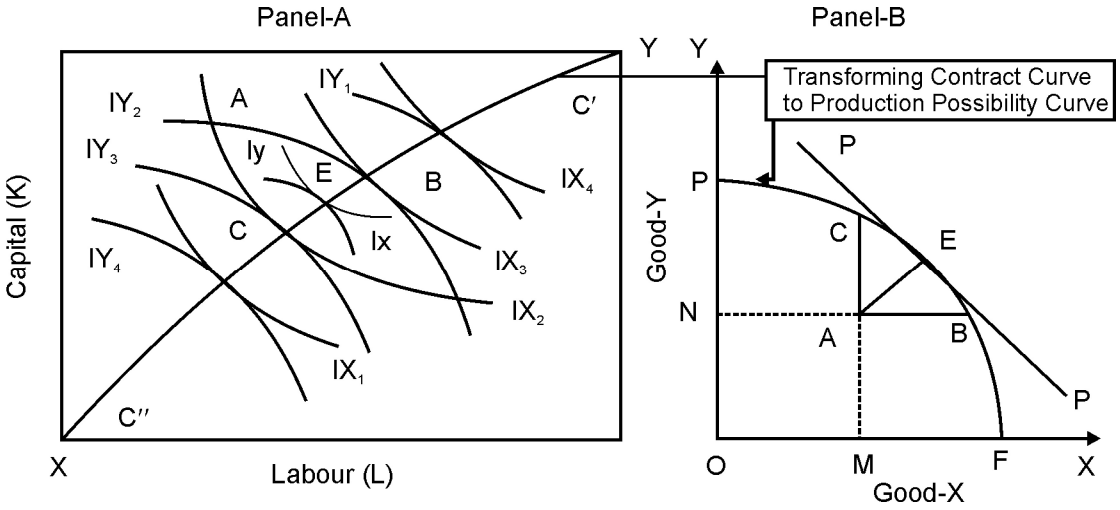


Fig. 1.2: Efficiency in Production and Derivation of Production Possibility Frontier

We can have various iso-quant such as IX_1, IX_2, IX_3 and IX_4 for good X. And for good Y we have IY_1, IY_2, IY_3 and IY_4. The rightward shift from iso-quant IX_1 to IX_4 indicates increase in production of good X. and move from IY_1 to IY_4 indicates more production of good Y. Now by allocating factor endowments if we move from point A to B and C there will be increase in production without reducing the production of other goods. So, the point A is inefficient. The point B is Pareto efficient because there is upward shift in iso-quant from IX_2 to IX_3. In this shift due to allocation of resources production of X will increase without reducing the production of Y. The point C is also Pareto efficient. At point C there is increase in production of goods Y without reducing goods X.

There are different tangency points between iso-quant of goods X and Y. These tangency points indicate efficient level of production. Now by joining all efficient points we can get contract curve of production. From this Edgeworth contract curve, we can derive production possibility frontier in panel B of figure 1.2. The PF is the production possibility frontier or production possibility curve. Every point of production possibility frontier represents production efficiency. Any side inside the production possibility frontier will be Pareto inefficient. The point A represents Pareto inefficient because without reducing either goods X or Y there is increase in goods X at point B. The

movement from point A to point B indicates Pareto efficient. At this point there is an increase in production of goods X without reducing goods Y. As like point B move from point A to C indicates increase in production of goods Y without reducing goods X. Point C also represents Pareto efficient.

- **Perfect Competition and Allocative Efficiency (Optimum Direction of Production)**

This condition requires the equality between MRT (Marginal Rate of Product Transformation) in production and MRS in consumption for every pair of commodities and for individuals. In the case of a very simple economy composed of only two commodities X and Y and two individuals A and B, Pareto optimality requires that

$$MRT_{XY} = MRSxy^{A} = MRSxy^{B}$$

Again, this condition can be ensured under perfect competition. We know a firm under perfect competition in equilibrium point produces output to that extent where its marginal cost is equal to the price of the commodity. Thus, for firms are in perfect competition, $MC_X=P_X$ and $MC_Y=P_Y$ where MC_X and MC_Y marginal costs of production of commodities X and Y respectively and P_X and P_Y are prices of commodities X and Y. Therefore, in perfect competition the equilibrium will set at such quantities as

$$MC_X / MC_Y = P_X / P_Y$$

We know that the ratio of marginal cost shows the number of units of Y that must be given up in order to expand the output of Y by one unit. This, however, is the definition of marginal rate of transformation and a firm working under perfect competition is as follows:

$MRT_{XY}=MC_X/MC_Y=P_X/P_Y$ ..... (i)

We already have that each consumer's MRS_{XY} is equal to price ratio (P_X/P_Y) under perfect competition:

$MRS_{XY}=P_X/P_Y$ ..... (ii)

As a result, we have $MRS_{XY}=MRT_{XY}$, which satisfy the product substitution condition or allocative efficiency or optimal product mix by operation of price system in a perfectly competitive market.

The above discussion ensures that all first order or marginal conditions required for the attainment of Pareto-optimality is possible to achieve if all the markets are perfectly competitive. This is called fundamental theorem of welfare economics.



CHECK YOUR PROGRESS

Q.4: What is meant by contract curve? (Answer in about 10 words).

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Q.5: What is the full form of MRS and MRTS? (Answer in about 10 words)

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Q.6: What are the assumptions required to full-fill all the marginal conditions of Pareto optimality? (Answer in about 20 words)

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1.4 SECOND THEOREM OF WELFARE ECONOMICS

The second welfare theorem tells us that when indifference curves are convex to their origin, every efficient allocation at any point on the contract curve represents competitive equilibrium depending on the initial allocation of an endowment. At competitive equilibrium a suitable redistribution of endowments can ensure social welfare in an economy.

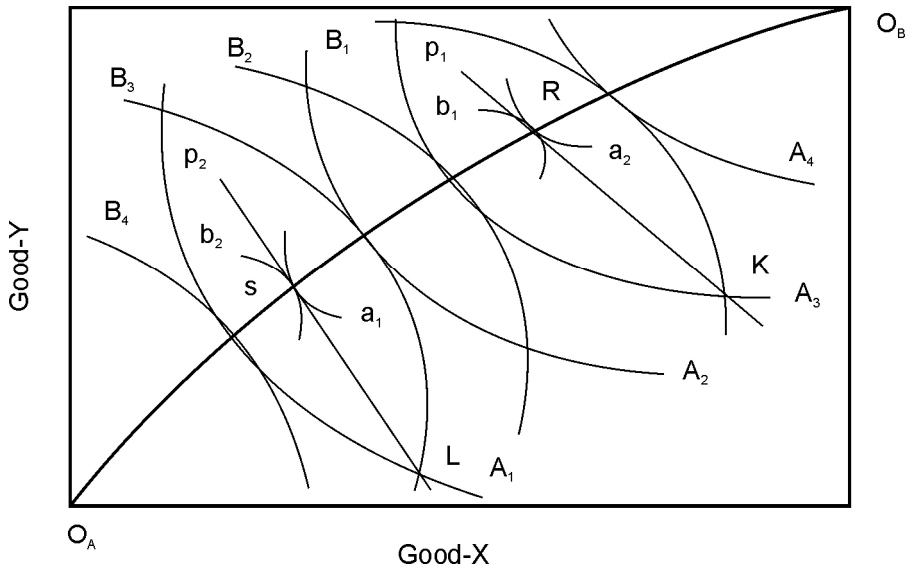


Fig. 1.3: Edgeworth Box Diagram to Prove Second Theorem of Welfare Economics

When preferences are convex, at Pareto efficient allocation, the bundles preferred by person A and bundles preferred by person B are disjoint. Therefore, if both agents have convex preferences, then we can draw a straight line between two sets of preferred bundles that separate one from others. The slope of this line gives us relative prices and any endowment that puts both agents on this line lead to final market equilibrium being the original Pareto efficient allocation. This can be shown in figure 1.3. Suppose the initial distribution between goods X and goods Y for two individuals A and B is at point K. Now due to existence of perfect competition, this can lead to the determination of price ratio of two goods as shown by price line P_1 so that by exchanging the goods X and Y both the individuals A and B can reach at point R. The point R represents higher level of welfare and Pareto optimal because at point R the new indifference curve a_2 of individual A and b_1 of individual B lies on contract curve and within the indifference curve A_3 of individual A and B_1 of individual B. Similarly, if initial distribution of goods that is real income is at point L, then perfect competition can lead to the determination of price ratio of goods as shown by price line P_2 so that by exchanging both the individuals can reach at point S. The point S represents higher level of welfare and Pareto optimal because at point S

the new indifference curve a_1 of individual A and b_2 of individual B lies on contract curve and within the indifference curve A_1 of individual A and B_3 of individual B.



LET US KNOW

Case where second welfare theorem does not hold

In case of non-convexity of preferences, the second welfare theorem does not hold. For example, out of two individuals, individual A has non-convex preferences. Then point like E can never be competitive market equilibrium. E represents Pareto efficient because here $MRS_{XY}^{A}=MRS_{XY}^{B}$ on indifference curve I_A of individual A and I_B of individual B. But at point E there is no set of prices at which both A and B will simultaneously want to consume. Suppose if we assumed that price set as a slope of the common tangent at E. Then individual B would prefer combinations of two goods X and Y at point E where his highest possible indifference is tangent to budget line. A, on the other hand, due to non-convex preferences choose bundle T on higher indifference curve IA_1 instead of bundle E on indifference curve I_A.

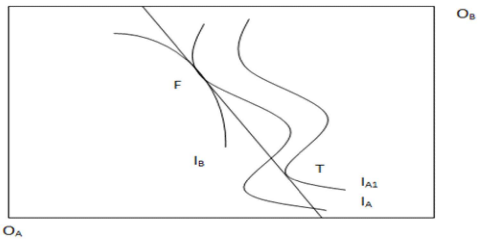


Fig.: 1.4 Non-convex Preferences



CHECK YOUR PROGRESS

Q.7: What is the shape of contract curve in the second theorem of welfare economics?

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1.5 CONCEPT OF SOCIAL OPTIMUM

We know that when demand is equal to supply in perfectly competitive market conditions, there is optimum production and exchange in an economy. The optimum production and exchange from consumers and producers' point of view represents the equality between price (P) and marginal cost (MC). The price is the amount that consumers pay for various units of goods. The price paid by a consumer is equivalent to marginal utility or marginal benefit that the consumers obtain from consuming various amounts of the goods. A consumer obtains consumer surplus when he is willing to pay over and above market price. Thus, the consumer surplus represents the net gain of utility or marginal benefit or well-being obtain from consuming the goods.

As like consumer surplus, a producer at P=MC when optimum production and exchange of goods take place as a producer from their respective marginal cost or supply curve earn producer surplus. The producer surplus is the excess of market price at which producers sell the quantity of a commodity over and above the minimum price at which they would be willing to supply it.

The surplus gained by both the producer and consumer is known as economic surplus. This is one of the most beneficial outcomes of the operation of perfectly competitive market that results in allocative efficiency. This allocative efficiency of perfectly competitive market implies the mutually beneficial exchange between consumers and producers so that both are better off and maximise social welfare due to participation in exchange. Allocative efficiency in perfect competition enables equality between marginal cost of producers and marginal benefit of consumers at a given price. To understand this, consider figure 1.4 of Panel-A, where competitive equilibrium is attained by producing OQ quantity of the good. The OQ output represents optimum output because at OQ output, marginal cost is equal with marginal benefit. If the level of production is below OQ then it will lower total economic surplus tough marginal cost which is lower than

marginal benefit (MC<MB). On the other hand, if the quantity is greater than OQ, i.e. more than optimum, it will lead to loss of total economic surplus and increased marginal cost in comparison to marginal benefit (MC>MB).

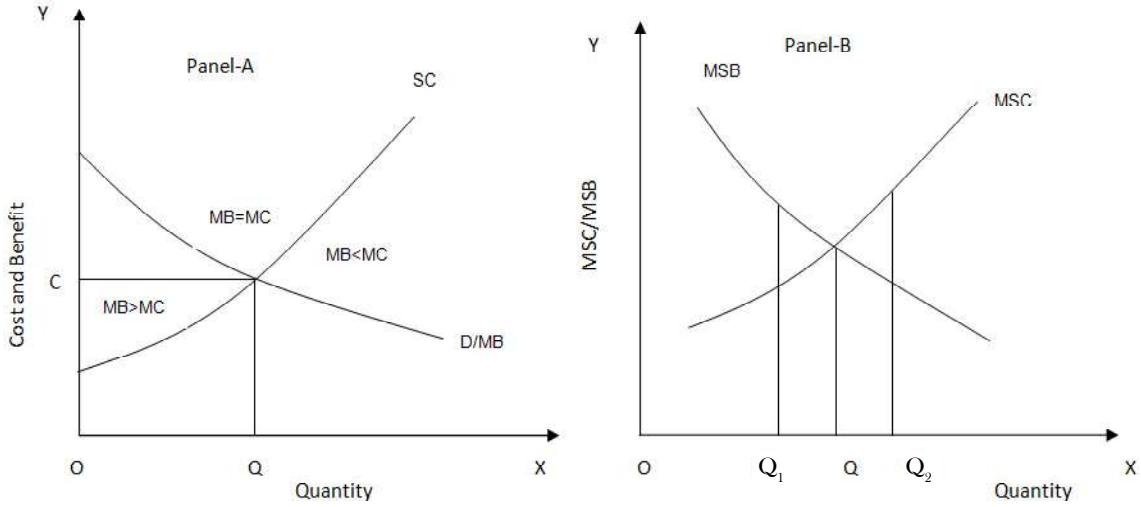


Fig. 1.4: Optimum Quantity

The attainment of social optimal output is simply not only equality between marginal cost and marginal benefit discussed above. Pigou, for the first time, in his book *Wealth and Welfare* discusses that even existence of perfect competition cannot guarantee the achievement of Pareto optimum. There is always presence of externalities. Any product has external effects or externalities. The externalities could be both positive and negative. For optimal distributions of resources in society, both the external costs and benefits as well as internal costs and benefits are taken into account. Social efficiency occurs when Marginal Social Benefit (MSB) is equal with Marginal Social Cost (MSC).

Marginal Social Benefit (MSB) consists of the following:

MPB = Marginal Private Benefit

MEB = Marginal External Benefit

And MSB = MPB + MEB

Also, Marginal Social Cost (MSC) consists of the following:

MPC= Marginal Private Cost

MEC= Marginal External Cost

And MSC = MPC + MEC

For a single level of output in the presence of externalities when MSB = MSC, the socially optimal output is found. In the figure 1.5 of Panel-B, it indicates that as long as MSB > MSC, production should be expanded because benefit exceeds additional cost. Similarly, if MSB < MSC, then production should be decreased. At OQ level of output, social optimum is obtained.

1.6 EQUITY-EFFICIENCY TRADE-OFF

The concept of equity refers to an allocation if no individual prefers another individual's consumption bundle to his own. For example, if individual 'A' prefers B's bundle of goods to his own, it will be termed as A envies B and vice versa. Thus, an equitable allocation means that there is no individual who envies someone else's bundle to his own. The issue of equity in distribution is logically separable from the issue of efficiency in allocation. We already examined that the possibility of different efficient allocations of commodities and resources under perfectly competitive market conditions. A competitive equilibrium leads to a Pareto efficient allocation that may or may not be equitable. As we know any point on the contract curve represents competitive equilibrium depending on the initial allocation. The competitive equilibrium exists in all intermediate points on contract curve, i.e. the second theorem of welfare which enables us to examine that there is a trade-off between equity and efficiency.

The concept of trade-off between equity and efficiency can be discussed with the help of figure 1.5. In this figure AZ curve is the production possibility curve (PPC) which is also called the transformation curve. The slope of AZ curve represents marginal rate of transformation (MRT) between output X and Y. As we know MRT=-dY/dX which implies that to gain small increase in output X is the result of sacrifice of output Y. At each point on the AZ curve the different combinations of X and Y can be distributed between individual A and individual B in various ways. Let us assume that

point E is efficient production on AZ curve in the sense that an increase in the production of good X requires a sacrifice of the good Y. The availability for exchange of quantities of X and Y will be determine by point E.

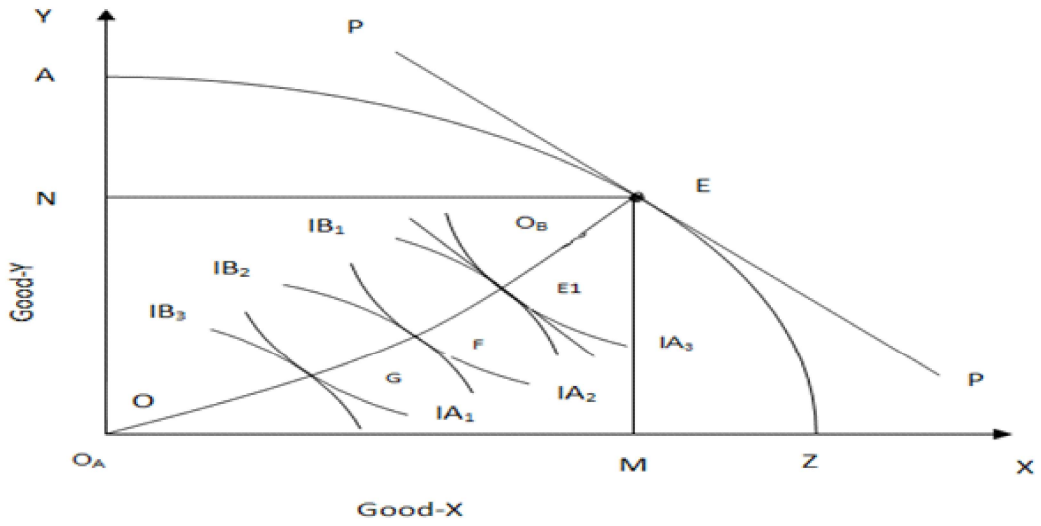


Fig. 1.5: Equity Efficiency Trade-off

Thus, we can construct an Edgeworth Box depicting the exchange possibilities for individuals A and B. At any point along the exchange contract curve, OE shows efficiency in exchange. As for example, the initial allocation gave all X and Y to B. At O_B and B would have no reason to enter into exchange. Similarly, at point O_A individual A in competitive equilibrium consume all goods X and Y. So, in that case individual A has no need to enter into exchange. Since efficient allocations are not necessarily equitable, society must rely to some extent on the government to achieve equity goals by redistributing income or goods among households. Thus, the second welfare theorem says that in order to distribute goods differently the state can tax one consumer on the basis of value of his endowment and transfer the money to others. For example, the revenue generated from progressive taxes are used to finance different public services such as health or medical care so that the poorer section can get benefit. Thus, the second welfare theorem tells us that redistribution need not be in conflict with economic efficiency.

Hence, according to the second welfare theorem lump sum taxation would be non-distortionary. It is required to lump sum suitable redistribution

among individuals to achieve Pareto optimality. However, redistribution of income in any society may discourage work. For example, the impositions of taxes discourage to work more and also negative impacts on consumption and production. In this context, as a policy planner, it is very difficult to make choices between equity goals and efficiency. So, the second welfare theorem ensures that there is usually trade-off between efficiency and equity.



LET US KNOW

We know that the locus of all efficient allocation of resources is Edgeworth contract curve. From this contract curve we can derive utility possibility frontier (UPF) and production possibility frontier (PPF). UPF and PPF represent various combinations of utility where consumption and production efficiency criteria are satisfied. Any point inside UPF or PPF will be inefficient because in that case it will be possible to make some one better off without making someone worse off.

Now, incorporating Bergson Samuelson Social welfare function we can easily understand the concept of social optimum and the trade-off between equity and efficiency.

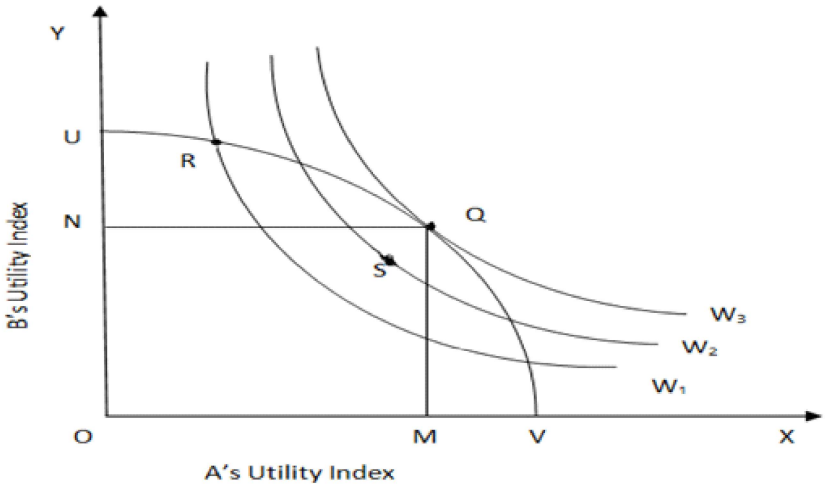


Fig. 1.6: Concept of Social Optimum and Equity Efficiency Trade-off

In the figure 1.6 on utility possibility frontier UV the social indifference curve W_3 of individual A and B tangent at point E. The

point E is known as the point of constrained bliss. Given the factor endowment and technology point E represents unique distribution of goods between both the individuals. In case of production it also represents unique combination of factors employed to produce a particular goods. Thus, the point constrained bliss represents optimum distribution as well as optimum level of production.

Point R of W_1 social indifference curve is lying on utility possibility frontier and representing economic efficiency. Point S of W_2 social indifference curve is economically inefficient because it is inside the utility possibility frontier. But, W_2 is above W_1 social indifference curve and representing more utility. So as per society's point of view point S is equitable distribution but not point R. But, for the sake of social interest sometimes inefficiency in resource allocation is accepted. Thus, we can conclude that there exists trade-off between equity and efficiency.



1.7 LET US SUM UP

- To establish the first theorem of welfare economics we need to sketch a general equilibrium model of an economy. In general equilibrium we assumed that there is efficiency in consumption, production and allocative efficiency. These conditions are known as marginal conditions of Pareto optimality. It is proved that in the presence of perfect competition all the marginal conditions are satisfied. Under the operation of perfect competition, the fulfillment of marginal conditions of Pareto optimality is known as first theorem of welfare economics.
- During the discussion of the first theorem with the help of Edgeworth box diagram, it is noted that indifference curves are convex to the origin and contract curve is concave to the origin. From contract curve we can derive production possibility curve.
- Convex preferences and efficiency on each point of concave contract

curve satisfy the total conditions of Pareto optimality. The contract curve or production possibility curve is concave to the origin due to diminishing returns in production or increasing opportunity cost. Opportunity cost increase because production differs for different goods.

- The competitive equilibrium exists on all intermediate points on contract curve which enables us to examine that there is a trade-off between equity and efficiency. The concept of equity-efficiency trade-off can easily be understood with the help of Bergson Samuelson social welfare function.
- The concept of social optimum indicates not just equality between MB=MC. There is presence of externalities. Thus optimum quantity means MSB=MSC.



1.8 FURTHER READING

1) Ahuja, H.L. (2017). *Advanced Economic Theory, Microeconomic Analysis*. New Delhi: S. Chand.

2) Koutsoyiannis, A. (1979). *Modern Microeconomics*. London: Macmillan Education Limited.

3) Madala, G.S. and Miller, Ellen. (2018). *Microeconomics Theory and Applications*. McGraw Hill Education (India) Pvt. Ltd.

4) Pindyck, Robert and Rubinfeld, Daniel (2019). *Microeconomics.* India: Pearson.



1.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Positive economics deals with cause and effect relationships and normative economics deals with what ought to be, i.e. what is good or bad for society.

Ans to Q. No. 2: The three marginal conditions of Pareto optimality are-

- Efficiency in consumption;
- Efficiency in production and
- Efficiency in allocation.

Ans to Q. No. 3: Pareto optimality is that efficient allocation of resources where it will not be possible to make some members of society better off without making some members of society worse off.

Ans to Q. No. 4: Contract curve is the locus of all efficient combinations of resources in production and efficient distribution of goods in consumption. It is the tangency point between the indifference curves in consumption and iso-quants curves in production. From contract curve we can derive production possibility frontier and utility possibility frontier. Slope of PPF is MRPT and it measures the rate at which economy can transform one good for the other.

Ans to Q. No. 5: The full form of MRS is Marginal Rate of Substitution and the full form of MRTS is Marginal Rate of Technical Substitution.

Ans to Q. No. 6: The assumptions required to fulfill all the marginal conditions of Pareto optimality are-

- All individuals and firms in the economy are price takers;
- An individual trying to maximize utility and producer trying to maximize profits is subject to budget constraint and production constraint and
- Assumption of self-interest in operation of perfect competition.

Ans to Q. No. 7: The shape of contract curve is concave to the origin.



1.10 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words).

Q.1: What is meant by economic efficiency? Does there exist economic efficiency and equity?

Q.2: What will happen if the preferences are non-convex in Pareto optimality? Explain.

Long Questions (Answer each question in about 300-500 words).

Q.1: All the three conditions for economic efficiency are satisfied only when perfect competitive markets are in equilibrium. Explain.

Q.2: Discuss the concept of social optimum.

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UNIT 2: MARKETS AND WELFARE-II

UNIT STRUCTURE

2.1 Learning Objectives

2.2 Introduction

2.3 Market Imperfection – Monopoly – Non-Linear Pricing

2.4 Externalities

- 2.4.1 Positive Externality
- 2.4.2 Negative Externality

2.5 Public Goods

2.6 Property Rights and Coase Theorem

2.7 Let Us Sum Up

2.8 Further Reading

2.9 Answers to Check Your Progress

2.10 Model Questions

2.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- explain the market failure and its different causes
- know the concepts of public good and externality
- understand the property rights and how we can internalise externality through assigning property rights.

2.2 INTRODUCTION

A market is defined as an institution where consumers and producers of a well-defined commodity interact, either directly or otherwise. The market provides for an in-built mechanism where a complexity of forces acts, leading to an efficient allocation of resources. The buyers and sellers who comprise of the two ends of the market mechanism for exchange, acts with independent motives of utility maximisation and profit maximisation respectively. They further act under their own sets of constraints in decision making. The resultant market model comprises of simultaneously acting

forces of demand and supply where the equilibrium output and prices of the commodity exchanged are determined. However, in the individual pursuit of self-interest, the decisions of the buyers and sellers may fail to achieve the social optimum output. This is market failure. Market failure exists when the said equilibrium is not Pareto efficient. Accordingly, the allocation of resources is not optimal.

Market failure occurs under a variety of causes like asymmetric information, imperfect markets, public goods, externalities, etc. In case of the presence of externalities in production or consumption, goods may be over produced or under produced than the social optimum. Public goods are another instance of market failure for the existence of non-rivalry in consumption and non-excludability. Again, lack of property rights leads to market failure as there is over exploitation of the respective property. Even for common property resources this is true despite the exclusion of non-members, the problem being referred to as the 'Tragedy of Commons'. The present chapter deals at length with some of the causes of market failure.

2.3 MARKET IMPERFECTION – MONOPOLY – NON-LINEAR PRICING

Market imperfections are said to exists when either of the characteristics of a competitive market fails to occur. These as we know are – infinite numbers of buyers and sellers, homogeneous product or services, free entry or exit of firms, perfect information about the product or services and the prices. However, perfect competition is a myth in the real world and what exists is imperfect competition. Market imperfections occur as in monopoly, monopolistic competition, monopsony and oligopoly. Under such market imperfections the price and output differ from the social optimum. The case of monopoly welfare loss is illustrated in the present chapter. Market imperfections in the underdeveloped countries in the form of rigid social structure, immobility of factors, price rigidity ultimately leads to underutilisation of the resources. Market imperfections also occur in the form of differences in the social and private estimates of cost and benefits leading to under or over production of output. Sometimes, there occurs

incomplete information about the exchanged goods that makes optimum production or consumption difficult.

A monopoly is an imperfect market that restricts output in an attempt to maximise profit. A monopoly market form is another instance showing market failure. A monopolist produces too little and charges a higher price for his output leading to net welfare loss to the society which is in contrast to a competitive market. This is discussed with the help of the diagram 2.1. In the diagram, MR is the monopolist marginal revenue curve, AR is his average revenue curve and MC the marginal cost curve.

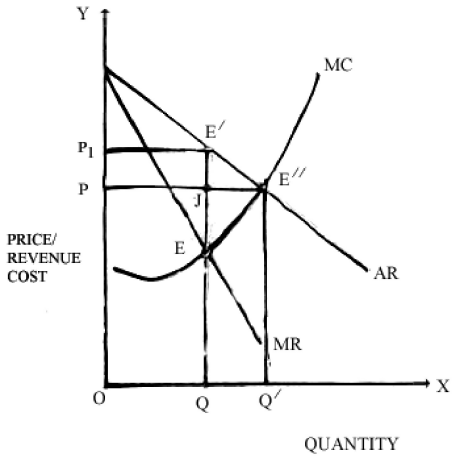


Fig. 2.1 : Price-output determination in monopoly

The profit-maximising equilibrium is at E where MC=MR. The monopolist determines its price at E″. The competitive price would have been however determined at E″. We, therefore, find that compared to competitive price the monopoly price is high. Again, the competitive output would be OQ′ but the monopolist produces only OQ. There is reduced consumer surplus to the extent of the area $P_1E'E''P$. But part of this is pocketed by the monopolist as higher prices to the extent of $P_1E'JP$. The area of the two triangles " E′E″J and " E″JE are the dead weight loss to the society arising out of the monopoly. The existence of deadweight loss is an indication of market failure. Monopoly form of market is further criticised of not remaining competitive over time in the absence of competition and for charging higher prices even beyond the cost in an attempt to maximise profits.

A monopolist in his urge to increase profit, discriminates the price charged. Price discrimination is of various types. In the first-degree price discrimination, a nomenclature followed by Prof. Pigou, the demand curve coincides with the marginal revenue curve. So, this implies that the competitive output is similar to the monopoly output. This perfect price discrimination is believed to lead to an efficient allocation of resources. The second-degree price discrimination or non-linear pricing is said to exist when the monopolist charges different prices for different ranges of output. For example, magazine subscribers are to pay more for the first year of subscription and lower prices for further years of subscription. Price discrimination is sometimes preferred from the society's point of view as in case of some goods production would not have been possible and the fulfilment of the want of some goods by the lower income class would not have been possible if higher price were not charged from those who could pay. Price discrimination is said to increase welfare if the total output produced by the monopolist increases in the urge to earn more profits. If the total output however, does not rise, price discrimination leads to loss in welfare as there is misallocation of resources through restriction in output.



CHECK YOUR PROGRESS

Q.1: Choose the correct one

Market failure occurs when there is-

a) Market imperfections b) Externality in production

c) None of these d) Both a and b

.....

Q.2: Is the monopoly output socially optimum? Why? (Answer in about 30 words)

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Q.3: What is nonlinear pricing? (Answer in about 10 words)

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2.4 EXTERNALITIES

Externalities are the result of economic behaviour of individuals or firms that affects the production or consumption of a third party. For example, an industry may be dumping waste to a river that raises the cost of fishing for fisherman living on the river bank. In any activity of production or consumption if the private and social cost and benefit differ then it is a case for externalities. A.C. Pigou in his book *Wealth and Welfare (1912)* first systematically dealt with this concept of externalities. Externalities are called spill over effects or neighbourhood effects which do not get reflected in the price of the goods. Externalities may be either benefitting to the third party or may cause harm. This spill over effects do not enter the respective private marginal cost or benefits. Accordingly, externality forms another instance of market failure causing mis-allocation of resources and that production and consumption differs from the optimum. They are an instance of market imperfections where price is not offered for benefits or damage caused to others.

Externalities are of two types – positive and negative. The beneficial spill over effects are termed as positive externalities and negative externalities. Depending upon whether the externalities pertain to production or consumption, we differentiate between the following four types of externalities.

- **Positive externality in consumption:** The consumption of a good which enhances the welfare of others is called a positive externality in consumption.
- **Negative externality in consumption:** When the consumption activity of one reduces the welfare of others it is called a negative externality in consumption.
- **Positive externality in production:** Sometimes some production activity renders benefits to other firms or individuals. These benefits accrue to the later in the form of reduced average costs of production and is called positive externality in production.

- **Negative externality in production:** When the production activity affects others adversely it is a case of negative externality in production.

As discussed above, externalities occur due to the difference between private and social cost and benefits. A discussion on externalities would be incomplete without understanding this discrepancy and analysing how this can be met to yield optimum levels of production or consumption. This is included in the following sections. One way to internalise the externalities is by levying taxes and subsidies to yield socially optimum output. Now, we know, that the marginal social cost or benefit is derived by adding up the private and external cost or benefit. In the following discussion the notations MSC, MPC, MEC, MSB, MPB, and MEB implies the following.

MSC-Marginal Social Cost

MPC-Marginal Private Cost

MEC-Marginal External Cost

MSB- Marginal Social Benefit

MPB- Marginal Private Benefit

MEB- Marginal External Benefit

Thus, we have; MSC= MPC+MEC; and MSB=MPB+MEB.

2.4.1 Positive Externality

The term positive here implies profitable, beneficial or pleasant spill over effects of any activity for which no price is appropriated. It is an effect external to the actual producer (or consumer) which benefits other producers (or consumers).

- ***Positive externality in production:*** An example of this type of externality is that of a bee hive near an apple orchard which helps increase production of apples as bees help enhanced pollination. As there are external benefits, the marginal social cost is less than the marginal private cost, i.e. MSC<MPC. Accordingly, if market forces are left alone the output will be less than what is socially optimal. This is shown in diagram 2.2.

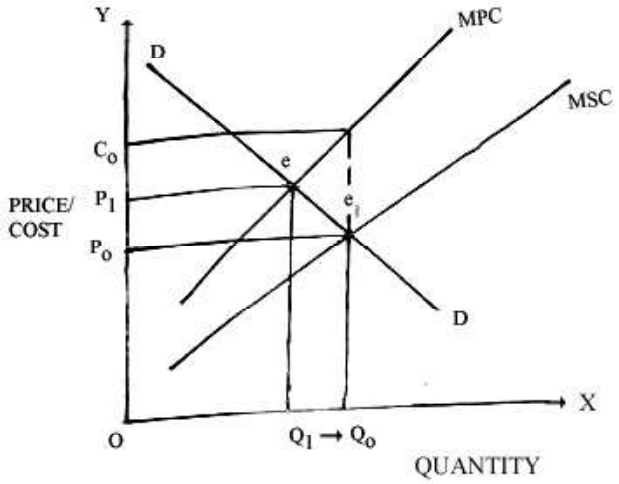


Fig. 2.2 Positive Externality in Production

The demand curve DD shows the marginal social (and private) benefits as there are no externalities in consumption, which cuts the MPC curve at e. OQ_1 output is produced corresponding to e. But the social optimum output is OQ_0 which corresponds to the intersection of the demand curve to the MSC curve at e_1. At OQ_0 level of output producers get P_0 price but their cost is C_0. One way to raise the production to OQ_0 is to pay the producers a subsidy for Q_1Q_0 to the extent C_0P_0. It is also suggested that the beneficiaries of the externality could be made to pay for raising production to the optimal level.

- ***Positive externality in consumption:*** An example for this may be that, if a person gets vaccinated for some contagious disease, he/she causes welfare to the entire neighbourhood by preventing the spread of the disease. Assuming that there are no externalities in production, the market supply curve reflects both the marginal social or private cost. However, due to existence of externalities in consumption the marginal social benefit is greater than the demand (or marginal private benefit).

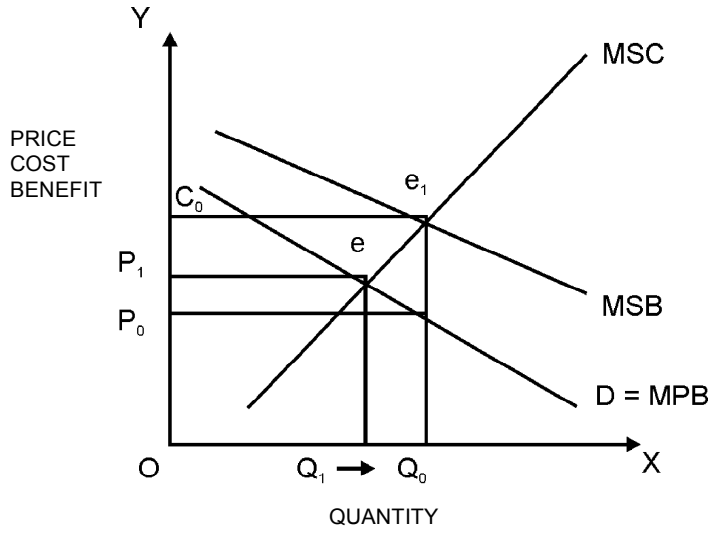


Fig. 2.3 Positive externality in consumption

Accordingly, in figure 2.3 we have MSB curve lying above the MPB or demand curve. The output produced is only OQ_1 as against the social optimum OQ_0. If OQ_0 is produced the cost is C_0 which is to be paid to the producers. But the market price will be P_0 which will be paid by the consumers. Therefore the consumers' needs to be subsidised by the amount C_0P_0 to raise their consumption.

2.4.2 Negative Externality

Negative externalities are those activities that reduces the welfare or harms individuals, firms or the environment at large for which the responsible party incurs nothing. For example, industries causing air or water pollution, noise pollution or causing harmful radiations, etc.

- ***Negative externality in production:*** An example of this is an industry dumping untreated waste to a river that raises the cost of fishing for nearby fisherman. As in figure 2.4, the MSC curve lies above the MPC implying that due to negative externalities the social cost of production is greater than the estimated private cost. Thus, the market production OQ_1 is more than the social optimum OQ_o. Thus, there is an excess production to the extent

Q_1Q_0. The private cost C_0 against the equilibrium is less than the optimum price of P_0 where a social optimum output OQ_o is produced. In this case, the producer of the negative externality can be taxed to the extent P_0C_0.

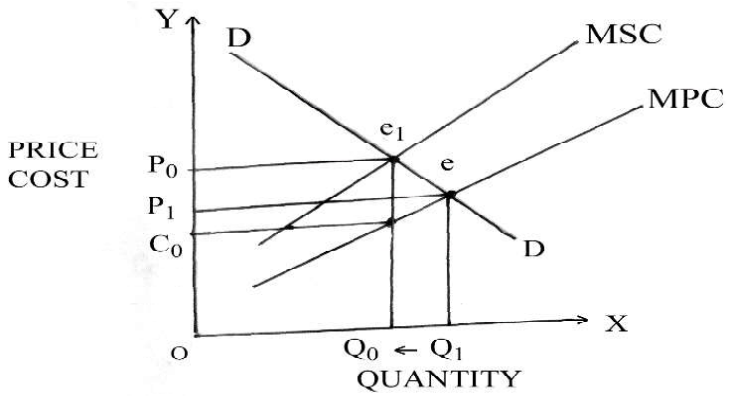


Fig. 2.4 Negative externality in production

- ***Negative externality in consumption*:** An example of this is playing of loud music during some festival in a neighbourhood by some, that cause annoyance to others. In case of negative externalities in consumption, the marginal social benefit is less than the marginal private benefit. The optimum output is OQ_o which is less than the OQ_1. This is shown in figure 2.5. The optimum price is P_0 which is greater than the cost C_0. The difference P_0C_0 can be raised as tax from the consumers which may be used to compensate the victims of the damage.

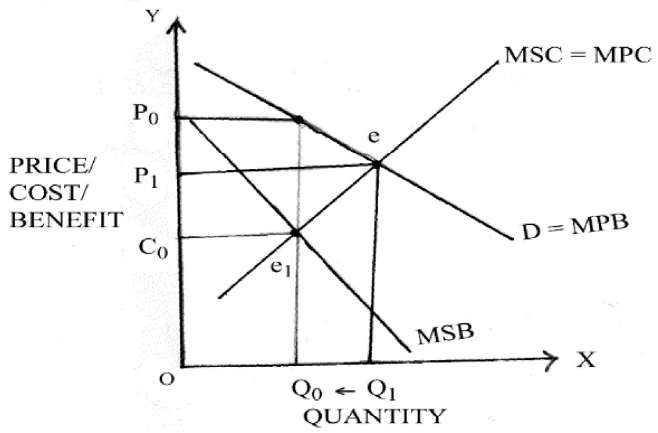


Fig. 2.5 Negative externality in consumption



CHECK YOUR PROGRESS

Q.4: Name one production activity that involves an external benefit.

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Q.5: Name one consumption activity that involves an external cost.

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2.5 PUBLIC GOODS

Public goods are another instance of the aforesaid market failure. Public goods are defined as goods characterised by non-excludability and non-rivalry. Any good will be excludable if it is possible to exclude individuals from using it. In case of public goods, it is either very expensive or technically impossible to exclude anyone from benefitting from the good. A classic example cited for non-excludability is that of a lighthouse. No ships can be stopped from using the services of a lighthouse. But we can certainly exclude people from watching a movie if they do not purchase the tickets. On the other hand, rivalry exist if the consumption of a good by one reduces the availability for others. However, for public goods consumption does not reduce its availability for others. For example, while a cake will be unavailable to others if consumed by some, the lighthouse utility will be the same for all ships. The following table 2.1 showing the classification of goods according to excludability and rivalry elicits the difference between public goods and private goods. This classification is irrespective of the nature of the physical attributes of goods.

A pure public good is both non-rival and non-excludable. For example, the lighthouse, national defence, environmental quality, etc. A pure private good is on the contrary, excludable and rival. Goods may be excludable yet non-rival. Public roads though are pure public goods yet toll roads can exclude non payers. Again, goods can be rival but non-excludable, example, forests, oil fields, ground water, etc.

Non-excludability, non-rivalry (Pure public good)	**Non-excludability, rivalry**
Excludability, non-rivalry	**Excludability, rivalry (Pure private good)**

Table 2. 1: Classification of goods on the basis of rivalry and excludability

Public goods do not provide any incentives to the private producers as they cannot be priced for being non-excludable. Again, the marginal cost of producing the goods being 0, it leads to the free rider problem. That is, once such good is provided no one wants to pay for it. The market failure in case of public goods leads economists to suggest that they be provided by the government.



CHECK YOUR PROGRESS

Q.6: Choose the correct one

Public goods are characterised by-

a. Rivalry b. Divisibility

c. Both rivalry and externality d. Externality

Q.7: Define public goods. And write its characteristics. (Answer in about 50 words)

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2.6 PROPERTY RIGHTS AND COASE THEOREM

Ronald H. Coase argued that in the presence of externalities it is not necessary that the government should intervene to provide the optimum output with subsidies or taxes. There is an administrative cost involved with such measures, adopted by the government and if this cost is higher than the social benefits from such government intervention then the government intervention in the same will not raise welfare. Coase, hence

suggested a private costless bargaining approach instead. He put forward the idea of assigning 'property rights' in this context.

Ronald Coase theorem can precisely be stated as that if property rights to a contested resource is assigned to any one of the concerned parties then negotiations between the two parties will lead to the attainment of a socially optimum equilibrium and a socially optimum level of output will be produced. This according to Coase will then be more effective way to internalise the negative externalities than government imposition of taxes or subsidies. The Coase theorem is based on the following assumptions.

- The numbers of affected parties are few.
- There is perfect information.
- There are no transaction costs.
- There exists a costless way to enforce agreements.
- The property rights must be well-defined.

Let us now consider the case of a river. Suppose there are two parties involved – first, an industry which dumps untreated waste into the river and second, the fishermen of a nearby village who depends on the river for their livelihood. For the Coase theorem it is necessary that property rights to the contested resource, here the river, be clearly defined. It is irrelevant whether the property rights are assigned to the polluter or the victims of the damage. Coase argued that the negotiations between the two parties will lead to socially optimum output and the externality will be internalised.

Bargaining with property rights to the fishermen: Let us assume that the property rights are assigned to the fishers. Here, the industry owner has to compensate the fishers for polluting the river. In fig. 2.6 we discuss how the externality gets internalised. The marginal social benefit (MSB) is here equal to the marginal private benefit (MPB) as there is no externality of consumption. But due to negative externality of production the marginal social cost curve (MSC) is above the marginal private cost (MPC) estimated by the industry.

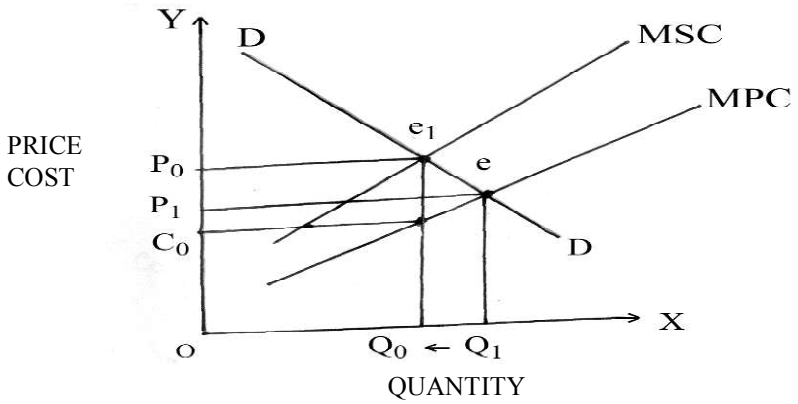


Fig. 2.6 Assigning property rights to victim(s)

As in the above figure 2.6 Q_0 is the socially optimum output but the industry produces Q_1. Now if the fishermen have the right to the river then the industry has to compensate for the pollution it causes. This compensation would be MSC-MPC per unit of pollution caused. Thus, including the compensation amount in estimating the cost the industry no longer considers MPC but MSC curve. Thus, the optimal output Q_0 is produced.

Bargaining with property rights to the industry: On the other hand, if the property rights were to be assigned to the industry then the fishermen have to bribe the industry to lessen their production and hence the pollution level. The idea here is not to consider pollution as an ideal but to explain the role of assigning property rights to either of the parties. The case is illustrated with figure 2.7 again.

Here, the industry has the right to dump waste to the river. Q_0 is the social optimum output. However, the industry will produce only the profit maximising output of Q_1. The fishermen need to bribe the industry to the extent MSC-MPC per unit of output produced. The industry will include this compensation from them and their cost curve will no longer be MPC but MSC (i.e. the opportunity cost of the increased production is included). Thus, Q_0 of output will be produced.

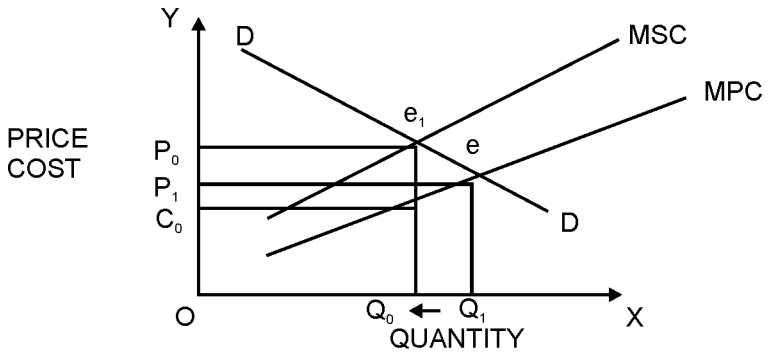


Fig. 2.7 Assigning property rights to polluter

The Coase theorem is based on some very restricting assumptions. Firstly, in reality the number of affected parties in either side of the market is innumerable. In our example the number of industries located near the river may be very high and also the beneficiaries of the resource are also usually high. Here it will be not possible to assign property rights. Moreover, parties will not be able to arrive at any consensus after negotiations. The assumptions of no transaction cost and income effects are also restrictive.



CHECK YOUR PROGRESS

Q.8: Choose the correct one

Coase theorem associated with-

a) Pricing of public goods

b) Solution to the problem of externalities c) Both a and c

d) None of the above



2.7 LET US SUM UP

- Market failure occurs when the freely functioning market mechanism fails to attain optimum output and their results in mis-allocation of resources.
- Market imperfections, divergence between social and private cost and benefit, non-rivalry, excludability, are the various instances where market failure occurs.
- Market imperfections leads to over or under production of the output and prices differ from the optimum level.

- Socially optimal output occurs at the point where social cost and benefits are equal. If production and consumption involve externality then the output determined is not optimum.
- For internalising the externality government intervention through taxes and subsidies becomes necessary.
- Public goods are characterised by the properties of non-excludability and non-rivalry.
- Coase argued that presence of externalities does not necessarily imply government intervention. The same can be dealt through mere assigning of property rights. It is however insignificant as to whom the property rights are assigned.



2.8 FURTHER READING

1) Madalla, G.S. Miller, E. (2018). *Microeconomics, theory and Applications*. McGraw Hill.
2) Dwivedi, D.N. (2008). *Microeconomics, theory and Applications. Pearson Education.*



2.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: d)

Ans to Q. No. 2: No, monopoly output is not socially optimum. A monopolist produces at the point where his marginal cost equals marginal revenue. Thus, his output is less than the social optimum.

Ans to Q. No. 3: Nonlinear pricing or second-degree price determination means charging different prices for different quantities of the good.

Ans to Q. No. 4: When massive plantation projects like timber, etc. enhances social fertility which helps farmers in agriculture.

Ans to Q. No. 5: Playing of loud music in festivals creates disturbances for neighbours.

Ans to Q. No. 6: c)

Ans to Q. No. 7: Public goods are those goods that are characterised by non-rivalry and externality. For example, a light house. Non-rivalry means that a good do not reduce in availability to others when consumed by some. Non excludability means any good cannot be prevented from being used by anybody or it is very expensive to do so.

Ans to Q. No. 8: b)



2.10 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words).

Q.1: What is meant by non-rivalry?

Q.2: What is meant by excludability?

Q.3: State Coase theorem.

Q.4: Cite an example of non-excludable good.

Q.5: Mention one way to internalise externality.

B) Essay-type Questions (Answer each question in about 300-500 words)

Q.1: What is meant by market failure? Discuss its various causes.

Q.2: What is meant by externality? Discuss its various types.

Q.3: Explain with an example how we can internalise the positive externality in consumption through giving subsidies.

Q.4: Give the assumptions of Coase theorem.

Q.5: Discuss how property rights allocated to the polluter help in achieving a socially optimal output.

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UNIT 3: GAME THEORY

UNIT STRUCTURE

3.1 Learning Objectives

3.2 Introduction

3.3 Some Preliminary Definitions and Terminologies

3.4 Types of Game

3.5 Two Person Zero Sum Game

3.5.1 The Maximin Minimax Principle

3.6 The Prisoner's Dilemma Game

3.7 Nash Equilibrium

3.8 Saddle Point

3.8.1 Rules for Determining a Saddle Point

3.9 Pure Strategy and Mixed Strategy

3.10 Dominant Strategy

3.10.1 Rules of Dominance Principle

3.11 Game Without Saddle Point (Mixed Strategy)

3.11.1 Algebric Method

3.11.2 Graphical Method

3.12 Limitation of Game Theory

3.13 Let Us sum Up

3.14 Further Reading

3.15 Answers To Check Your Progress

3.16 Model Questions

3.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- understand the basic ideas of game theory
- apply the various concepts of game theory to solve the problems occur frequently within economics, as well as in the rest of the world
- obtain saddle point with pure and mixed strategies.

3.2 INTRODUCTION

Game theory offers many insights into oligopolistic interdependence and strategic behaviour of the firms. The interdependence of firms in oligopolistic markets and the inherent uncertainty about competitors' reactions to any course of action adopted by a firm cannot be analysed effectively by the traditional tools of economic theory.

The first systematic attempt of application of theory of games to economics was Van Neumann's and Morgenstern's 'Theory of Games and Economic Behaviour' published in 1944. Since that time numerous economists have developed theories of oligopolistic behaviour based on the theory of games.

In general, game theory is concerned with the choice of an optimal strategy in conflict situations. Specifically, game theory can help an oligopolist choose the course of action (e.g., the best price to charge) that maximises its benefits or profits after considering all possible reactions of its competitors. Game theory is a tool that has been created to help us study decision-making in situations in which there is a mixture of conflict and cooperation.

3.3 SOME PRELIMINARY DEFINITIONS AND TERMINOLOGIES

Before going into the technical aspects of game theory, let us first learn about the terminologies used in this theory.

- **Game :** A game is a competitive activity involving skill, chance and endurance on the part of two or more persons, who play according to rules, regulations and conventions known to all players. A game is described in terms of the players, the rules of the game, the payoffs of the game, and the information that players have about the details of the game. These elements are common to all conflict situations, and they constitute the fundamental characteristics of a game.
- **Player :** The decision-making unit is called a player, who may be a single person, a firm, or an organisation.

- **Strategy :** A strategy is a complete specification of what actions a player will take under each contingency in the playing of a game. In other words, a strategy is one participant's plan of action adopted in the light of his own belief about the reactions of his rival players.Strategy may be of two types-pure strategy and mixed strategy.(This is explained in details in the later part of the unit).
- **Payoff :** The payoff is the outcome or consequence of each strategy. The payoff of a stratogy is the payment it brings to the participant for any given counter strategy of the rival (s). It is usually expressed in terms of the profits or losses of the firm that we are examining as a result of the strategies adopted by the firm and the responses of the rivals to those strategies.
- **Payoff matrix :** A table that gives the payoffs from all the strategies open to the firm and the rival's responses is called the payoff matrix. For example, let us assume that there are two firms in a industry. Firm 1 has to choose among five strategies (A_1, A_2, ..., A_5) and the Firm 2 can react by adopting any one of the six strategies open to it (B_1, B_2, ... , B_6). Thus to each strategy of firm I, there are six possible counter strategies of firm II, and similarly to each strategy of firm II there are five counter strategy of the rival firm I. Thus the payoff matrix of each firm will include 5x6 = 30 payoffs, corresponding to the results of each possible combination of strategies selected by both rivals.

  The payoff matrix can be written as–

  Firm 1's payoff matrix

		Firm II					
		B_1	B_2	B_3	B_4	B_5	B_6
Firm I	A_1	π_{11}	π_{12}	π_{13}	π_{14}	π_{15}	π_{16}
	A_2	π_{21}	π_{22}	π_{23}	π_{24}	π_{25}	π_{26}
	A_3	π_{31}	π_{32}	π_{33}	π_{34}	π_{35}	π_{36}
	A_4	π_{41}	π_{42}	π_{43}	π_{44}	π_{45}	π_{46}
	A_5	π_{51}	π_{52}	π_{53}	π_{54}	π_{55}	π_{56}

Where π_{ij} (i = 1, 2, ... , 5; j = 1, 2, ..., 6) is the net gain or payoff to firm I when it adopts ith strategy and firm II adopts j^{th} strategy.

3.4 TYPES OF GAME

A game can be classified on the basis of the number of players, the number of strategies, the nature of payoff function and the nature of negotiation.

- Games classified by the number of players in game theory are termed as two-person game, if there are two players; three-person game, if there are three players and n-person game, when there are n-players.
- Games classified by number of strategies are called finite games and infinite games, depending on the strategies available to each of the players in the game. The game is finite if the strategies available to each player is limited and in case of infinite games, choice of strategies available to each player is unlimited.
- Games classified by the nature of the payoff function are called constant sum game, zero-sum game and non zero-sum game. Costant sum game is a situation or interaction in game theory where the sum of the payoffs of all players always adds up to the some constant figure for any particular outcome. Thus, one player's gain must be offest by another one or more players' loss. Zero sum game is a type of constant sum game. In the zero sum game, the payoff to all the players sum up to zero. On the other hand, non-zero sum games are games in which the sum of gains and losses by the players are sometimes more or less than what they began with.
- The games classified by the nature of negotiations are called cooperative games or non-cooperative games. A game is called cooperative if the players can negotiate binding contracts that allow them to implement and to enforce joint strategies. By contrast, in a non-cooperative game, the negotiation or enforcement of a binding contract is not possible.

3.5 TWO PERSON ZERO SUM GAME

The simplest and most highly developed part of game theory is the two-person zero-sum game. It is a special type of zero sum game which involves only two players, and where the gains made by one equals the loss incurred by the other. In general, if firm X has m-strategies and firm Y has n strategies, the payoff matrix will be-

$$\begin{bmatrix} \pi_{11} & \pi_{12} & \pi_{13} & ..... & \pi_{1n} \\ \pi_{21} & \pi_{22} & \pi_{23} & ..... & \pi_{2n} \\ \pi_{31} & \pi_{32} & \pi_{33} & ..... & \pi_{3n} \\ ..... & ..... & ..... & \pi_{ij} & .... \\ \pi_{m1} & \pi_{m2} & \pi_{m3} & ..... & \pi_{mn} \end{bmatrix}$$

Where, π_{ij} is X's net gain if X emplays the ith strategy and Y employs the j^{th} strategy. Since, the game is zero sum, the corresponding payoff of the firm Y is - π_{ij} .

The game will be a two person zero sum game if

$$\pi_{ij}^{X} + \pi_{ij}^{Y} = 0$$

Let us take an example where there exists two firms– firm X and firm Y. Firm X has choice of two strategies ($X_1$and X_2) and firm Y has a choice of three strategies (Y_1, Y_2 and Y_3) . The payoff matrix is given as –

Firm X's strategies

Firm Y's strategies

	Y_1	Y_2	Y_3
X_1	$(20, -20)$	$(10, -10)$	$(40, -40)$
X_2	$(-10, 10)$	$(0, 0)$	$(60, -60)$

If X employs his first strategy and Y employs his third, X's profit is 40, and Y's is - 40. If x employs his second strategy and Y employs his first, X's profit is -10 and Y's is 10.

There are two key assumptions about the behaviour of the two players in the Zero Sum Game. The first is that both the players are rational. The second is that both players are greedy, which means that they choose their strategies in their own interest to promote their own gain.

3.5.1 The maximin minimax principle

The maximin minimax principle is used for the selection of optimal strategy by the two player.

The duopolist's decision problem consists of choosing an optimal strategy. X desires the outcome (40) and Y wishes the outcome (–10). But the final outcome depends upon the strategies of both duopolists, and neither has the power to enforce his desires. If X selects his first strategy, Y might select his 2nd and hence the outcome would be 10 to X rather than 40. If Y selects his first strategy, X might select his first, and the outcome would be 20 to X rather than –10. The point which needs emphasis is that largest possible guaranteed payoff results from choosing a strategy that maximises the payoff only under the assumption that the opponent reveals his own strategy in advance.

The theory of games postulates behaviour patterns which allow the determination of equilibrium in these situations. X fears that Y might discover his choice of strategy and desires to 'play it safe'. That is X always assumes that whatever row is choosen, Y will choose the column maximising the returns to Y and there by minimise the returns to X. Thus, if X selects his i^{th} strategy, his minimum profit, and hence Y's maximum, is given by the smallest element in the ith row of the profit matrix :

$$\min_j \pi_{ij}$$

X desires to maximise his minimum expected profit. Therefore, X selects the strategy i for which $\min_j \pi_{ij}$ is the largest. X's expected payoff is therefore.

$$\max_i \min_j \pi_{ij} \quad \text{—— (1)}$$

In any circumtances, X's expected payoff cannot be smaller than eq^n (short form of equation) (i), it may be larger.

$$\text{i.e. } \pi_{ij} \geq \max_i \min_j \pi_{ij}$$

Similarly, Y also follows the same principle of playing safe. If Y employs his jth strategy, he fears that X may employ the strategy corresponding to the largest element in the jth column of the payoff matrix :

$$\min_{i} \pi_{ij}$$

Therefore, Y select the strategy j for which $\max_{i} \pi_{ij}$ is the smallest, and his expected payoff is given by–

$$\min_{j} \max_{i} \pi_{ij} \quad \text{—— (2)}$$

Where $\pi_{ij} \leq \min_{j} \max_{i} \pi_{ij}$

The decisions of the duopolists are consistent and equilibrium is achieved if

$$\max_{i} \min_{j} \pi_{ij} = \min_{j} \max_{i} \pi_{ij} = \pi_{ij}$$

In the above example

	Y_1	Y_2	Y_3	Row min	Maximin
X_1	(20, –20)	(10, –10)	(40, –40)	10	10
X_2	(–10, 10)	(0, 0)	(60, –60)	0	
Column max	20	10	60		
Minimax	10				

Hence in this game

max.min π_{ij} = min.max π_{ij}=10

The value of the game is 10 to firms X, which is also the saddle point.

3.6 THE PRISONER'S DILEMMA GAME

The firms working in oligopolistic markets make decisions in the face of uncertainty about how their rivals will react to their moves. The prisoner's dilemma is a standard example of a game analysed in game theory that shows why two completely rational individuals might not cooperate, even if it appears that it is in their best interests to do so. Model of prisoner's dilemma explains how rivals behaving selfishly act contrary to their mutual

or common interest. Let us explain prisoner's dilemma with an example which helps in understanding the behaviours of firms faced with uncertainity of their rivals' action.

Two members of a criminal gang are arrested for committing a certain crime. However, the evidence is not adequate to charge them with the crime unless either or both confess. Each prisoner is interrogeted in isolation from his companion with no means of communication with the other. It is promised to each one that no punishment will be given to him if he confesses; but a heavy punishment of going to jail for say, 20 yrs if he does not confess. Each prisoner is given the opportunity either to betray the other by testifying that the other committed the crime, or to cooperate with the other by remaining silent. The possible outcomes are :

- If neither confesses, they both will be set free
- If both confesses, they face reduced sentences for say 10 yrs.
- If one confesses and the other does not, the one who confesses will be set free while the one who does not confess will face the maximum jail sentence say, for 20 yrs and vice versa.

The payoff matrix of this problem can be describe in the form of the following table :

		Prisoner's B's strategy	
		Confess	Not to confess
Prisoner's A's strategy	Confess	(10, 10)	(0, 20)
	Not to confess	(20, 0)	(0, 0)

Given the lack of communication between the players and the uncertainity over the loyalty of the other prisoner, each prisoner prefer to adopt the strategy 'confess', so that each of them get 10 years of imprisonment; clearly a worse of situations as compared with the adoption of not to confess strategy by both prisoners. If they could rely on each other and had not confessed, they would have both been better off. The irony of prisoner's dilemma is that when each of two players acts selfishly and does not cooperate with the other (i.e., when confesses), they do worse than when they act unselfishly and cooperate together (i.e. when they are not confesses). Thus, each player following the rule 'expect the worst from

the other,' confesses and find himself in a worse situation than both of them needed to be in. The individually rational behaviour led to the inferior situation for both.

The concept of prisoner's dilemma was developed by Merrill Flood and Melvin Dresher and was formalised by Albert W. Tucker.

3.7 NASH EQUILIBRIUM

Nash equilibrium is named after its inventor, John Nash, an American mathematician. It is considered one of the most important concepts of game theory, which attempts to determine mathematically and logically the actions that participants of a game should take to secure the best outcomes for themselves.

In game theory, the nash equilibrium is a concept involving two or more players, in which each player is assumed to know the equilibrium strategies of the other players and no player has anything to gain by changing only his own strategy unilaterally. In the nash equilibrium, each player's strategy is optimal when considering the decisions of other players. A nash equilibrium exists when there is no unilateral profitable deviation by any of the players involved. In other words, no player in the game would take a different action as long as every player remains the same. If each player has chosen a strategy, and no player can benefit by changing strategies while the other players keep theirs unchanged, then the current set of strategy choices and their corresponding payoffs constitutes a nash equilibrium.

The concept of nash equilibrium can be explain with the following payoff matrix :

Payoff table of player A

Player A's strategy	Player B'S strategy	
	Advertise	Don't Advertise
Advertise	4,3	5,1
Don't Advertise	2,5	6,2

The Nash equilibrium is a situation in which each player chooses an optimal strategy, given the strategy chosen by the other player. In the above

example, the high advertising strategy for firm A and firm B is the Nash equilibrium, because given the firm B chooses its strategy of advertising, the optimal strategy for firm A is also to advertise. Similarly, if B believes that A will choose advertise then B will also choose advertise which is his best response. The belief that company A and B will adopt (advertise, advertise) is self conformatory. Thus it is in their best interest to adopt this strategy profile until the other player changes his strategy.

Thus (advertise, advertise) on (4, 3) is a Nash equilibrium.

3.8 SADDLE POINT

A saddle point of a payoff matrix is that position where the maximum of row minimum co-incides the minimum of column maximum. The payoff at the saddle point is called the value of the game and is obviously equals to the maximin and minimax value of the game.

3.8.1 Rules for Determining a Saddle Point

Step 1 : Find out the row minima of each row and mark them with a circle.

Step 2 : Select the column maxima of each column and mark them with a square.

Step 3 : Find the maximin and minimax and if they are equal then the game has a saddle point. The value of the maximin and minimax is the value of the game.

We can also find out the saddle point by looking at the payoff matrix. If the element in the payoff matrix marked both by a circle and a square appears then, the position of that element is the saddle point of the payoff matrix.

Example 1: Find out the saddle point solution of the following games

(a)

		Player B			
		B_1	B_2	B_3	B_4
	A_1	48	88	16	23
Player A	A_2	25	3	7	93
	A_3	65	32	10	20

Solution: Player B

	B_1	B_2	B_3	B_4	Row minima	Maximin
A_1	48	[88]	(16)	23	16	16
A_2	25	(3)	7	[93]	3	
A_3	[65]	32	(10)	20	10	
Column maxima	65	88	16	93		
minimax			16			

Here, maximin = minimax

$\therefore$ We have a saddle point. The saddle point solution is A_1B_3 and value of the game is 16. Optimal strategy for player A and player B are A_1 and B_3 respectively.

Example 2:

		Player B		
		B_1	B_2	B_3
Player A	A_1	15	2	3
	A_2	6	5	7
	A_3	-7	4	0

Solution:

		Player B				
		B_1	B_2	B_3	Row minima	Maximin
Player A	A_1	[15]	(2)	3	2	
	A_2	6	[(5)]	[7]	5	5
	A_3	[-7]	4	0	-7	
Coloumn maxima		15	5	7		
minimax			5			

Since,

maximin = minimax

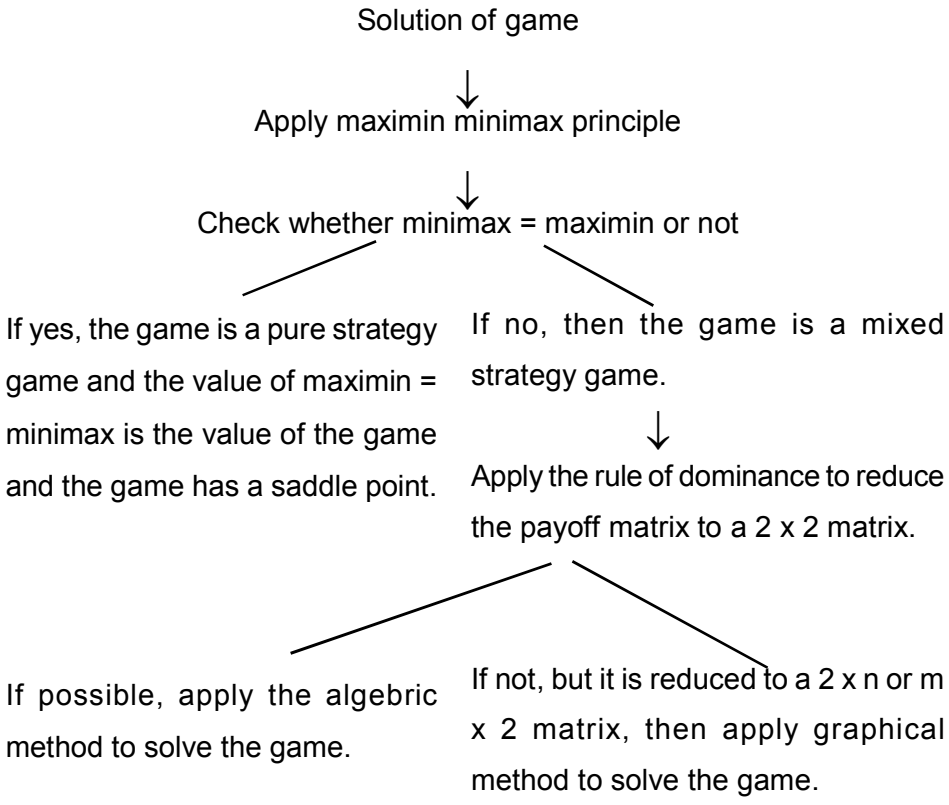
$\therefore$ The game has a saddle point. The saddle point solution is A_2B_2 and the value of the game is 5.

3.9 PURE STRATEGY AND MIXED STRATEGY

Strategies may be of two types : pure and mixed

A pure strategy is when a player or individual chooses one particular course of action duting every play. In this case each player knows exactly what the other player is going to do and the objective of the player is to

maximise gains or minimise losses. On the other hand, mixed strategy is when individual chooses either of his actions with some probability. i.e., when the players use a combination of strategies and each player always keep on guessing to which course of action or strategy is to be selected by the other player than this is known as mixed strategy.



3.10 DOMINANT STRATEGY

In game theory, a dominant strategy is the course of action that results to the highest payoff for a player regardless of what the other player does. Not all players in all games have dominant strategies, but when they do, they can blindly follow them, since a dominant strategy is the optimal strategy unconditionally i.e., there is no dependence on the strategy the other player choses.

3.10.1 Rules of Dominance Principle

The principle of dominance states that if one strategy of a player dominates over the other strategy in all conditions then the later

strategy can be ignored. A strategy dominates over the other only if it is preferable over other in all conditions.

The rules of dominance principle are :

Rule 1: If each element of a column is greater than or equal to the corresponding element of other column in a payoff matrix, then the column with the greater element is dominated by the column with the smaller element. A logical player will never use the dominated strategy and so the column corresponding to this strategy can be eliminated from the payoff matrix.

Rule 2: If each element of a row is less than or equal to the corresponding elements of any others row in the payoff matrix, then the row with the smaller element is dominated by the row with the larger elements, and the dominated strategy can be deleted from the pay off matrix.

Rule 3: A strategy can also be eliminated if it is inferior to an average of two or more pure strategies.

The dominance principle in game theory problem is explained below with an example :

Player B

Player A		I	II	III	IV
	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

Here, all the elements of 1st row is dominated by IIIrd row, so delete 1st row from the payoff matrix. The payoff matrix became

B

A		I	II	III	IV
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

For player B, all the element of 1st column is greater than or equal to IIIrd column, so column I can be eleminated.

$$
\begin{array}{cc} & \text{B} \\ & \begin{array}{cccc} & \text{II} & \text{III} & \text{IV} & \frac{\text{III}+\text{IV}}{2} \end{array} \\ \text{A} & \begin{array}{c} \text{II} \\ \text{III} \\ \text{IV} \end{array} \begin{bmatrix} 4 & 2 & 4 & 3 \\ 2 & 4 & 0 & 2 \\ 4 & 0 & 8 & 4 \end{bmatrix} \end{array}
$$

Again, all the elements of II[nd] column are greater than the corresponding average of III[rd] and IV[th] columns, and hence IInd column may be deleted from the payoff matrix. Thus, the new payoff matrix is

$$
\begin{array}{cc} & \text{B} \\ & \begin{array}{cc} \text{III} & \text{IV} \end{array} \\ \text{A} & \begin{array}{c} \text{II} \\ \text{III} \\ \text{IV} \end{array} \begin{bmatrix} 2 & 4 \\ 4 & 0 \\ 0 & 8 \end{bmatrix} \\ \frac{\text{III}+\text{IV}}{2} & 2 \quad 4 \end{array}
$$

All the elements of II[nd] row are equal to the corresponding average of IIIrd and IV[th] rows. So the II[nd] row can be eleminated and obtain a reduced (2 x 2) payoff matrix.

$$
\begin{array}{cc} & \text{B} \\ & \begin{array}{cc} \text{III} & \text{IV} \end{array} \\ \text{A} & \begin{array}{c} \text{III} \\ \text{IV} \end{array} \begin{bmatrix} 4 & 0 \\ 0 & 8 \end{bmatrix} \end{array}
$$

Example 3: Reduce the following payoff matrix to a 2 x 2 matrix using the rules of dominance.

(a) Player B

$$
\begin{array}{cc} & \begin{array}{ccc} \text{I} & \text{II} & \text{III} \end{array} \\ \text{Player A} & \begin{array}{c} \text{I} \\ \text{II} \\ \text{III} \end{array} \begin{bmatrix} 4 & 5 & 6 \\ 6 & 5 & 8 \\ 8 & 2 & 7 \end{bmatrix} \end{array}
$$

Solution:

Player B

$$\text{Player A} \quad \begin{matrix} & \text{I} & \text{II} & \text{III} \\ \text{I} \\ \text{II} \\ \text{III} \end{matrix} \begin{bmatrix} 4 & 5 & 6 \\ 6 & 5 & 8 \\ 8 & 2 & 7 \end{bmatrix}$$

All the elements of column 3 are greater than the corresponding elements of column 2, so column 3 can be deleted. The new payoff matrix is

Player B

$$\text{Player A} \quad \begin{matrix} & \text{I} & \text{II} \\ \text{I} \\ \text{II} \\ \text{III} \end{matrix} \begin{bmatrix} 4 & 5 \\ 6 & 5 \\ 8 & 2 \end{bmatrix}$$

Again, all the elements of row 1 are smaller than or equal to the corresponding elements of row 2, therefore row 1 can be deleted and obtain a reduced (2 x 2) payoff matrix.

Player B

$$\text{Player A} \quad \begin{matrix} & \text{I} & \text{II} \\ \text{II} \\ \text{III} \end{matrix} \begin{bmatrix} 6 & 5 \\ 8 & 2 \end{bmatrix}$$

Example 4: Reduce the following game by rule of dominance

Player B

$$\text{Player A} \quad \begin{bmatrix} 3 & 5 & 4 & 2 \\ 5 & 6 & 2 & 4 \\ 2 & 1 & 4 & 0 \\ 3 & 3 & 5 & 2 \end{bmatrix}$$

Solution : Given

Player B

$$\text{Player A} \quad \begin{bmatrix} 3 & 5 & 4 & 2 \\ 5 & 6 & 2 & 4 \\ 2 & 1 & 4 & 0 \\ 3 & 3 & 5 & 2 \end{bmatrix}$$

All elements of row 3 are smaller than or equal to the

corresponding elements of row 1, therefore row 3 can be eliminated. The payoff reduce to

Player B

Player A $\begin{bmatrix} 3 & 5 & 4 & 2 \\ 5 & 6 & 2 & 4 \\ 3 & 3 & 5 & 2 \end{bmatrix}$

All element of column 2 are greater than or equal to the corresponding elements of column 1, therefore column 2 can be deleted.

Player B

Player A $\begin{bmatrix} 3 & 4 & 2 \\ 5 & 2 & 4 \\ 3 & 5 & 2 \end{bmatrix}$

Again,

All elements of column 1 are greater than column 3, so column 1 can be eliminated.

Player B

Player A $\begin{bmatrix} 4 & 2 \\ 2 & 4 \\ 5 & 2 \end{bmatrix}$

Finally, all elements of row 1 are smaller than or equal to the corresponding elements of row 3, therefore row 1 can be deleted and obtain a reduce (2 x 2) payoff matrix.

Player B

Player A $\begin{bmatrix} 2 & 4 \\ 5 & 2 \end{bmatrix}$

Example 5: Determine which of the following two person zero sum games are strictly determinable and fair. Give the optimum strategies for each player in case of strictly determinable game.

A. B.

$$A \begin{matrix} A_1 \\ A_2 \end{matrix} \begin{bmatrix} B_1 & B_2 \\ 8 & 0 \\ 5 & -2 \end{bmatrix} \qquad A \begin{matrix} A_1 \\ A_2 \end{matrix} \begin{bmatrix} B_1 & B_2 \\ 5 & 0 \\ 0 & 4 \end{bmatrix}$$

Solution A :

1. Given, the payoff matrix for player A is

		B			
		B_1	B_2	Row minima	maximin
A	A_1	8	0	0	0
	A_2	5	-2	-2	
Column maxima		8	0		
minimax			0		

$\because$ maximin = minimax = 0

$\therefore$ The game has a saddle point and the value of the game is zero.

It is a pure strategy game and it is strictly determinable and fair. Optimum strategies for player A and B are A_1 and B_2 respectively.

N.B. : In game theory, a strictly determined game is a two player zero sum game that has at least one Nash equilibrium with both players using pure strategies.

A game is called a fair game if the value of the game is zero and if it is non-zero than the game is called as an unfair game. Thus

$\begin{cases} \text{if maximin = minimax = 0} \Rightarrow \text{fair game} \\ \text{if maximin = minimax} \neq 0 \Rightarrow \text{unfair game} \end{cases}$

Solution B :

2. Given, the payoff matrix for player A is

		B			
		B_1	B_2	Row minima	maximin
A	A_1	5	0	0	0
	A_2	0	4	0	
Column maxims		5	4		
minimax			4		

$\because$ maximin $\neq$ minimax

$\therefore$ The game has no saddle point and it is not strictly determinable.

Example 6 : Determine the range of values of p and q that will make the payoff element a_{22} a saddle point for the game whose payoff matrix is given below :

Player B

$$\text{Player A} \quad \begin{matrix} & B_1 & B_2 & B_3 \\ A_1 & 2 & 4 & 7 \\ A_2 & 12 & 7 & q \\ A_3 & 4 & p & 10 \end{matrix}$$

Solution : Let us find out the maximin and minimax value of the payoff matrix ignoring the values of p and q.

Player B

$$\text{Player A} \quad \begin{matrix} & B_1 & B_2 & B_3 & \text{Row Minima} & \text{maximin} \\ A_1 & 2 & 4 & 7 & 2 & \\ A_2 & 12 & 7 & q & 7 & 7 \\ A_3 & 4 & p & 10 & 4 & \end{matrix}$$

Comuma maxima 12 7 10

minimax 7

$\because$ maximin = minimax

$\therefore$ The game exists a saddle point at the position a_{22}

Now, p must be less than or equal to 7 and q must be greater than or equal to 7 to make the payoff element a_{22} a saddle point.

Therefore, the required range of values of p and q is

$p \leq 7$ and $q \geq 7$



CHECK YOUR PROGRESS

Q.1: Find the saddle point (or points) and hence solve the following game.

(a)

Player B

$$\text{Player A} \quad \begin{matrix} & B_1 & B_2 & B_3 \\ A_1 & 15 & 2 & 3 \\ A_2 & 6 & 5 & 7 \\ A_3 & -7 & 4 & 0 \end{matrix}$$

(b)

Player B

$$\text{Player A} \quad \begin{matrix} & B_1 & B_2 & B_3 \\ A_1 & 0 & -4 & -3 \\ A_2 & 1 & 3 & 1 \\ A_3 & 1 & 5 & -1 \end{matrix}$$

Q 2: Reduce the following game by rules of dominance.

Player B

Player A

$$\begin{array}{c} \\ A_1 \\ A_2 \end{array} \begin{array}{c} \begin{array}{cccc} B_1 & B_2 & B_3 & B_4 \end{array} \\ \begin{bmatrix} -20 & 40 & -10 & 60 \\ 15 & -5 & 25 & 70 \end{bmatrix} \end{array}$$

3.11 GAME WITHOUT SADDLE POINT (MIXED STRATEGY)

If maximin and minimax of a particular game is not equal then we do not obtain a saddle point. Under such circumtances, when given payoff matrix has no saddle point, a mixed strategy technique of solving the game is used. In such cases both the players must determine an optimal mixture of strategies to find a saddle or equilibrium point. The optimal mix for each player may be determined by assigning each strategy a probability of it being chosen. Thus these mixed strategies are probabilistic combinations of available better strategies and such games hence called probabilistic games.

In this chapter we will discuss the following two methods for the solutions of games with mixed strategies :

- Algebric method
- Graphical method

3.11.1 Algebric Method

A 2 x 2 payoff matrix where there is no saddle point can be solved by algebric method.

Let us assume that for a two person zero sum game player A and B each have two strategy A_1, A_2 and B_1, B_2 respectively. Again, let player A selects stratgies with probabilities P_1 and P_2 so that $P_1 + P_2 = 1$, Similarly, player A selects strategies with probabilities q_1 and q_2 where $q_1+q_2 = 1$. The payoff matrix of player A is

B's strategy

A's strategy

$$\begin{array}{c} \\ A_1 \\ A_2 \end{array} \begin{array}{c} \begin{array}{cc} B_1 & B_2 \end{array} \\ \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \end{array}$$

Value of the game is

$$V = \frac{a_{11}a_{22} - a_{21}a_{12}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$$

with

$$p_1 = \frac{a_{22} - a_{21}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$$

$$q_1 = \frac{a_{22} - a_{12}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$$

Example 7:

(i) Find the value of the game

$$\begin{array}{c} \\ A_1 \\ A_2 \end{array} \begin{array}{c} \begin{array}{cc} B_1 & B_2 \end{array} \\ \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix} \end{array}$$

Solution:

$$\begin{array}{c} \\ A_1 \\ A_2 \end{array} \begin{array}{c} \begin{array}{cc} B_1 & B_2 \end{array} \\ \begin{bmatrix} 5 & 1 \\ 3 & 4 \end{bmatrix} \end{array} \begin{array}{c} \text{Row minima} \\ 1 \\ 3 \end{array} \quad \begin{array}{c} \text{max imin} \\ \\ 3 \end{array}$$

Column maxima 5 4

minimax 4

$\because$ maximin $\neq$ minimax, therefore no saddle point exists.

We can solve by algebric method.

Let we assume that p_1 and p_2 be the probabilities with which player A chooses strategy A_1 and A_2.

Again q_1 and q_2 be the probabilities with which player B chooses strategy B_1 and B_2.

V is the value of the game.

$$P_1 = \frac{4 - 3}{(5 + 4) - (1 + 3)}$$

$$= \frac{1}{9 - 4} = \frac{1}{5}$$

$$P_2 = 1 - p_1 \quad [\because \ p_1 + p_2 = 1]$$

$$= 1 - \frac{1}{5} = \frac{4}{5}$$

$$q_1 = \frac{4 - 1}{(5 + 4) - (1 + 3)}$$

$$= \frac{3}{9-4}$$

$$= \frac{3}{5}$$

$$q_2 = 1 - q_1 \quad [\because \ q_1 + q_2 = 1]$$

$$= 1 - \frac{3}{5}$$

$$= \frac{2}{5}$$

$$V = \frac{a_{11}a_{22} - a_{21}a_{12}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$$

$$= \frac{5.4 - 3.1}{(5+4) - (1+3)}$$

$$= \frac{20 - 3}{9 - 4}$$

$$= \frac{17}{5}$$

(ii) In Example 4 above, we reduce the given payoff matrix using dominance property to 2 x 2 payoff matrix

Player B

Player A $\begin{bmatrix} 2 & 4 \\ 5 & 2 \end{bmatrix}$

Since, maximin $\neq$ minimax, there is no saddle point, it shall, therefore, be solved using mixed strategy technique.

$$p_1 = \frac{2-5}{(2+2)-(4+5)} \quad = \frac{3}{5}$$

$$p_2 = 1 - p_1 \quad [\because \ p_1 + p_2 = 1]$$

$$= 1 - \frac{3}{5}$$

$$= \frac{2}{5}$$

$$q_1 = \frac{2-4}{(2+2)-(4+5)}$$

$$= \frac{2}{5}$$

$$q_2 = 1 - q_1 \quad [\because \ q_1 + q_2 = 1]$$

$$= 1 - \frac{2}{5}$$

$$= \frac{3}{5}$$

and the value of the game is

$$V = \frac{2.2 - 5.4}{(2+2) - (4+5)}$$

$$= \frac{4 - 20}{4 - 9}$$

$$= \frac{16}{5}$$

3.11.2 Graphical Method

The graphical method is used to solve the games whose payoff matrix has

- Two rows and n columns (2 x n)
- m rows and 2 columns (m x 2)

Let us consider the following 2 x n game

		Player B				
		B_1	B_2	.....	B_n	Probability
	A_1	a_{11}	a_{12}	.....	a_{1n}	p_1
Player A	A_2	a_{21}	a_{22}	.....	a_{2n}	$1- p_1$
Probability		q_1	q_2	.....	q_n	1

We again assume that the game has no saddle point. Player A chooses his strategies A_1 and A_2 with probabilities P_1 and P_2 ($P_1 + P_2=1$). Player B has n strategies $B_1, B_2, \ldots\ldots, B_n$ which can select with probabilities $q_1, q_2, \ldots\ldots q_n$ such that $q_1 + q_2 + \ldots\ldots + q_n = 1$.

The expected payoff for A for different strategy selection by player B is given by

B's strategy A's expected payoff (Ep)

B_1 $E_p^1 = a_{11}p_1 + a_{21}p_2 = a_{11}p_1 + a_{21}(1-p_1)$

B_2 $E_p^2 = a_{12}p_1 + a_{22}p_2 = a_{12}p_1 + a_{22}(1-p_1)$

- -
- -
- -
- -

B_n $E_p^n = a_{1n}p_1 + a_{2n}p_2 = a_{1n}p_1 + a_{2n}(1-p_1)$

According to the maximin criteria. Player A will choose to the values of P_1 and P_2 so as to maximise his minimum expected payoff. It can be done by plotting the straight lines representing the expected payoff of player A.

$$E_p^j = a_{ij}\,p_1 + a_{2j}\,(1-p_1)$$
$$= a_{ij}\,p_1 + a_{2j} - a_{2j}\,p_1$$
$$= (a_{ij} - a_{2j})\,p_1 + a_{2j},\ (j = 1, 2, \ldots., n)$$

The highest point on the lower envelope of these straight lines will give the maximum expected payoff to player A and also the maximum value of p_i.

The two lines passing through the maximin point identify the 2 critical moves or strategies of player B, which combined with the two strategies of A gives a 2 x 2 matrix. The algrabic method can now be applied to determined the optimum strategies of two players and also the value of the game.

The m x 2 games can also be solved in the same way but in such games minimax point is the lowest point on the upper envelope of straight lines.

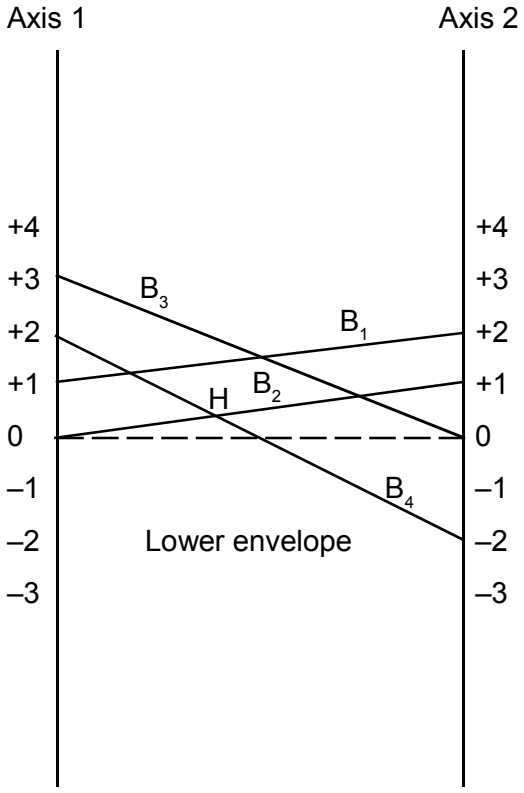
Example 6: Solve the following game graphically

		Player B			
		B_1	B_2	B_3	B_4
Player A	A_1	2	1	0	–2
	A_2	1	0	3	2

Solution : Let P_1 is the probability of selecting strategy A_1 and P_2 ($P_2 = 1–P_1$) is the probability of selecting strategy A_2 by player A. The expected payoff of A for various strategies of player B are

B's strategy	Expected payoff of player A
B_1	$2p_1+1p_2 = 2p_1+1(1-p_1) = 2p_1+1-p_1 = p_1+1$
B_2	$1.p_1+0.p_2 = p_1$
B_3	$0.p_1+3p_2 = 3(1-p_1) = 3 - 3p_1$
B_4	$-2p_1+2p_2 = -2p_1+2(1-p_1) = -2p_1+2-2p_1 = -4p_1+2$

These expected payoff lines are row plotted as functions of P_1 as shown in the diagram.



The diagram shows the expected payoff of player A, the line B_1 joints the first payoff element 2 in the first column represented by + 2 on axis 2, and the second payoff element 1 in the first column represented by +1 on axis 1. Similarly, lines B_2, B_3 and B_4 joined the corresponding payoff element in the second, third and fourth columns. Since the player A wishes to maximise his minimum expected payoff, the highest point of intersection H on the lower envelope of the A's expected payoff equations represents the maximin expected value of the game for A. The lines B_2 and B_4 passing through H defines the two relevent moves or strategies for

player B and other two strategies B_1 and B_3 can be eliminated from the payoff matrix. The payoff matrix now becomes

		Player B	
		B_1	B_2
Player A	A_1	1	–2
	A_2	0	2

$$\therefore \quad p_1 = \frac{2-0}{(1+2)-(-2+0)}$$

$$= \frac{2}{3+2}$$

$$= \frac{2}{5}$$

$$p_2 = 1 - p_1$$

$$= 1 - \frac{2}{5}$$

$$= \frac{3}{5}$$

$$\text{Again,} \quad q_1 = \frac{2-(-2)}{(1+2)-(-2+0)}$$

$$= \frac{2+2}{3+2}$$

$$= \frac{4}{5}$$

$$q_2 = 1 - q_1$$

$$= 1 - \frac{4}{5}$$

$$= \frac{1}{5}$$

$$\text{And,} \quad v = \frac{1\times 2 - 0\times(-2)}{(1+2)-(-2+0)}$$

$$= \frac{2+0}{3+2}$$

$$= \frac{2}{5}$$

3.12 LIMITATION OF GAME THEORY

The limitations of the game theory are as follows-

- The assumption, that each player has the complete knowledge about his own and other player's payoff is not practical.
- The method of solution becomes complex with more than two players.
- The technique of solving games involving mixed strategies is very complicated.
- The assumption of both the players are equally wise and they behave in a rational way, is also not possible.



3.13 LET US SUM UP

- Game theory is a tool that has been created to help us study decision-making in situations in which there is a mixture of conflict and cooperation.
- A game can be classified on the basis of the number of players, the number of strategies, the nature of payoff function and the nature of negotiation
- A game may or may not have a saddle point.
- If maximin = minimax, then we have a saddle point and the game is a pure strategy game and if maximin and minimax of a particular game is not equal, then the game is a mixed strategy game.
- The value of the maximin = minimax is the value of the game.
- Algebric and graphical methods are used for the solutions of games with mixed strategies.



3.14 FURTHER READING

1) Madnani, G.M.K., (2003) Mathematical Economics: A Mathematical Approach to Microeconomic Theory. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

2) Koutsoyiannis, A., (1979) *Modern Microeconomics*. London: Macmillan. Education Ltd.

3) Swarup, K., Gupta, P. K. and Mohan, M., (2006) *Operations Research.* New Delhi : Sultan Chand and Sons.

4) Henderson, J. M. and Quant, R. E.. (2003) *Microeconomic Theory : A Mathematical Approach.* Mc Graw Hill International Editions.

5) Varian, H. R., (2006) *Intermediate Microeconomics: A Modern Approach.* New Delhi: EWP Pvt. Ltd.

3.15 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: (a)

Player B

Player A	B_1	B_2	B_3	Row minima	maximin
A_1	15	2	3	2	
A_2	6	5	7	5	5
A_3	−7	4	0	−7	

Column maxima 15 5 7

minimax 5

$\because$ maximin = minimax

$\therefore$ The game has a saddle point and value of the game is 5. Optimal strategy for player A and B are A_2 and B_2 respectively.

Ans to Q. No. 2: (b) Given,

Player B

Player A	B_1	B_2	B_3	Row minima	maximin
A_1	0	−4	−3	−4	
A_2	1	3	1	1	1
A_3	1	5	−1	−1	

Column maxima 1 5 1

minimax 1

Since, maximin = minimax, the game is a pure strategy game and value of the game is 1.

Here, we observed that there are two saddlepoints of the game.

The optimal strategy for player A is A_2 and the optimum strategy for player B are B_1 and B_3.

Ans to Q. No. 3: (a) Given,

$$\text{Player A}\begin{matrix} \\ A_1 \\ A_2 \end{matrix}\overset{\text{Player B}}{\begin{bmatrix} B_1 & B_2 & B_3 & B_4 \\ -20 & 40 & -10 & 60 \\ 15 & -5 & 25 & 70 \end{bmatrix}}$$

Each elements of the 3rd column is greater than the corresponding elements of 1st column and hence the 3rd column is dominated by 1st column. So, 3rd column can be deleted.

$$\begin{matrix} \\ A_1 \\ A_2 \end{matrix}\overset{B}{\begin{bmatrix} B_1 & B_2 & B_4 \\ -20 & 40 & 60 \\ 15 & -5 & 70 \end{bmatrix}}$$

Again, 4th column is dominated by 1st and 2nd columns and hence it can be eliminated. Therefore, the payoff matrix can be reduced to :

$$A\begin{matrix} \\ A_1 \\ A_2 \end{matrix}\overset{B}{\begin{bmatrix} B_1 & B_2 \\ -20 & 40 \\ 15 & -5 \end{bmatrix}}$$



3.16 MODEL QUESTIONS

Q.1: Find the optimal strategies and value of the game whose payoff matrix is

		Player B			
		B_1	B_2	B_3	B_4
	A_1	1	7	3	4
Player A	A_2	5	6	4	5
	A_3	7	2	0	3

Q.2: Find the saddle point and value of the game for the following games:

		Player B		
		B_1	B_2	B_3
Player A	A_1	15	0	–2

A_2	0	–15	–1
A_3	1	2	0

Q.3: For what value of λ, the game with following payoff matrix is strictly determinable?

Player B

$$\text{Player} \quad \begin{matrix} \\ A_1 \\ A_2 \\ A_3 \end{matrix} \begin{matrix} B_1 & B_2 & B_3 \\ \end{matrix} \begin{bmatrix} \lambda & 6 & 2 \\ -1 & \lambda & -7 \\ -2 & 4 & \lambda \end{bmatrix}$$

Q.4: Give the following payoff matrix of player A and total market share of profit is Rs. 10.

$$\begin{bmatrix} 2 & 8 & 1 \\ 4 & 3 & 9 \\ 5 & 6 & 7 \end{bmatrix}$$

(i) Find the nature of the game.

(ii) Find maximin and minimax payoffs.

(iii) Find the saddle point of the game.

(iv) Find the optimal strategies for the two players.

(v) Is possible to find payoff matrix for player B.

Q.5: Solve the following game and determine the value of the game :

$$\begin{matrix} \\ A \end{matrix} \begin{matrix} B \\ \end{matrix} \begin{bmatrix} 6 & -3 \\ -3 & 0 \end{bmatrix}$$

Q61: Use graphical method in solving the following game.

Player B

$$\text{Player A} \quad \begin{bmatrix} 6 & -3 & 7 \\ -3 & 0 & -6 \end{bmatrix}$$

*** ***** ***

UNIT 4: THE THEORY OF FACTOR PRICING

UNIT STRUCTURE

4.1 Learning Objectives
4.2 Introduction
4.3 Importance of Factor Pricing
4.4 Marginal Productivity Theory of Distribution
4.5 Equilibrium under Perfect Competition in the Factor Market
4.6 Equilibrium under Imperfect Competition in the Factor Market
4.7 Modern Theory of Distribution
4.8 Product Exhaustion Problem
4.9 Let Us Sum Up
4.10 Further Reading
4.11 Answer to Check Your Progress
4.12 Model Questions

4.1 LEARNING OBJECTIVES

After going through this unit, you will be able to—

- understand the importance of factor pricing
- describe the marginal productivity theory of distribution
- explain the equilibrium under perfect and imperfect competition in the factor market
- discuss the modern theory of distribution
- explain the product exhaustion problem.

4.2 INTRODUCTION

The theory of factor pricing is also known as the theory of distribution. In the theory of factor pricing we study how the inputs used for producing goods and services are rewarded with the aim of making economic profit. We already know that there are four factors of production i.e land, labour, capital and entrepreneurship. Output of an economy is produced by employing these four factors. After output is produced it is sold in the market

resulting in revenue generation. This revenue is distributed among the various factors. Hence this theory is also known as the theory of distribution. According to Chapman, “The economics of distribution accounts for the sharing of the wealth produced by a community among the agents, or the owners of the agents, which have been active in its production”. In short we can say that the theory of factor pricing or the theory of distribution studies how rent of land, wage of labour, interest on capital and profit of entrepreneur is determined.

There are two aspects of distribution-personal distribution and functional distribution. Personal distribution refers to the distribution of national income among various individuals or persons in the society. It is a macroeconomic aspect. And functional distribution deals with the distribution of income in relation to the factors of production. It studies how the various factors of production are rewarded for their service in the production process.

In this chapter we will study how this revenue is distributed among various factors. We will also discuss about the equilibrium under perfect and imperfect competition in factor market. Along with these we will study the modern theory of distribution. The adding up problem or the product exhaustion theorem is discussed at the end of the unit.

4.3 IMPORTANCE OF FACTOR PRICING

Production of goods and services in an economy is the result of joint efforts of factors of production. Factor pricing is concerned with the analysis of how and in what manner the factors of production get remunerated in such production process for their contribution. The main reasons of studying the factor pricing are:

- Factor pricing determines the allocation of productive resources among the various alternative uses
- Optimum utilization of input factors crucially depends on factor price.
- Factor prices determine the share of various factors of production in national income.

4.4 MARGINAL PRODUCTIVITY THEORY OF DISTRIBUTION

The marginal productivity theory of distribution which is also known as the neo-classical theory of distribution, is an attempt on the part of the economists like J.B. Clark, Wickstead, Marshall and others, to evolve a general theory which will explain the determination of factor prices. In other words, it serves as a general theory of distribution in terms of which the price of a variable factor could be determined. According to this theory, under certain conditions, the variable factors are paid according to their marginal product. The theory is based on the following assumptions,

- Perfect competition prevails both in the factor and product market.
- The law of variable proportion prevails.
- There is full employment in the economy.
- State of technology remains unchanged.
- Profit maximization is the goal of the factor employing firm.

Now, before we explain the theory, let us understand the meaning of marginal productivity. Marginal productivity of a factor is the increase in total output as a result of employing an additional unit of the factor, quantity of other factors remaining the same. If we measure the increase in total output in physical terms i.e. in terms of physical units, we receive the marginal physical product (MPP) of a factor. Again, if we measure such increase in total output in money terms, we get the marginal revenue product (MRP). MRP is the increase in the total value of the product as a result of the employment of an additional unit of a variable factor, when quantity of other factors remaining the same. The marginal revenue product (MRP) of a factor can be obtained by multiplying the marginal revenue (MR) of the firm with the marginal physical product (MPP) of the variable factor. More specifically,

MRP = MPP x MR

A related concept of marginal productivity is the value of marginal product (VMP), which is obtained by multiplying the price (average revenue/

AR) of the product of the firm with the marginal physical product (MPP) of the variable factor. i.e.

VMP = MPP x Price (AR)

Under perfect competition, the demand curve of the product of an individual firm is perfectly elastic, so price (AR) and marginal revenue (MR) of the firm are equal. As a result, under perfect completion, marginal revenue product (MRP) and value of marginal product (VMP) of a variable factor are equal. i.e.

MRP = VMP

Now, let us explain the marginal productivity theory with the help of the following diagram-

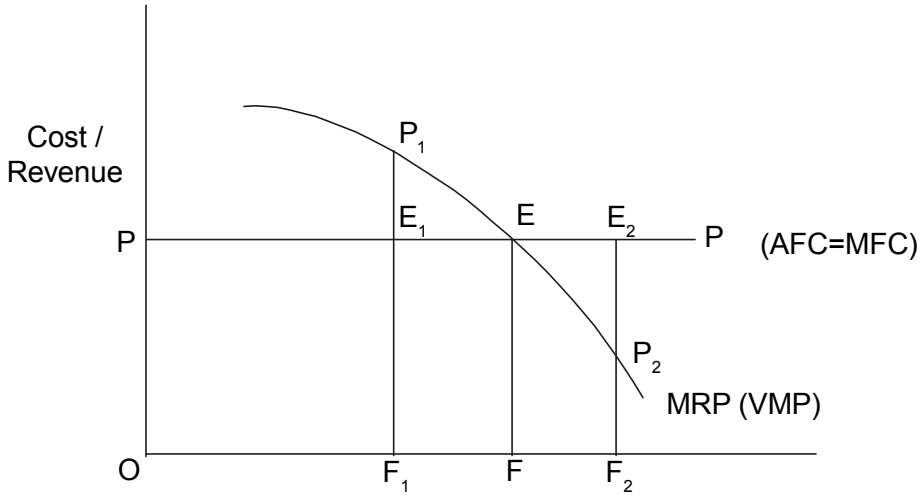


Fig. 4.1: Determination of equilibrium

In the above figure, we measure cost and revenue of labour in the Y-axis and units of factor in the X- axis. Since there is perfect competition in the factor market, the factor price will be given to the firm and the wage line PP is parallel to X axis indicating that at factor price OP unlimited amount of factor will be available to the firm. The factor price OP can also be considered as the cost for the entrepreneur. In actual terms, the price OP is the average factor cost of the variable factor and since there is perfect competition, it is also the marginal factor cost of the variable factor. Because of the operation

of the law of variable proportion, the MPP will be downward sloping. Also, since there is perfect competition in the product market the MR will remain constant, as a result of that MRP curve is also downward sloping and it coincide with VMP curve. The profit maximizing firm attains equilibrium by equating its MR and MC curve. In our diagram, at the point E_1, price of the labour is less than its marginal revenue, since MRP line lies above the price curve. So it will be profitable for the firm to increase the number of labour. E is the point where MRP is equal to the price of the labour. In other words, E is the point of equilibrium, where MC curve is intersecting the MRP curve from below. At equilibrium the firm is employing OF unit of the variable factor at OP price. Beyond this point price of the labour will be more than its marginal productivity, as shown by point E_2 in our diagram.

Criticisms:

The marginal productivity theory of distribution has been considered as a pillar in the neo-classical theory of income distribution. However, the theory suffers from certain serious weaknesses which are noted below :

- Unrealistic assumptions: The assumption of perfect competition is unrealistic both in the factor market and in the product market. Features like homogeneity of factors, perfect mobility, perfect knowledge, and non intervention of the state are not to be found in the real world.

  But Prof. Douglas pointed out that most of the assumptions are reasonably good description of actual long run market conditions and are thus generally valid over time.

- Unrealistic assumption of profit maximization : Another assumption of the theory is that the producer is motivated by profit maximization. This will be true only when the wages of a labour is equal to its marginal productivity. R. A. Lester, an American economist criticized the marginal productivity theory of distribution on the ground that entrepreneurs do not behave as a maximizer of profit and therefore wages of the real world will differ from the marginal productivity of labour.

  But economist like Machlup and Pen defend the theory. Pen said that, “It is not necessary for every entrepreneur to be able to find the

exact point of equilibrium, some will overshoot the equality of wage and marginal product; others will remain below it. However, they always tend towards equality".

- One sided theory: The theory discusses about the demand of the factors, and neglects the supply side of the factor . The theory does not explain how the given wage rate and given interest rate is determined. According to Samuelson, this theory cannot be applied to the factor market as a whole which requires a theory of both the demand for and supply of factors. Thus it is a one sided theory.
- Ignores the importance of technical progress: According to Hicks, this theory fails to throw light on the determination of the relative shares of the factors by neglecting the influence of technological change.



CHECK YOUR PROGRESS

Q.1: Name some economists who have rendered the marginal productivity theory of distribution?

.....

.....

Q.2: What is meant by MRP? (Answer in about 20 words)

.....

.....

Q.3: State the concept of marginal productivity. (Answer in about 20 words)

.....

.....

4.5 EQUILIBRIUM UNDER PERFECT COMPETITION IN THE FACTOR MARKET

The Equilibrium of the firm under perfect competition can be discussed by the marginal productivity theory of distribution. We know that according to the theory the firm will be in equilibrium when the marginal revenue

productivity (MRP) of any factor of the firm equals its marginal cost (MC). In case of a firm with perfect competition in the labour market, the equilibrium will be established when MRP of labour equals the MC of labour.

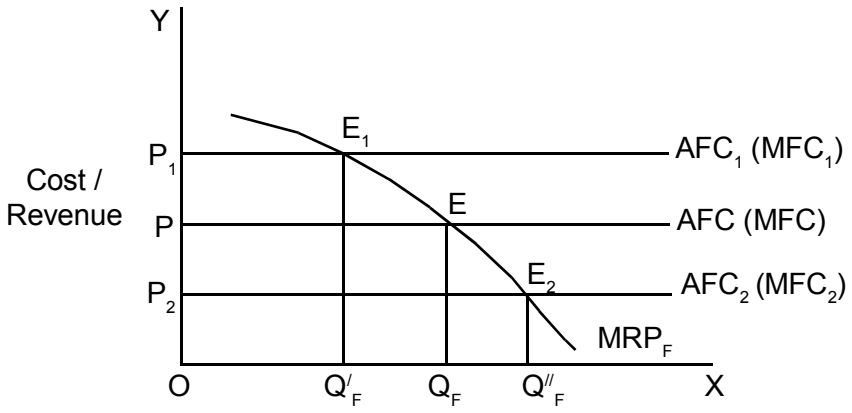


Fig. 4.2: Derivation of demand curve

Since we are dealing with the perfect competition, so the price of the variable factor is given to the firm by the market and in our diagram, we consider it to be OP. Again given the downward sloping MRP_F (the MRP curve of a factor), E is the pt. of equilibrium. In this situation, the firm employs OQ_F amount of the factor at OP price. Assume that the market given price of a factor increases to P_1, other things being equal ,the employment offered by the firm reduces to OQ'_F. Likewise if market given price of the factor goes down to OP_2, the employment offered by the firm increases to OQ''_F. Thus, if we join the equilibrium points such as E_1, E and E_2 , we get a curve which reflect the inverse relationship between the quantity of factor employed by the firm and the factor price. Therefore, we can consider such a line as the demand curve of the firm for the factor. In general the MRP curve of a variable factor is also the demand curve for the factor of the employing firm. We may note that the demand for a variable factor depends on the following–

- The price of the input. The higher the price of a factor lower is the demand for it.
- Marginal physical product of the factor.

- The price of the cammodity produced by the factor.
- The amount of other factors which are combined with a factor.
- The prices of other factors.
- The technological progress as it effects the MPP (Marginal Physical Product) of inputs and hence their demand.

In the above section, we discussed about the derivation of the demand curve of an individual firm for a variable factor. Now, we try to derive the market demand curve for a variable factor from the individual demand curves of different firms.But we cannot simply laterally sum up the individual demand curves of firms to get the market demand curve for a variable factor,as the changes in factor price will bring about changes in the marginal productivity of the factor. This is explained below with the help of the following figures -

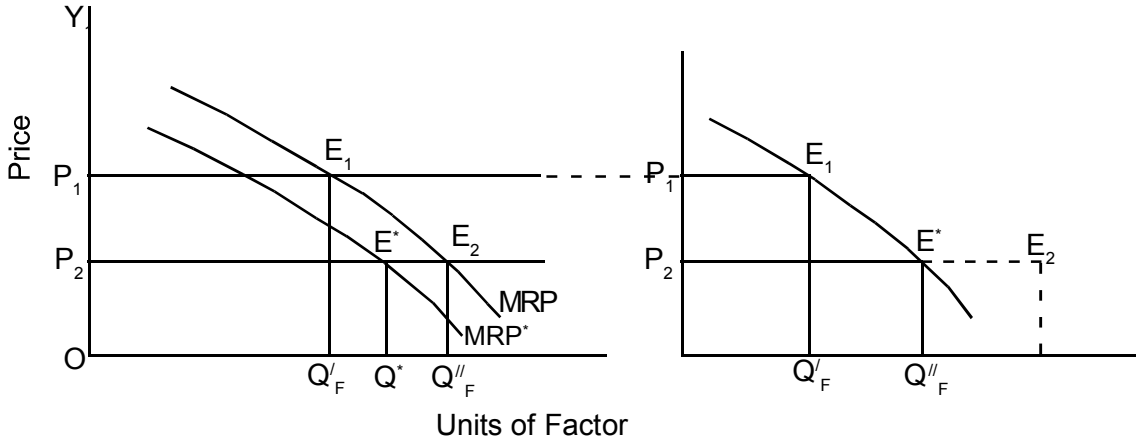


Fig. 4.3: Demand for a single firm

Fig. 4.4: Market demand for Labour

It is clear in the diagram that, as the price of the variable factor decreases from P_1 to , the firm increases its employment from $Q^{/}F$ to $Q^{//}_F$. Thus the section E_1E_2 (in figure 4.3) constitutes its demand curve. But we may note that all other firms in the market will do the same. Consequently, overall employment of the factor will go up which will increase the production and hence the supply of the output produced by this factors. Given market demand for the product, the price of the product will fall. In other words, the MR will decrease which will cause MRP to shift downwards. Therefore

following the fall in price, the MRP curve will shift downward to a new position. In our figure 4.3, the new MRP curve is MRP^*. When the price of the variable factor falls to P_2, the firm will be in equilibrium not at point E_2 (on the original MRP curve) but at point E^* on the new MRP or demand curve MRP^*. At this new position the firm will employ OQ^* amount of the factor and not $OQ^{//}_F$. When we connect the points E_1 and E^* we get the actual demand curve of the firm of the variable factor where market adjustments have been taken into account. The market demand curve for the variable factor is derived simply by laterally summing up such individual demand curves as shown in figure 4.4. Summing horizontally over all firms, at different prices of the variable factor like P_1 and P_2 we obtain the total demand for the input as represented by the points E_1 and E^* respectively in figure 4.4. Joining this two points we get the market demand curve for the variable factor, which is obviously downwards sloping.It is important to note here that, point E_2 in figure 4.4, does not belong to the market demand curve for the variable factor, as it represents the demand for labour in the market with the price of the commodity unchanged. If we consider it to be one point of market demand curve, it will led to an overestimation of the demand for the variable factor.

In general, whether the variable factor is labour or any other factor, the supply curve in a market is positively sloped. If the variable factor happens to be labour then the main determinants of the market supply are–

- Price of labour
- Taste of consumers, which define their trade off between leisure and work.
- The size of the population.
- The labour force participation rate.
- Occupational, educational and geographic distribution of labour price.

Now, given the downward sloping market demand curve and positively sloped market supply curve of the variable factor, market equilibrium is acheived where both the curves intersect each other and at that particular point the price of the variable factor is also determined. As seen in the figure 4.5, positively sloped supply curve S_F intersects the demand curve D_F at E. Thus, at this point the demand for factor equals its supply. Hence,

E is the point of equilibrium. Corresponding to it we get OP as equilibrium factor price at which OF amount of employment will be offered.

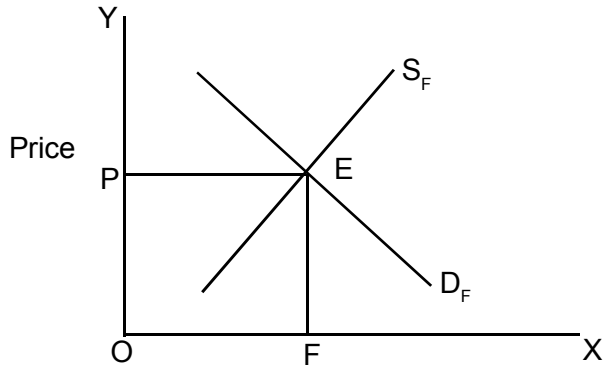


Fig. 4.5: Determination of Equilibrium

4.6 EQUILIBRIUM UNDER IMPERFECT COMPETITION IN THE FACTOR MARKET

We have already discussed about the equilibrium under perfect competition in the factor market. However, in the real world, factor market is imperfect. Here we are going to discuss about the equilibrium under imperfect competition. The same mechanism is deployed for the determination of equilibrium condition under imperfect competition(when there are imperfection in the commodity and factor market) as in case of perfectly competitive market i.e through the interaction of demand and supply. But in case of imperfect markets, the factors determining demand and supply are different.Since here, both the labour and product markets are involved, we get the following combination of imperfections in the market–

- Perfect competition in the product and imperfect competition in the factor market.
- Imperfect competition in the product market and perfect competition in the factor market.
- Imperfect competition both in product and factor markets.

- **Perfect competition in the product and imperfect competition in the factor market:**

Let us suppose that imperfections in the factor market takes the form of monopsony. In a monopsony factor market , there will be a single firm buying the services of the factor .The bargaining power of labour under this situation will be very weak and the firm can get more of factor services by offering higher price for it. Here, we are considering the case of a firm in the labour market. In the labour market the presence of a monopsony implies that Average Wage (AW) curve will be increasing and Marginal Wage (MW) curve will be above the AW curve as more and more workers are employed.

Again, since there are perfect competition in the product market, it implies that the price of the product will be given to the firm and it will remain constant. Therefore, MR curve will coincide with the AR curve and the marginal product of labour in revenue term i.e marginal revenue product of labour (MRP_L) will be equal to the value of marginal product of labour (VMP_L). The equilibrium in the market is shown in the following diagram :

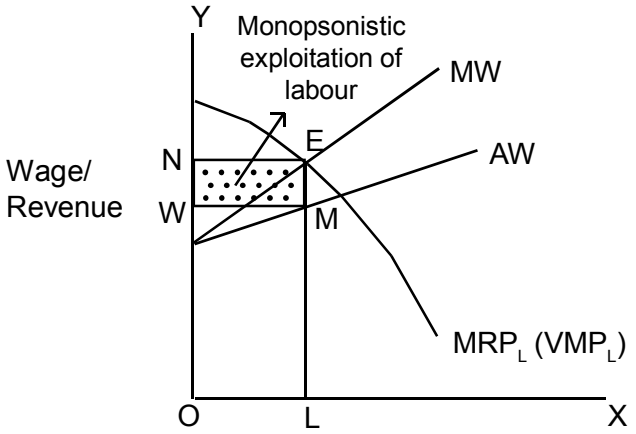


Fig. 4.6: Determination of Equilibrium in the Market

In the above figure 4.6 it is clear that the marginal wage curve is intersecting the MRP_L curve at E. It is important to note here that marginal wage curve and MRP_L curve are MC curve and MR curve respectively for the employment giving firm. So, E is the point of equilibrium. And at equilibrium, OL amount of labour is employed by the firm and OW will be the equilibrium wage rate. The total wage is given by the area OLMW (OL x OW), but as we

can see that the total value of marginal product of labour or the total value of the contribution made by the workers is given by the area OLEN (OL x ON). So it is clear from the above diagram that the workers are not paid according to their contribution, but less than that. The amount of difference between their contribution (OLEN) and payment received (OLMW) is given by the area WMEN. This is the area representing the exploitation of labour and this exploitation is possible due to the presence of monopsony in the factor market. Professer John Robinson termed it as monopsonistic exploitation of labour.

- **Imperfect competition in the product market and perfect competition in the factor market:**

Let us suppose that imperfections in the product market takes the form of monopoly.We know that in the monopoly structure of a market both the AR and MR curves are downward sloping and MR curve lies below the AR curve. Therefore, the VMP_L curve which is nothing but AR curve and MRP_L curve which is representing the MR curve will be both downward sloping and MRP_L will lie below VMP_L.

Again since there is perfect competition in the factor market, so the market determined wage will be given to the firm. Therefore, AW curve is a straight line and the MW curve will coincide with it.

The equilibrium in this situation is shown below–

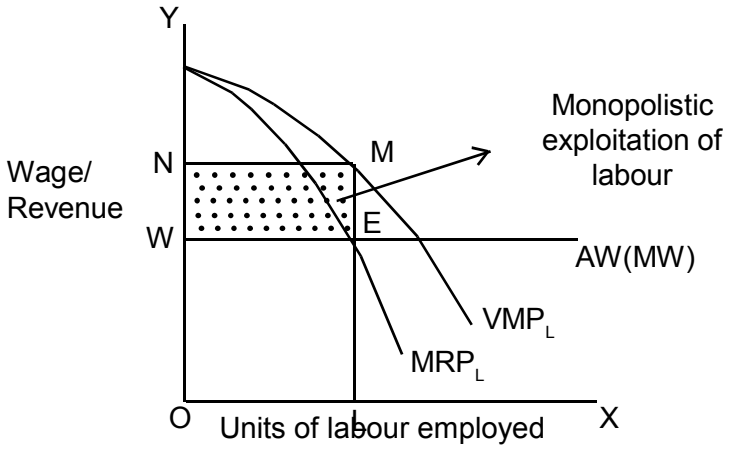


Fig. 4.7: Determination of Equilibrium in the Market

In the above figure 4.7, E is the point of equilibrium as at that particular point MW curve cut the MRP_L curve . And at equilibrium, the firm employs

OL units of labour at OW wage rate. Thus, the total payment made to the labour is given by the area OLEW(OL x OW). As, the value of marginal product of labour is ML(ON) per unit of labour, so the total contribution made by the labour employed is represented by the area OLMN. So it is clear from our diagram that employed workers are paid less than their contribution by the amount EMNW(OLMN - OLEW). This area clearly representing the exploitation of labour and since this exploitation is possible due to the presence of monopoly in the product market, so this is known as monopolistic exploitation of labour.

- **Imperfect competition both in product and factor markets:**

Let us suppose that imperfections in the product and factor markets take the form of monopoly and monopsony respectively. In this situation, because of presence of monopsony market structure, both the MW and AW curves are upward sloping and MW curve lies above the AW curve. Also, there is presence of monopoly market structure, so both VMP_L and MRP_L curves are downward sloping and MRP_L curve lies below the VMP_L curve. The equilibrium in this situation is shown below.

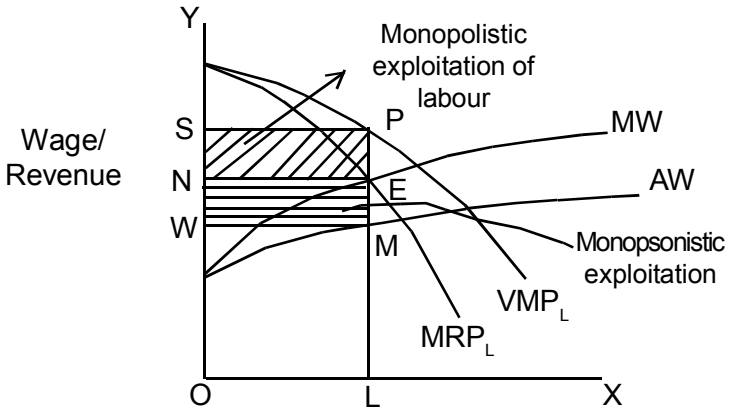


Fig. 4.8: Determination of Equilibrium in the Market

In the Figure 4.8 we see that the MW curve cuts the MRP_L curve from below at point E. Therefore, E is the point of equilibrium. Accordingly, the firm employs OL units of labour at OW wage rate. Thus the total payment made to employed labour is given by the area OLMW.

However, the value of marginal product of labour is given by the distance PL per unit of labour. Therefore, the total contribution made by the labour

employed is given by the area OLPS. It is important to note here that, the total contribution of labour (represented by the area OLPS) is more than what they actually receive (represented by the area OLMW).So it clearly reveals that the workers are deprived of an amount represented by the area WMPS in our diagram.This is exploitation of labour. We may note that the amount of WMPS can be divided into two parts- WMEN and NEPS. The first part i.e WMEN arises because of the presence of monopsonistic power in the factor market. So the first part is termed as monopsonistic exploitation of labour. Again, second part i.e NEPS arises because of the presence of monopoly power in the product market. So, it is termed as monopolistic exploitation of labour. So, we can conclude that, when there is imperfections both in the factor and product markets, there is double exploitation of labour.



CHECK YOUR PROGRESS

Q.4: State the condition of equilibrium of the firm under perfect competition according to the the marginal productivity theory of distribution. (Answer in about 20 words)

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Q.5: Can we simply laterally sum up the individual demand curves of firms to get the market demand curve for a variable factor under perfect competition? If not why? (Answer in about 40 words)

.....

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Q.6: State True (T) or False (F):

(a) In the labour market the presence of a monopsony implies that Average Wage (AW) curve will be increasing and Marginal Wage (MW) curve will be above the AW curve as more and more workers are employed. (True/False)

(b) When there is imperfections both in the factor and product markets, there is double exploitation of labour. (True/False)

4.7 MODERN THEORY OF DISTRIBUTION

We have already studied the marginal productivity theory of distribution. This theory tells us about how many labour an employer will engage at a given wage rate in order to maximize the profit. But the theory does not explain how that wage rate is determined. The marginal productivity theory was also criticized on the ground that it is a one sided theory since it ignores the supply side. Hence this theory is not considered as an inadequate explanation for the determination of the factor prices. To overcome these disadvantages the modern theory of factor pricing has been developed which provides satisfactory explanation for the determination of the factor prices. The theory states that price of a factor is determined by demand for and supply of that particular factor. According to the modern theory of distribution, the factor price is determined at a point where demand for and supply of factors intersect each other.

Assumptions:

- Every producer tries to get maximum profit.
- There is no intervention of the state in determining the price of the factors.
- Perfect competition exists both in the factor and product market.

Determination of demand curve for the factor of production:

The demand for a factor of production is known as derived demand. The productivity of a factor refers to the amount of contribution made by the factors in the process of production. The demand of the employer for a factor depends on its marginal revenue productivity and the quantity of the factor that a firm will employ will depend on the prevailing wage rate. More labour will be employed if wages are low and less if wages are high. If the demand for good produced by the factor is more, than its demand will also increase and vice versa.

The following diagram will illustrate the position of a firm regarding the employment of the factor, say, labour.

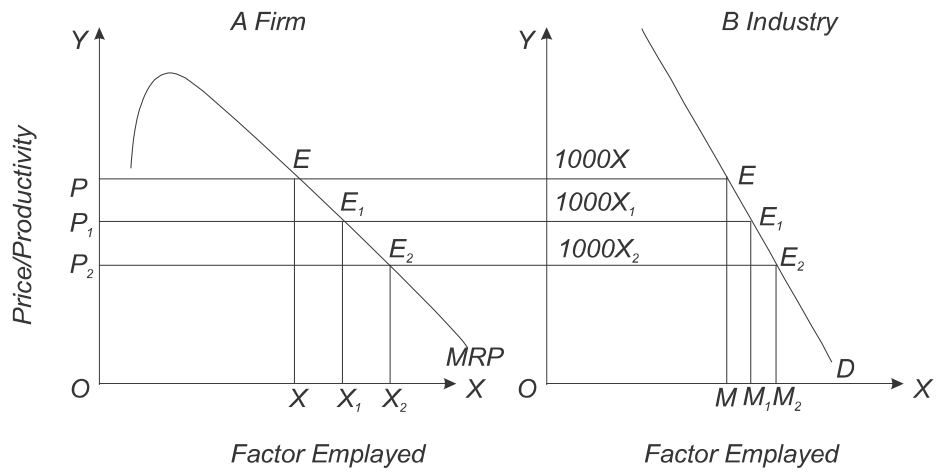


Fig. 4.8: Derivation of Demand Curve

When the price of the factor is OP, the firm is in equilibrium at the point E and the demand for the factor is OX; similarly, at OP_1 price, the demand is OX_1 and at OP_2 price rate the demand is OX_2. MRP is the demand curve for a factor of production for an individual firm. The demand curve of an industry is the sum total of the marginal productivity curve of all individual firms . DD is the demand curve for the industry. We assume that there are 100 firms in the industry. At OP price rate the demand of an individual firm is OX, but the demand of the whole industry at the same price is OM, which is equal to 100 OX. Similarly, at OP_1 price, the demand of factor for the whole industry is OM_1, which is equal to 100 OX_1 and at OP_2 price, the demand of factor for the entire industry is OM_2, which is equal to 100 OX_2.The demand curve of the entire industry is DD which is downward sloping to the right. This is because of the law of diminishing marginal productivity, which states that the more a factor is employed the lower is the marginal productivity.

Determination of Supply curve for the factor of production:

For the supply side, the supply curve of a factor depends on various factors such as size and composition of population, geographical distribution, education, labour efficiency and so on. In case of labour if the wage goes up, supply of labour will increase but demand for labour will decrease. Again if wage rate decreases, the supply of labour decreases but demand for labour increases. Hence, the supply curve of a factor rises from left to right upward.

Interaction of demand and supply:

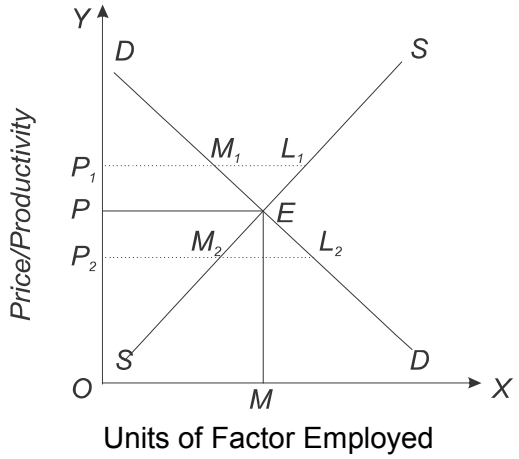


Fig. 4.9: Determination of Equilibrium

The price of the factor is established at the point E where demand and supply are in equilibrium. This equilibrium is at the point of intersection of the demand and supply curves. In the diagram they intersect at the point E, and the price of the factor thus determined will be OP. At OP_1 price level, demand for labour is P_1M_1 which is less than the supply P_1L_1 .In this case, the competition among the sellers will tend to bring down the price to OP. On the other hand, at OP_2 price level the demand for labour P_2L_2 is greater than supply P_2M_2, hence the price will tends to grow up to OP where demand and supply will be equal.

This is how the price of a factor of production in the factor market is determined by the interaction of the forces of demand and supply of the factors.

4.8 PRODUCT EXHAUSTION PROBLEM

The marginal productivity theory of distribution created a controversy among the economists regarding whether the total value of the product will be exhausted if factors are paid according to their marginal product. In other wards, the controversy was whether the total factor payments in the economy will add up to the value of the total output produced in the economy. And this is known as the adding up problem or product exhaustion problem.

Now, assuming that there are only two factors of production viz. labour (L) and capital (K) and Q is the quantity of output produced in the

economy in physical terms and P be its price, then the adding up problem can be expressed as,

$P.Q = w.L + r.K$ ---------- (1)

Where w is price of labour & r is price of capital.

In equation (1) L.H.S. represents value of output the R.H.S. represents the total factor payments.

i.e. Value of output = Payment to the labour + Payment to the capital

Now, dividing both side of the equation (1) by PQ, we get,

$$\Rightarrow \frac{PQ}{PQ} = \frac{wL}{PQ} + \frac{rK}{PQ}$$

$\Rightarrow 1=wL/PQ+rK/PQ$

$\Rightarrow$ 1 = share of L + share of K.

Therefore,the adding up problem also shows that the factor shares add to unity.

The marginal productivity theory of distribution tells us that each factor should be paid according to its marginal product. Accordingly, when all factors of production are remunerated according to their marginal product, the total product will be exactly exhausted without any surplus or deficit.

If MPP_L is the marginal physical product of labour and MPP_k is the marginal physical product of capital, then according to adding up problem,

$Q = MPP_L.L + MPP_k.K$ ..... (2)

Leonhard Euler, a Swiss mathematician has shown that the equation (2) will hold if there is constant returns to scale in production or the production function is linearly homogeneous.. This proposition has came to be known as the Euler's theorem.

Now, let us prove or establish the Euler's theorem by using the case of a typical Cobb Douglas production function which is subject to constant returns to scale in production. The typical expression of a Cobb Douglas production function is

$$Q = AK^{\alpha}L^{\beta}(\alpha + \beta = 1) \quad \text{----------(3)}$$

where, Q – quantity; A – efficiency parameter; L – labour; K - capital and α ε β are co-efficients

Now, differenciating equation (3) with respect to L we get,

$$MPP_L = \frac{\delta Q}{\delta L} = \frac{\delta}{\delta L}(AL^{\alpha}K^{\beta})$$

$$= A\alpha L^{\alpha-1}K^{\beta}$$

Multiplying L with both side of the above equation we get,

$$L.MPP_L = A\alpha L.L^{\alpha-1}K^{\beta}$$

$$= \alpha A L^{\alpha} K^{\beta} \text{ ----------(4)}$$

Again, differenciating equation (3) with respect to K we get,

$$MPP_K = \frac{\delta Q}{\delta K} = \frac{\delta}{\delta K}(AL^{\alpha}K^{\beta})$$

$$= AL^{\alpha}\beta K^{\beta-1}$$

Multiplying K with both side of the above equation we get,

$$K.MPP_K = A\beta L^{\alpha}K^{\beta-1}.K$$

$$= \beta AL^{\alpha}.K^{\beta} \text{ ----------(5)}$$

Adding equation (4) and (5), we get,

$$\therefore L.MPP_L + K.MPP_K = (\alpha+\beta)AL^{\alpha}K^{\beta} = Q \quad (\text{Since } \alpha+\beta=1)$$

The above clearly establishes that the equation (2) holds.

This proves that if the production function is linearly homogeneous or homogeneous of degree one, then with Euler's theorem it is easy to demonstrate that when each factor is paid according to its marginal product, the total product will be fully exhausted.



CHECK YOUR PROGRESS

Q.7: What is meant by modern theory of distribution? (Answer in about 20 words)

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Q.8: Briefly explain the adding up problem. (Answer in about 50 words)

.....

.....

Q.9: State the Euler's theorem. (Answer in about 20 words)

.....

.....

Q.10: State True (T) or false (F):

(a) The adding up problem also requires that the factor shares add to unity. (True/False)

(B) According to adding up problem, Q = MPPL.L + MPPk.K. (True/False)



4.9 LET US SUM UP

- Production of goods and services in an economy is the result of joint efforts of factors of production. Factor pricing is concerned with the analysis of how and in what manner the factors of production get remunerated in such production process for their contribution.
- According to the marginal productivity theory, under certain conditions, the variable factors are paid according to their marginal product.
- Marginal revenue product (MRP) is the increase in the total value of the product as a result of the employment of an additional unit of a variable factor, when quantity of other factors remaining the same.
- Value of marginal product (VMP) is obtained by multiplying the price (average revenue/AR) of the product of the firm with the marginal physical product (MPP) of the variable factor.
- Under perfect completion : MRP = VMP
- The Equilibrium of the firm under perfect competition can be discussed by the marginal productivity theory of distribution.
- In case of imperfection the factors determining the demand and supply are different.Since here, both the labour and product markets are

involved, we get the following combination of imperfections in the market–

(a) Perfect competition in the product and imperfect competition in the factor market.

(b) Imperfect competition in the product market and perfect competition in the factor market.

(c) Imperfect competition both in product and factor market.

- The exploitation of labour is possible due to the presence of monopsony in the factor market and perfect competition in the product market, which is known as monopsonistic exploitation of labour.
- The exploitation of labour is possible due to the presence of monopoly in the product market and perfect competition in the factor market, which is known as monopolistic exploitation of labour.
- When there is imperfections both in the factor and product markets, there is double exploitation of labour.
- According to the modern theory of distribution the factor price is determined at a point where demand for and supply of factors intersect each other.
- If MPP_L is the marginal physical product of labour and MPP_K is the marginal physical product of capital, then according to adding up problem, $Q = MPP_L.L + MPP_K.K$



4.10 FURTHER READING

1) Ahuja, H. L. (2000). *Advance Economic Theory: Microeconomic Analysis.* New Delhi: S. Chand & Company Ltd.

2) Jhingan, M. L. (2005). *Microeconomic Theory.* Delhi: Vrinda Publications (P) Ltd.

3) Koutsoyiannis, A. (1979). *Modern Microeconomics.* London: Macmillan Press.

4) Maddala, G. S. & Ellen Miller (1989). *MicroEconomic Theory and Applications*. Singapore: Mcgraw-Hill.

5) Seth, M. L. (2004). *Refresher Course in Micro Economics.* Agra: Educational Publishers.

4.11 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: The marginal productivity theory of distribution was developed by host of economists like J.B. Clark, Wickstead, Marshall and others.

Ans to Q. No. 2: MRP is the increase in the total value of the product as a result of the employment of an additional unit of a variable factor, when quantity of other factors remaining the same

Ans to Q. No. 3: The term marginal productivity refers to the extra output gained by adding one unit of variable factor when all other factors of productions are remained constant.

Ans to Q. No. 4: According to the marginal productivity theory of distribution, the firm will be in equilibrium when the marginal revenue productivity (MRP) of any factor to the firm equals its marginal cost (MC).

Ans to Q. No. 5: No, we cannot simply laterally sum up the individual demand curves of firms to get the market demand curve for a variable factor under perfect competition, as the changes in factor price will bring about changes in the marginal productivity of the factor.

Ans to Q. No. 6: (a)True (b) True

Ans to Q. No. 7: The modern theory of distribution states how the price of the factor is determined through demand and supply of the factor of production.

Ans to Q. No. 8: The marginal productivity theory of distribution created a controversy among the economists regarding whether the total value of the product will be exhausted if factors are paid according to their marginal product. In other wards, the controversy was whether the total factor payments in the economy will add up to the value of the total output produced in the economy. And this is known as the adding up problem or product exhaustion problem.

Ans to Q. No. 9: According to the Euler's theorem if the production function is linearly homogeneous or homogeneous of degree one and each factor of production is paid according to its marginal product, then the total product will be fully exhausted.

Ans to Q. No. 10: (a) True (b) True



4.12 MODEL QUESTIONS

A) Short Questions (Answer each questions in about 150 words)

Q.1: State the importance of factor pricing.

Q.2: 'Each factor receives an income equal to its marginal product'. Comment.

Q.3: Define the marginal physical product of a factor of production.How is the marginal revenue product related to the marginal physical product?

Q.4: Distinguish between the value of marginal product and marginal revenue product of a factor. Under what conditions will they be equal?

Q.5: Briefly explain the product exhaustion problem.

B) Long Questions (Answer each questions in about 300 - 500 words)

Q.1: Critically explain the marginal productivity theory of distribution.

Q.2: Explain the equilibrium of the firm in the factor market under perfect competition.

Q.3: Explain the equilibrium of the firm in the factor market under imperfect competition.

Q.4: Explain the modern theory of distribution.

Q.5: 'When each factor is paid according to its marginal productivity, the total product is exhausted'. Examine critically.

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UNIT 5: INTER-TEMPORAL CHOICE

UNIT STRUCTURE

5.1 Learning Objectives

5.2 Introduction

5.3 The Concept of Present Value

- 5.3.1 Computation of Present Value
- 5.3.2 Present Value of an Income Stream
- 5.3.3 Net Present Value and Choice of Investment Project

5.4 Internal Rate of Return

5.5 Inter-Temporal Consumption Decisions

- 5.5.1 Investment in Human Capital

5.6 Inter-Temporal Production Decisions

- 5.6.1 The Behaviour of Market Price

5.7 Let Us Sum Up

5.8 Further Reading

5.9 Model Questions

5.10 Answers to Check Progress

5.1 LEARNING OBJECTIVES

After going through this unit, you will be able to:

- explain the inter- temporal choice of investment decisions
- understand computation of NPV and IRR and their relevance to choice of investment project
- explain the individual consumption decisions of inter-temporal choice
- explain the production decision under inter-temporal choice pattern with behaviour of market price.

5.2 INTRODUCTION

When a firm decides whether to build a factory or purchase machines, it must compare the outlays it would have to make now with the additional

profit that the new capital will generate in the future. To make this comparison, it must address the following question: how much are future profits worth today? This problem does not arise while hiring labour or purchasing raw materials. To make these choices, the firm need only compare its current expenditure on the factor. Investment decisions involve comparing an outlay today with the profits that will be received in the future. Individuals also make decisions involving costs and benefits of investments occurring at different points of time, and the same principles apply. The answers to these investment and production decisions depend in part on the interest rate that one pays or receives when borrowing or lending money.

5.3 THE CONCEPT OF PRESENT VALUE

Present Value is the concept that states that an amount of money today is worth more than that same amount in the future**.** Money received today is valued more than money receivable tomorrow. Cash in hand is valued more because it gives a) liquidity and b) opportunity to invest it and earn return (interest) on it. This is called the time value of money. The time lag between the investment and the first return from the investment is called time lag. During this time lag, the investor losses interest on the expected incomes. This implies that a rupee received today is worth more than a rupee receivable at some future date. Or conversely, a rupee expected to be received one year hence is worth less than a rupee today. In the contest of the time value of money, the present value of a future income is lower than the value of the same amount received today.

5.3.1 Computation of Present Value

Suppose an amount of X_0 is invested for a period of one year at a compound interest rate. At the end of the year, the total receipt, say X_1 can be expressed as:

$$X_1 = (X_0 + r X_0) = X_0 (1+r) \quad \text{.....(i)}$$

Where r refers to the rate of interest.

Equation (i) shows that X_0 increases at the rate of (1+r) to take the value X_1 after one year. It implies that if X_1 is discounted at the same rate of interest, it gives its Present Value (PV). The formulae for computing the present value is give below:

$$\text{PV of } X_0 = \left(\frac{X_1}{1+r}\right) = X_1\left(\frac{1}{1+r}\right) \quad \text{.....(ii)}$$

In equation (ii), $\left(\frac{1}{1+r}\right)$ is the discount rate for one year. Given the rate of interest (the numerical value for r), any income receivable after one year can be discounted to its present value. For example, the present value of an income of Rs.500 expected after one year at 10 percent interest per annum (where r=0.10) can be calculated as

$$PV = 500\left(\frac{1}{1+0.10}\right) = 454.55$$

It means that at 10 percent interest rate, the present value of Rs.500 expected after one year is Rs.454.55. The discount rate (d_2) for an income receivable after 2 years will be $\left(\frac{1}{(1+r)^2}\right)$ and for an income receivable after 3 years, $d_3 = \left(\frac{1}{(1+r)^3}\right)$ and so on. The formulae for discount rate for the n^{th} year is given as

$$d_n = \frac{1}{(1+r)^n} \quad \text{.....(iii)}$$

The formulae for calculating Present Value (PV) of an amount receivable in the n^{th} year is given as

$$PV = X_n\left[\frac{1}{(1+r)^n}\right] \quad \text{..... (iv)}$$

Or, $$PV = \frac{X_n}{(1+r)^n}$$

5.3.2 Present Value of an Income Stream

The concept of present value is associated with the time value of money. The idea is that an amount of money today is worth more

than the same in the future. This happens due to that fact that prices of goods and services always go on rise and we have limited amount of income of the other. The formulae for calculating the Total Present Value (TPV) of an income stream of annual return (R) over n years is given as

$$TPV = \frac{R_1}{(1+r)} + \frac{R_2}{(1+r)^2} + \frac{R_3}{(1+r)^3} + \ldots\ldots + \frac{R_n}{(1+r)^n} \quad \text{.....(v)}$$

$$= \sum_{j=1}^{n} \frac{R_n}{(1+r)^n} \quad \text{.....(vi)}$$

For example, if a stream of cash flows (or the return) consists of + Rs.100 at the end of period one, and the interest rate is 5% (0.05) then the present value of the Cash Flow will be:

$$TPV = \frac{R_n}{(1+r)^n} = \frac{100}{(1+0.05)^1} = \frac{100}{1.05} = \text{Rs. } 95.24$$

5.3.3 Net Present Value and Choice of Investment Project

Present value adjusted for the cost of investment provides the basis of investment decisions. The investment decision is taken on the basis of net present value. It may be defined as the difference between the Present Value (PV) of an income stream and the cost of investment (C), that is

$$NPV = PV - C$$

$$= \sum_{j=1}^{n} R_n \left[\frac{1}{(1+r)^n} \right] - C$$

Where C is the total cost of investment without any recurring expenditure

The investment decision rules can be specified as below:

- If NPV>0, the project is acceptable
- If NPV=0, the project is accepted or rejected on non economic considerations

- If NPV<0, the project is rejected

If investment is a recurring expenditure, the Total Present Cost (TPC) for n years can be calculated in the same manner as present value of an income stream is calculated, that is

$$TPC = \sum_{j=1}^{n} \frac{C_n}{(1+r)^n} \quad \text{.....(vii)}$$

$$\text{And then, NPV} = \sum_{j=1}^{n} \frac{R_n}{(1+r)^n} - \sum_{j=1}^{n} \frac{C_n}{(1+r)^n}$$

$$= \sum_{j=1}^{n} \frac{R_n - C_n}{(1+r)^n} \quad \text{.....(viii)}$$

The investment decision rule in this case is the same as given above.



CHECK YOUR PROGRESS

Q.1: What is meant by NPV? (Answer in about 20 words)

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Q.2: Briefly explain how investment decisions are taken based on NPV. (Answer in about 40 words)

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5.4 INTERNAL RATE OF RETURN

Internal rate of return (IRR) refers to the percentage rate of return implicit in the flows of benefits and costs of projects. IRR is the discount rate at which the net present value of the future cash flows is equal to the initial investment, and it is also the discount rate at which the total present value of costs equals the total present value of the benefits. The Internal

rate of Return (IRR) is also called Marginal Efficiency of Investment (MEI). If a one year project costing Rs.100 million yields Rs.120 million at the end of the year, then its IRR (r) can be obtained as follows:

$$\frac{120 \text{ million}}{1+r} = \text{Rs. } 100 \text{ million}$$

$$= (1+r)\ 100 = 120$$

$$1+r = \frac{120}{100}$$

$$r = 1.2-1$$

$$r = 0.2$$

The IRR of this project is 0.20 or 20 percent. No other value of r can equate the NPV of the project with its cost.

The IRR or MEI is defined as 'the rate of interest or return which renders the discounted present value of its expected future marginal yields exactly equal to the investment cost of project'. In other words, 'IRR is the rate of return (r) at which the discounted present value receipts and expenditures are equal.' The IRR of a project yielding a stream of returns over n years and involving different investment costs can be obtained by using the formula given in the following equation:

$$\sum_{j=1}^{n} \frac{R_n}{(1+r)^n} = \sum_{j=1}^{n} \frac{C_n}{(1+r)^n}$$

This criterion is basically the same as Keynesian MEI which is theoretically superior to other criteria.

5.5 INTER-TEMPORAL CONSUMPTION DECISIONS

Consumers also face some situations when they purchase durable goods, such as the cars or major appliances. Suppose, one has to decide to buy a new car from the market; if s (he) keeps the car or six or seven years, most of the benefits will occur in the future. Therefore, s (he) must compare the future flow of net benefits from owning the car with the purchase price.

The main benefit from owning a car is the flow of transportation services it provides. The value of those services differs from consumer to

consumer. Let's assume that the consumer values the service at S per year and total operating expense (insurance, maintenance etc.) is E per year, that the car costs Rs.20000 and that after six years, its resale value will be Rs. 4000. The decision to buy the car can then be frames in terms of present value:

$$NPV = -2000 + (S-E) + \frac{(S-E)}{(1+R)} + \frac{(S-E)}{(1+R)^2}$$

$$+.....+ \frac{S-E}{(1+R)^6} + \frac{4000}{(1+R)^6}$$

Here, the discount rate is the opportunity cost of money. If the consumer already has Rs. 20000 and does not need a loan, the correct discount rate is the return that could be earned by investing the money in another asset- say, a savings account or a government bond. On the other hand, if the consumer is in debt, the discount rate would be the borrowing rate that he or she is already paying. Because this rate is likely to be much higher than the interest rate on a bond or savings account, the NPV of the investment will be smaller.



CHECK YOUR PROGRESS

Q.3: What is meant by IRR? (Answer in about 20 words)

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5.5.1 Investment in Human Capital

Human capital is the knowledge, skills and experience that make an individual more productive and thereby able to earn a higher income over a lifetime. Now, the question is how an individual should decide whether to invest in human capital or not. Here, net present value can be applied. For example, one needs to decide whether to invest in going to college for four years after high school or skip college and go to work instead. Let us analyse the situation purely on financial basis and ignore other factors. An important benefit of

college is the ability to earn a higher salary throughout your working life. In India, a college student graduate will on average earn about Rs.20000 per year more than a high school graduate. In practice, the salary differential is largest during the first 5 to 10 years following the college graduation and then becomes smaller. For simplicity, however, we will assume that this Rs.20000 salary differential persists for 20 years. In that case, the NPV of investing in a college education is

$$NPV = -40 - \frac{40}{1+R} + \frac{40}{(1+R)^2} - \frac{40}{(1+R)^3} + \frac{20}{(1+R)^4} + \ldots\ldots + \frac{20}{(1+R)^{23}}$$

We shall use real discount rate. In this case, a reasonable real discount rate would be about 5 percent. This rate would reflect the opportunity cost of money for many households- the return that could be made by investing in assets other than human capital. The NPV shall come out to be Rs. 66000. With 5 percent discount rate, investing in a college education is a good idea, at least as a purely financial matter.

5.6 INTER- TEMPORAL PRODUCTION DECISIONS

Production decision often has inter- temporal aspects- production today affects sales or costs in the future. Suppose, one of your rich friend gives you an oil well. The well contains 1000 barrels of oil that can be produced at a constant average and marginal cost of Rs.10 per barrel. Now the question is whether to produce oil today or save it for future. The decision depends not on the current profit level but on how fast you expect the price of oil to rise. Oil in the ground is like money in the bank. You should keep it in the ground only if it earns a return at least as high as the market interest rate. If you expect the price of oil to remain constant or rise very slowly, you would be better off extracting and selling all of it now and investing the proceeds. But, if you expect the price of oil to rise rapidly, you should leave it in the ground. The value of oil in your barrel of oil in your well is equal to the price of oil less the Rs.10 cost of extracting it. (This is the profit you can obtain by extracting and selling each barrel). This value must rise at least as fast as the rate of interest for you to keep the oil. Your production

decision rule is therefore: Keep all your oil if you expect its price less its extraction cost to rise faster than the rate of interest. Extract and sell all of it if you expect price less cost to rise at less than the rate of interest. What if you expect price less cost to rise at exactly the rate of interest? Then you would be indifferent between extracting the oil and leaving it in the ground. Letting, P_t be the price of oil this year, P_{t+1} the price next year, and c the cost of extraction, we can write this production rule as follows:

If $(P_{t+1} - C) > (1+R)(P_t - C)$, Keep the oil in the ground

If $(P_{t+1} - C) < (1+R)(P_t - C)$, sell all the oil now

If $(P_{t+1} - C) = (1+R)(P_t - C)$, makes no difference

Given our expectation about the growth rate of oil prices, we can use this rule to determine production. But the question arise how fast should we expect the market price of oil to rise.



CHECK YOUR PROGRESS

Q.4: Define human capital. (Answer in about 20 words)

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5.6.1 The Behaviour of Market Price

Suppose there are no OPEC cartels and the oil market consisted of many competitive producers with oil wells like our own. Then, one needs to determine how quickly oil prices are likely to rise by considering the production decisions of other producers. If other producers want to earn the highest possible return, then one needs to follow the production rule as stated above. This means that price less marginal cost must rise equally with the rate of interest. Suppose, price less cost is to rise faster than the rate of interest- in that case no one would sell any oil. Inevitably, this would drive up the current price. If, on the other hand, price less cost were to rise at a rate less than the rate of interest, everyone would try to sell all of their oil immediately, which would drive the current price down.



5.7 LET US SUM UP

- When a firm makes a capital investment, it spends money now in order to earn profits in the future. To decide whether the investment is worthwhile, the firm must determine the present value of future profits by discounting them.
- The discount rate that a firm uses to calculate the NPV for an investment should be the opportunity cost of capital – that is the return the firm could earn on a similar investment.
- Consumers are also faced with investment decisions that require the same kind of analysis as those of firms.
- When deciding whether to buy a durable good like a car or a major appliance, the consumer must consider the present value of future opportunity costs.
- Investments in human capital- the knowledge, skills and experience that make an individual more productive and thereby able to earn a higher income in the future- can be evaluated in much the same way as other investments.
- Investing in further education, for example, makes economic sense if the present value of the expected future increases in income exceeds the present value of the costs.



5.8 FURTHER READING

1) Pindyck, Robert and Rubinfeld, Daniel. (2018). *Microeconomics*. Singapore: Pearson Education.

2) Dwivedi, D. N. (2009). *Managerial Economics*. Delhi: Vikas Publishing House.

3) Alexander, G. J., Sharpe, W. F. & Bailey, J. V. (2007). *Fundamentals of Investments.*, Singapore: Pearson Education.

4) Bhole, L. M. (2006) *Financial Institutions and Markets: Structure, Growth & Innovation.* New Delhi:Tata Mc.Graw Hill.



5.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: NPV is the difference between the Present Value (PV) of an income stream and the cost of investment (C), that is NPV = PV– C.

Ans to Q. No. 2: The investment decisions are taken based on the following conditions of NPV:

- If NPV>0, the project is acceptable
- If NPV=0, the project is accepted or rejected on non economic considerations
- If NPV<0, the project is rejected

Ans to Q. No. 3: IRR is the rate of return (r) at which the discounted present value receipts and expenditures are equal.

Ans to Q. No. 4: Human capital is the knowledge, skills and experience that make an individual more productive and thereby able to earn a higher income over a lifetime.



5.10 MODEL QUESTIONS

A) Short Questions (Answer each questions in about 150 words)

Q.1: Why cash in hand is valued more?

Q.2: What is meant by Present Value?

Q.3: Define time value of money.

Q.4: Briefly explain how present value is computed.

B) Easy type Questions (Answer each question in about 300-500 words)

Q.1: How the decisions are made on the basis of NPV? Explain

Q.2: Explain inter-temporal consumption decision with a suitable example.

Q.3: Explain inter-temporal production decision with a suitable example.

Q.4: Discuss how investment decisions are taken based on the different criterion.

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UNIT 6: CHOICE UNDER UNCERTAINTY

UNIT STRUCTURE

6.1 Learning Objectives

6.2 Introduction

6.3 Individual Behaviour Towards Risk

- 6.3.1 Risk-Averse
- 6.3.2 Risk-Loving
- 6.3.3 Risk-Neutral
- 6.3.4 Preference Axioms

6.4 Expected Utility and Certainty Equivalence Approaches

6.5 Mean-Variance Analysis

6.6 Portfolio Selection

6.7 Let Us Sum up

6.8 Further Reading

6.9 Answers to Check Your Progress

6.10 Model Questions

6.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- learn about individual behaviour towards risk and various types of risk an individual can possess
- identify economic agents as being risk adverse, risk neutral and risk seeker/risk lover
- know the pivotal importance of the expected utility theorem and understand the important concepts like certainty equivalence
- understand the mean variance analysis and portfolio selection in the risk analysis.

6.2 INTRODUCTION

The behaviour of economic agents under conditions of certainty can be seen easily, i.e., the situation in which consequences of any choice

made was fully known beforehand. The traditional theory of consumer behaviour does not include an analysis of uncertain situation. Von Neumann and Morgenstern showed that under some circumstances it is possible to construct a set of numbers for a particular consumer that can be used to predict her choices in uncertain situations. However, there is a great controversy that has centred on the question of whether the resulting utility index is ordinal or, cardinal. It will be shown that Von Neumann – Morgenstern utilities possess at least some cardinal properties. Traditional consumer behaviour analysis is unrealistic in the sense that it assumes actions the consumer are followed by determinate consequences which are knowable in advance. For instance, all automobiles of the same model and produced in the same factory will not always have the same performance characteristics. As a result of random accidents in the production process, some substandard automobiles could be occasionally produced and sold. The consumer has no way of knowing ahead of time whether the particular automobile, which she purchased, is of standard quality or not. Let A represent the situation in which the consumer possesses a standard quality automobile and B be a situation in which she does not. Again, let there be C, in which she possesses a substandard automobile. Assume that the consumer prefers A to B and B to C. That is, not having a car is assumed preferable to owning a substandard one because of the nuisance and expense involved in its uptake. Present her with a choice between two alternatives: (1) she can maintain the status quo and have no car at all. This is a choice with certain outcome i.e., the probability of the outcome equals unity. (2) She can obtain a lottery ticket with a chance of winning either a satisfactory automobile (alternative A) or an unsatisfactory one (alternative C). The consumer may prefer to retain her income (or money) with certainty, or she may prefer the lottery ticket with dubious outcome, or she may be indifferent between them. Her decision will depend upon the chances of winning or losing in this particular lottery. If the probability of C is very high, she might prefer to retain her money with certainty; if the probability of A is very high, she might prefer the lottery ticket. The triplet of numbers (P, A, B) is used to denote a lottery offering outcome A with probability 0<P.

Once we bring in choices to be made under uncertainty, the theoretical prescriptions by far remain an uncovered domain. As our income levels fluctuate, price we pay change or health conditions worsened, we need to model choices accounting for such possible events. Also, see that most of decisions we take are forward looking: planning a holiday trip or to buy insurance are examples. Decisions on these are usually taken on the basis of our beliefs about what is the optimal plan for present and future. Thus, these choices are made in the context of uncertainty. Consequently, there is a risk that the assumptions made in our plans may not materialise. Anticipating such eventualities we resort to contingencies and probabilities. That is, if we want a realistic model of choice, it would be necessary to include in our models the effects of uncertainties. This unit discusses certain important ideas pertaining to uncertainties.

6.3 INDIVIDUAL BEHAVIOUR TOWARDS RISK

Individuals can be grouped into three categories according to their attitude towards risk given by their respective utility functions. These categories are risk averse, risk loving and risk neutral. Consider the case of a coin toss, Rs.10 is earned if heads, and Rs.20 if tails. The expected value is (0.5 x 10) + (0.5 x 20) = Rs.15. Different risk attitudes are explained below.

6.3.1 Risk-Averse

If an individual's utility from the expected value of the lottery exceeds the expected utility from the lottery, he is categorised as risk-averse. Risk-averse behaviour is usually enraptured by a concave utility function, for instance, a logarithmic function. For the above coin toss experiment, we consider a risk-averse person whose utility function is of the form U (E) = log (E), where E is the outcome. The expected utility is 0.5 x log (10) + 0.5 x log (20). This equals to 1.15. The utility of the expected value of this coin toss on the other hand is log (15) = 1.176

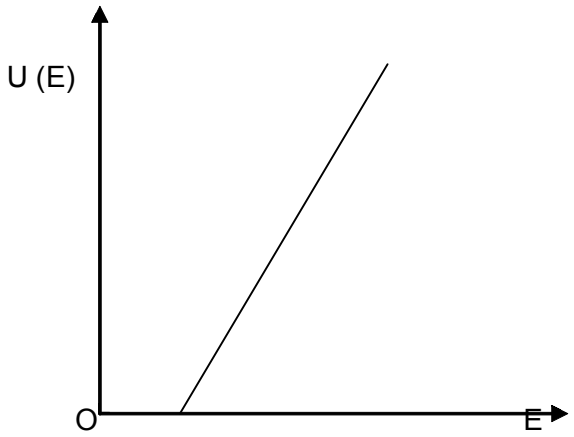


Fig. 6.1: Utility Function of a Risk-Averse Individual

6.3.2 Risk-Loving

If an individual's utility of the expected value of the lottery is less than his expected utility from the lottery, he is the risk-loving type. A convex utility function depicts risk-loving behaviour; an exponential function is a good example for this case. Let the utility function take the form $U(E) = E^2$. The expected utility is $0.5\times 102 + 0.5 \times 202 = 250$; it needs to be compared with the utility of the expected value of the coin toss which is $15^2 = 225$

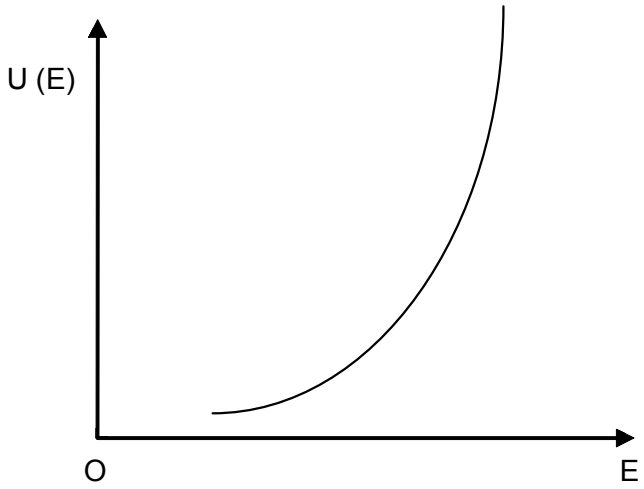


Fig. 6.2: Utility Function of a Risk-Loving Individual

6.3.3 Risk-Neutral

If an individual's utility of the expected value of a lottery is equal to his expected utility from the lottery, he is said to be risk-neutral.

Risk-neutral behaviour is captured by a linear utility function, for instance U (E) = 2E. The expected utility in this case is given by (0.5 x 2 x 10) + (0.5 x 2 x 20) = 30, this is equal to the utility of the expected value of the lottery itself, 2 x 15 = 30.

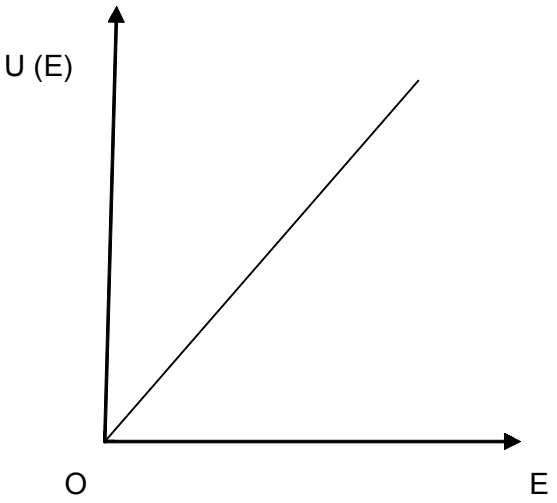


Fig. 6.3: Utility Function of a Risk-Neutral Individual

6.3.4 Preference Axioms

It is possible to construct a utility index which can be used to predict choice in uncertain situations if the consumer conforms to the following five axioms:

- **Axiom of Complete-ordering**: For the two alternatives A and B one of the following must be true: the consumer prefers A to B, she prefers B to A, or she is indifferent between them. The consumer's evaluation of alternatives is transitive: if she prefers A to B and B to C, she prefers A to C.
- **Axiom of Continuity:** Assume that A is preferred to B and B to C. The axiom asserts that there exists some probability P, 0<P<1.
- **Axiom of Compound-lottery**: Let $L_1 = (P_1, A, B)$, and $L_2 = (P_2, L_3, L_4)$, where $L_3 = (P_3, A, B)$ and $L_4 = (P_4, A, B)$, be a compound lottery in which the prizes are lottery tickets. L_2 is equivalent to L_1 if $P_1 = P_2P_3 + (1-P_2)\,P_4$. Given L_2 the probability of obtaining L_3 is P_2. Consequently, the probability of obtaining A through L_2 is

P_2P_3. Similarly, the probability of obtaining L_4 is $(1-P_2)$, and the probability of obtaining A through L_4 is $(1- P_2) P_4$. The probability of obtaining A with L_2 is the sum of the two probabilities. The consumer evaluates lottery tickets only in terms of the probabilities of obtaining the prizes, and not in terms of how many times she is exposed to a chance mechanism.

These axioms are very general in nature, and it may be difficult to object to them on the grounds that they place unreasonable restrictions upon the consumer's behaviour. However, they rule out some types of plausible behaviour. Consider a person who derives satisfaction from the share of gambling. It is conceivable that there exists no P other than P=1 or P=0 for such a person, so that she is indifferent between outcome B with certainty and the uncertain prospect consisting of A and C; she will always prefer the "sure thing" to the dubious prospect. This type of behaviour is ruled out by the continuity axiom and the compound lottery axiom. The axioms have been developed for situations in which there are only two outcomes. Assuming that the pair-wise axioms hold, analysis is easily extended to cases with any number of outcomes. Let $L = (P_1,\ldots,P_n, A_1,\ldots,A_n)$ denote a lottery with n outcomes where $0<P_i<1$ is the probability of the outcome A_i and $\sum_{i=1}^{n} P_i = 1$



CHECK YOUR PROGRESS

Q.1: Distinguish between the categories - risk averse and risk loving. (Answer in about 40 words)

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Q.2: What is meant by the risk neutral? (Answer in about 30 words)

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6.4 THE EXPECTED UTILITY AND CERTAINTY EQUIVALENCE APPROACHES

Expected utility: Expected utility theory is used as a tool for analyzing situations where individuals make a decision without knowing which outcomes may result from that decision, i.e., decision making under uncertainty. It can be calculated by taking the weighted average of all possible outcomes under certain circumstances, with the weights being assigned by probability on the basis of occurrence of a particular event.

Let us take an utility function U that has the expected utility property (for any gamble) E with possible outcomes $\{e_1, e_2,...,e_n\}$ and probabilities P_1, $P_2,...,P_n$, respectively, then the expected utility is given by: $U(E) = P_1U(e_1) + P_2U(e_2) + ... + P_n U(e_n)$. An individual chooses one gamble over another on the basis of its expected utility.

Most of the people are unwilling to participate in fair game. For example, offer of participating in a gamble is which a person has even chance of winning or losing of any amount is a fair game. Daniel Bernoulli has provided an explanation to this case. According to him, a rational individual will take decisions under risky and uncertain situations on the basis of expected utility rather than expected monetary value. He further contended that marginal utility of money to the individual declines as he has extra money. Under such circumstances, most individuals will not play the game that is he will not make a bet.

Certainty Equivalence: The Certainty equivalent is a guaranteed return that someone would accept now, rather than taking a chance on a higher, but uncertain return in future. An individual is indifferent between certainty equivalent and the probable amount of money with a certain probability in an uncertain and risky situation such as in a lottery ticket or gamble. An example will make the point clearer. Let us take an example of a lottery ticket whose first prize is Rs.5000 with a probability of 0.6 of winning and 0.4 of losing (getting a consolidation prize of Rs.10). We ask the individual X as to how much sure sum of money and the above lottery ticket with the given prize and probabilities he would be indifferent. Suppose the individual reveals that

he is indifferent between Rs.3000 and the above lottery ticket with the aforesaid prize and probabilities. Then, in this case, certainty equivalent is Rs.3000 with which one can calculate the marginal utility of Rs.3000.



LET US KNOW

St. Petersburg Paradox

Let's consider the case, wherein, a fair coin will be tossed repeatedly until tails turns up. If tails turns up on the n^{th} toss, the individual will receive Rs.2^n, i.e. if tails turns up on the 6^{th} toss, the person will receive Rs.2^6 = Rs.48.

The expected value of the gamble can be calculated by the usual procedure, the probability of the coin turning up tails on the n^{th} toss equals $1/2^n$. The expected value of the gamble would be:

(1/2) x 2 + (1/4) x 4 + (1/8) x 8 + (1/16) x 16 + ... = 1 + 1 + 1 + 1 + ...

This is an infinite series and expected value is infinity. It would be hard to find anyone who would want to participate in such a gamble with infinite expected value. This situation has been termed as St. Petersburg Paradox.



CHECK YOUR PROGRESS

Q.3: How Daniel Bernoulli resolved the St. Petersburg Paradox? (Write in 70 words)

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6.5 MEAN-VARIANCE ANALYSIS

Usually individuals prefer more assets to less. However, with risk aversion, risk is seen as a variation in return. So we can measure risk

through variance and represent preferences such that individuals make choice by looking at mean and variance. There is one section of risk analysis, which indicates that individual's choice among assets is decided by the mean and variance of the return.

Let us specify the following elements of the problem for an individual decision maker under uncertainty:

a) A set of states (1,2,,,,,s,...S) of nature. A state of nature is a complete description of a possible environment.For example, the possible states of nature may be 'rain', 'cloud sky' and 'clear sky'. The possible states of nature may not refer to weather conditions at all. For example, one may be interested in the economy and define a particular state of nature (such as high inflation rate, low employment rate, high fiscal deficit). In the simplest case, 'Nature' chooses which state of nature actually materializes.

b) A set of acts (1,2,...,x.....X) available to the individual. For example, the acts may be 'buy an umbrella' or 'not to buy an umbrella'.

c) A consequence function c(x,s) showing outcomes under all possible combinations of acts and states. For example, weather might materialize together with the act of the individual will determine his/her payoffs.

Agents who use the expected value rule to choose between alternatives are focusing only on the mean outcome and ignoring the dispersion of the values around mean. The dispersion of the value represents the risk associated with an alternative. One measure of dispersion that is widely used is the variance V:

$V(x) = \sum p_x [c(x,s) - Ec]^2$

To calculate variance, let us find out the differences of each value from the mean value, square these differences, weigh them by respective probabilities and finally sum them up over all possible states of nature. Sometimes, we also use the square root of V, which is called the standard deviation (s.d)

Since V or s.d measures the risk of an alternative, one method of taking a decision is to use mean variance analysis, which employs both the mean and the variance. Given two risky alternatives A and B, the mean-variance analysis says:

1. If alternative A has a higher expected value and a lower variance than B, then A should be chosen over B.
2. If both A and B have the same expected value, then the one with the lower variance should be chosen.
3. If both have identical variances, then the one with higher expected value should be chosen.



CHECK YOUR PROGRESS

Q.4: What is the difference between Standard Deviation and Variance? (Answer in about 30 words)

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6.6 PORTFOLIO SELECTION

Individuals try to reduce risk by diversification by which they choose a portfolio of assets. To examine the choice of an optimum portfolio, budget frontier helps us. A budget frontier represents the combinations of risk and return that are obtainable with the given available funds from mixed portfolios of any two assets, say, shares of Aditya Birla capital and Kotak industries limited. Suppose the expected returns from these assets are 20 percent and 10 percent respectively. If a portion W_i of the given funds are invested in Aditya Birla Capital and the remaining funds W_t are invested in Kotak industries limited, the expected return of the portfolio of these two assets is given by:

$r_p = W_i r_i + W_t r_t$ ..... (1)

Where,

r_p = expected return of the portfolios of two assets

r_i = the expected return of investment in Aditya Birla Capital

r_t = the expected return of investment in Kotak industries limited

W_i = the proportion of the given funds invested in Aditya Birla Capital

W_t = the remaining portion of the given funds invested in Kotak industries limited

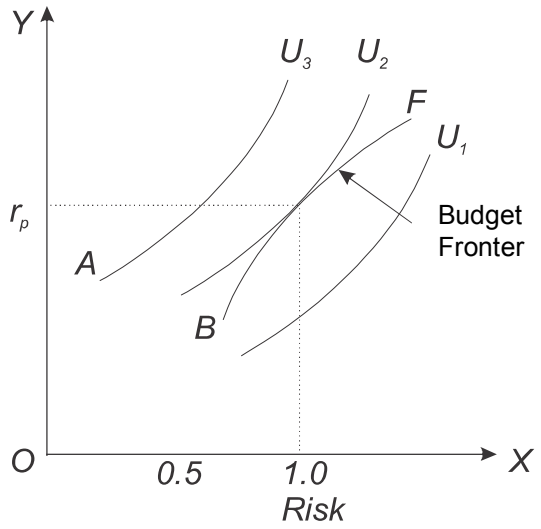


Fig. 6.4 : Portfolios Selection

Note that $W_i + W_t = 1$ and different portfolios of two assets involve different degrees of risk (σ) and also yield different returns. In the above fig. 6.4, BF shows the budget line which is the combinations or portfolios of two assets obtainable from the given funds. The budget frontier BF is tangent to the trade-off function curve U_2 at point E which represents the optimum portfolio of two assets that yield a return of and involve a risk (σ) of 1.0. The combination of two assets represented by E is an optimally diversified portfolio containing a mix of two assets. Suppose the individual has spent 40 percent of its investible funds on shares of Aditya Birla Capital and the remaining 60 percent on shares of Kotak industries limited. The rate of return on the portfolio can be calculated as follows:

$r_p = W_i r_i + W_t r_t$

$= 0.40 \times 20 + 0.60 \times 10$

$= 8+6 = 14$

Thus, the rate of return of the portfolio of the two assets is 14 percent in the above case.



CHECK YOUR PROGRESS

Q.5: Define Budget Frontier. (Answer in about 30 words)

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6.7 LET US SUM UP

- There are three groups of individuals on the basis of risk taking. They are- risk lover, risk neutral and risk averse.
- Their utility function varies on the basis of their relative risk behaviours. With wealth as the single argument of the utility function, the utility of the expected value of the outcome of an uncertain situation exceeds the expected utility of the outcome for a risk-averse consumer; i.e., her utility function is strictly concave. Similarly, risk lovers and risk neutrals have strictly convex and linear utility functions respectively.
- The mean variance analysis is a mathematical framework for assembling a portfolio of assets such that the expected return is maximised for a given level of risk.
- It is a formalisation and extension of diversification in investing, the idea that owning different kinds of financial assets is less risky than owning only one type. Its key insight is that an asset's risk and return should not be assessed by itself, but by now it contributes to a portfolio's overall risk and return. It uses variance of asset prices as a proxy for risk.
- Certainty equivalent is the amount of guaranteed cash that a person would accept instead of taking the risk of receiving a larger amount at a later date.
- The difference between the certainty equivalent and the amount an organisation must pay investors for the use of their money is thus risk differential. For example, when a start up company must pay investors a 15% return when the yield on U.S Treasury insurance is 2%, this means that investors must be paid the 13% differential because they perceive the investment to be a risky one.
- The certainty equivalent varies by investor. Since each person has a different tolerance for risk. For example, a person approaching retirement is more likely to have a high certainty equivalent, since he is less willing to put his retirement funds at risk.



6.8 FURTHER READING

1) Arrow, K. (1971). *Essays in the Theory of Risk Bearing*. New York: Markham.

2) Dornbush, R.and Fischer, S.(1987). *Macroeconomics*. New York: McGraw-Hill.4th edition.

3) Henderson, J.M. & Richard, R.E. Quandt. (2003*). Microeconomic Theory: Mathematical Approach.* New Delhi: Tata McGraw-Hill Publishing Company Limited.

4) Koutsoyiannis, A. (1979).*Modern Microeconomics*. Second edition, London: Macmillian.

5) Varian, Hal (1992*), Microeconomic Analysis*. New York: W.W. Norton & Company, Inc.



6.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Risk averter is a type of individual who prefers a certain given income to a risky job with the same expected income. On the other hand, risk lover or risk seeker person prefers a risky outcome with the same expected income as a certain income.

Ans to Q. No. 2: If an individual's utility of the expected value of a lottery is equal to his expected utility from the lottery, he is said to be risk-neutral. Risk-neutral behaviour is captured by a linear utility function, for instance U (E) = 2E.

Ans to Q. No. 3: St. Petersburg paradox refers to the problem why most people are unwilling to participate in a fair game or bet. Daniel Bernoulli has provided a convincing explanation of the said behaviour. According to him, a rational individual will take decisions under risky and uncertain situations on the basis of expected utility rather than expected monetary value. He advocated that marginal utility of money to the individual declines

as he has more of it. Since, the individual behaves on the basis of expected utility from the extra money if he wins the game and the marginal utility of money to him declines as he has extra money, most individuals will not play the game. It means the individual will not make fair bet. In this way, Bernoulli resolved St. Petersburg paradox.

Ans to Q. No. 4: The Variance of a data-set measures the mathematical dispersion of the data relative to the mean. On the other hand, standard deviation as the square root of the variance gives a value is in the same units as the original values.

Ans to Q. No. 5: A budget frontier represents the combinations of risk and return that are obtainable with the given available funds from mixed portfolios of any two assets.



6.10 MODEL QUESTIONS

A) Short Questions(Answer each question in about 150 words)

Q.1: Discuss the individual attitude towards risk with suitable diagram.

Q.2: How individual is better off with a mixed investment? Examine in the light of portfolio investment approach

Q.3: If there are two risky alternatives, what are the important conclusions that can be made from Mean Variance analysis on the basis of expected value and respective variances?

B) Long Questions (Answer each question in about 300-500 words)

Q.1: Explain Expected utility and certainty equivalence with suitable example.

Q.2: How mean variance analysis is used in the choice under uncertainty? Explain.

Q.3: Diagrammatically explain Portfolio selection process associated with investment in risky assets.

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UNIT 7: THEORY OF WAGES

UNIT STRUCTURE

7.1 Learning Objectives

7.2 Introduction

7.3 Nominal Wages Versus Real Wages

7.4 Subsistence Theory of Wages

7.5 Marginal Productivity Theory of Wages - Its Limitations

7.6 Wages under Imperfect Competition

7.7 Exploitation of Labour and Trade Union

7.8 Wage Differential

7.9 Let Us Sum Up

7.10 Further Reading

7.11 Answers to Check Your Progress

7.12 Model Questions

7.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- know what are real and nominal wages
- explain the marginal productivity theory of wages
- understand the determination of wages under imperfect market forms
- discuss the exploitation of labour and the role of trade union
- understand the causes of wage differentials.

7.2 INTRODUCTION

Wage is the income of the labour engaged in the process of production. It is the amount paid by any employer to a labour under contract for the services rendered by the labour. Wages may be in cash or in kind. Wages may be paid at definite time intervals, like monthly, weekly, daily, etc or may be paid per work done. Wages differ across people and across occupations, resulting in horizontal and vertical differences in wages. The

present chapter discusses at length as to how wage paid to a labour is determined under different market forms.

7.3 NOMINAL WAGES VERSUS REAL WAGES

Money wages or nominal wages is the amount of money paid to a worker for his services. It is the amount of wages in monetary terms. However, real wages measure the purchasing power of the wage received by a worker. It means the necessities, comforts and luxury that a labour can command over, in return of his services. It is a true indicator of a workers' prosperity or the standard of living he has access to, rather than the money wages. Accordingly, real wages depend on a number of factors like the nature and conditions of the work done. If there are included favourable, agreeable, pleasant facilities of lunch, recreation etc. real wages are good. In high paying but risky jobs, the real wages will be less. Again, the price level determines the purchasing power of money. Thus, it determines the real wages of a worker's money income. The additional facilities or extra incomes that a worker receives over his income increase his real wage.



CHECK YOUR PROGRESS

Q.1: Define real wages. (Answer in about 20 words)

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7.4 SUBSISTENCE THEORY OF WAGES

Different theories were put forward by different economist at different times to determine the wages of workers. One such theory is the subsistence theory of wages. Subsistence wages means the minimum wages needed for the physical sustenance of the workers. As per the classicist, it is the natural level of wages. The exponents of this theory of wages were the Physiocrats and the theory was further accepted by the German Economists who called it the 'Iron law of wages'. The theory considers wages to be determined as the price of any commodity in the long run. In the long run

price equals cost. Accordingly, the wages in the long run are nothing but the cost of production of labour. This theory is based on the following assumptions of long run, that in the long run subsistence wages prevail and that subsistence wages remain constant for long time.

The theory of subsistence wages states that wages tend to remain at the subsistence or bare minimum level. Even if wages rise due to rise in demand there will be a rise in population. This shall increase a competition for resources for which wages will shrink to subsistence level. Alternatively, if wages fall labours will starve. Thus, population and hence labour supply will fall. This will raise wages again to the subsistence level.

The theory has been criticized on many grounds. Firstly, rise in wages enhances standard of living for which population tends to decrease. The theory advocates a homogeneous price across all labour. This is not true. Again, it is based on the supply-side of labour. It is based on long run and do not answer to wage determination in a point of time. The theory may be true for underdeveloped countries and with rapid population growth. However, it shows us that wages cannot or should not fall beyond a minimum level.



CHECK YOUR PROGRESS

Q.2: What is meant by subsistence wages? (Answer in about 20 words)

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7.5 MARGINAL PRODUCTIVITY THEORY OF WAGES- ITS LIMITATIONS

The marginal productivity theory of wages determines the price of labour, an important factor of production, according to their marginal physical product. Marginal physical product or the marginal product of labour (MP_L) is the change in the total output when an additional unit of labour is employed. The essence of this theory is that a firm employs a factor (here,

labour) because of its productivity or the contribution it makes to the total output. Hence, the remuneration to the factor will also depend upon the same. Higher the productivity, higher is the income and so on.

The marginal productivity theory is based on the following assumptions:

- There exists perfect competition in the product market.
- There is perfect competition in the factor market.
- All units of labour are homogeneous.
- There is full employment.
- The law of variable proportions operates.

The marginal productivity theory consists in the determination of wages in the same way as the price of any other good, i.e. from the demand and supply schedules. Therefore, the first priority is to understand the nature of the demand and supply of labour to the individual firm and industry. Since there exists perfect competition in the factor market, the supply curve of labour to the individual firm is a horizontal straight line parallel to the X axis at the ongoing OW wage. This is shown in fig. 7.1. Now, a firm being a profit maximiser will hire labour as long as the additional unit of labour will add more to the total revenue than to the cost. Thus, the demand for labour for the individual firm will be the value of marginal product curve of labour (VMP_L). VMP_L curve shows the value of the output produced by an additional unit of labour employed and is given by MP_L*Price of the product.

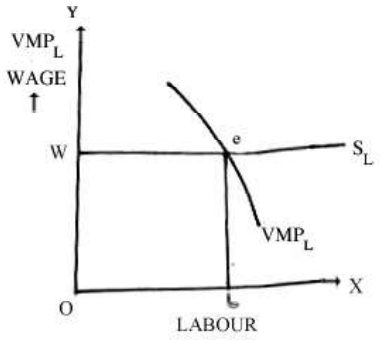


Fig: 7.1 : Equilibrium of a firm

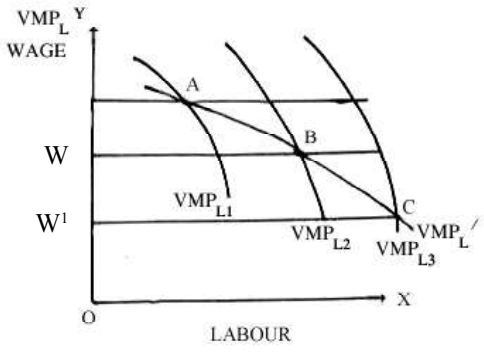


Fig: 7. 2 : Derivation of VMP_L curve

Thus, a firm will be in equilibrium at e, as in fig.7.1 where the VMP_L cuts the labour supply curve. Accordingly, in equilibrium the firm employs OL of labour at OW wage. To the left of e, labour cost less than the output produced and to the right of e cost of labour rises more than the value of the output. So, profit is maximum at e. The above discussion was based on the assumption that labour is the only variable factor. However, if all the factors of production are variable than the demand curve of labour is no longer the VMP_L curve. The demand for labour curve in this case will be a new curve obtained by joining the points of equilibrium of different wages and the corresponding VMP_L curves. This is the curve VMP_L shown in fig. 7.2. This too is a downward sloping curve. When wage falls from OW to OW^1 and so on the VMP_L curve slopes down the original VMP_L curve to the right because of an outward shift in the marginal product of labour. This is because when wage falls there is not only an increase in output because with same total expenditure the firm can purchase more of labour and capital than before but also that the expenditure of the firm will increase in the context to raise profit. Thus, the MP_L will shift outward with increased amounts of all the factor inputs. For different wages we can generate points such as A, B, C etc. as in fig. 7. 2 and joining those points we can arrive at the demand for labour curve of the firm. This is sometimes referred to as the long run demand for labour curve as well.

For the industry, the equilibrium will be at the point where the market demand and supply curves will intersect. The market supply curve of labour is considered to be positively sloped as with increased wages more labour will be attracted. The market demand curve of labour is a downward sloping curve but it is not a simple horizontal summation of the individual VMP_L curves. This is because when wages fall all firms intend to demand more labour. Increased employment enhances output which further reduces price of the output. In the determination of the $VMP_{L,}$ price of the output is an important component. Accordingly, as wage falls VMP_L falls. This is shown in fig. 7. 3.

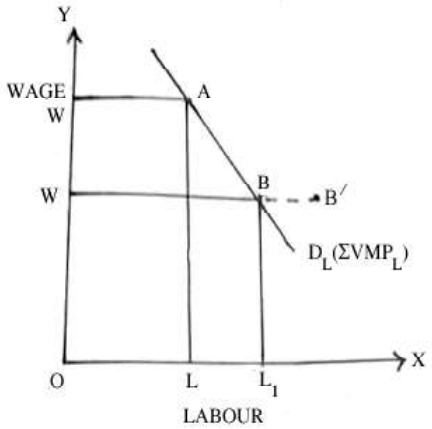


Fig: 7. 3 : Market demand curve

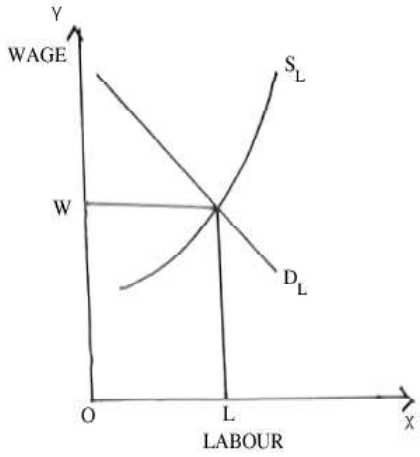


Fig: 7. 4 : Market equilibrium

If the change in output price is ignored, we will have a point B′ on the market demand for labour curve. But the appropriate market demand will be AB as shown in the figure 7.3. In fig. 7.4, we have the market demand curve of labour D_L and the market supply curve of labour S_L. The two intersects at point e which is the point of equilibrium. Thus, OW wage and OL employment is determined at equilibrium.

The limitations of this theory are discussed as below:

- The theory is based on the unrealistic assumption that all units of labour are homogeneous; there exists perfect competition; there is perfect labour mobility; there exists constant returns to scale.
- The theory is criticised on the ground that it does not determine the wage. Simply the firm equates the value of marginal product with the given wage.
- Another criticism against the theory is that it is biased on the demand side of the factor and ignores the effect of supply of the factor on its price.
- This theory considers the wage the reward of the value of marginal product but in reality, the two affect each other.
- Further the theory assumes that labour units are perfectly divisible while in reality, it is not so.



CHECK YOUR PROGRESS

Q.3: What is meant by Value of Marginal Product? (Answer in about 20 words)

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Q.4: Why is the supply of labour to a firm perfectly elastic for a competitive factor market? (Answer in about 30 words)

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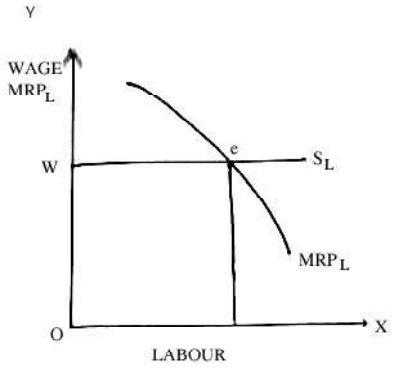
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7.6 WAGES UNDER IMPERFECT COMPETITION

The following analysis in only but an extension of the above discussed marginal productivity theory of wages. The above analysis assumed that there exists perfect competition in both the factor and product market. If this assumption is relaxed then there will be ensuing changes in the demand and supply of labour. This will affect the wage determined under conditions of equilibrium.

Model A: Monopolistic power in the product market and perfect competition in the factor market

Let us initially assume that labour is the only variable factor. Since the labour market is perfect the wage rate is given for the firm and the supply of labour is perfectly elastic to the individual firm. However, in the firm having monopoly power in the product market, its marginal product curve MR will lie below the average revenue curve AR. Here, the demand curve of labour shall be the marginal revenue product of labour curve, i.e. the MRP_L curve of labour (MRP_L=MR×MP_L, marginal product curve of labour). Since, MP_L and MR falls as output expands and price falls so the MRP_L will also fall.



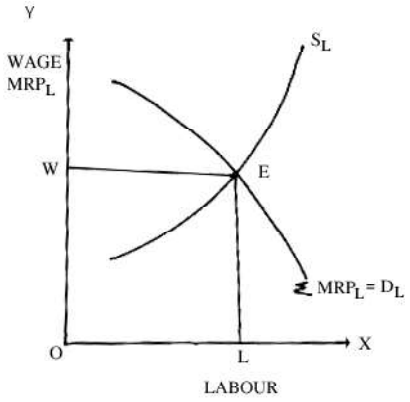


Fig: 7.5 : Equilibrium of firm **Fig. 7.6 : Market equilibrium**

The monopoly firm is in equilibrium at point e with OL employment and OW wage as in fig. 7.5. To the left of e, the further employment of labour adds more to the revenue of the firm than the expenses on labour. Secondly, to the right of e further employment of labour becomes more expensive than the change in total revenue. Thus, the monopolist using one variable factor labour is in equilibrium by employing labour till wage rate equals MRP_L. When more than one variable factor is used the demand curve of labour is no longer the MRP_L but a new curve obtained by joining the points of intersection between the shifting MRP_L curves and different wages at which the firm is in equilibrium. This is the same as the analysis contained in the above section. The market price of labour will be determined by the market demand D_L and supply curves S_L. While the market supply curve of labour is unchanged as in the above section the market demand for labour is obtained by aggregating the demand for labour curves of all the individual firms. In so doing, we must consider the decrease in price when wages fall and the corresponding fall in the marginal revenue product. The market equilibrium is shown in fig. 7.6.



CHECK YOUR PROGRESS

Q.5: Why is the demand for labour curve the marginal revenue curve is found in an imperfect product market? (Answer in about 20 words)

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Model B: Monopolistic power in the product market and monopsonist power in the factor market

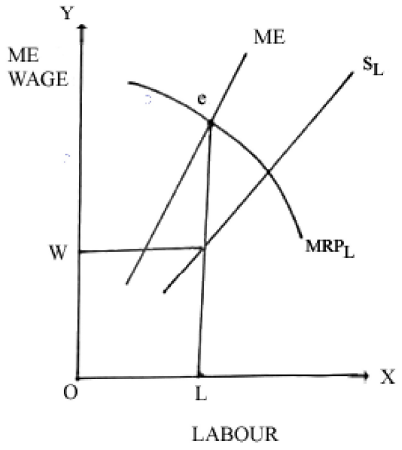


Fig. 7.7 : Market equilibrium

In this context, the demand curve of labour will be the same MRP_L curve as the individual firm is the same as in the previous section. However, the supply curve to the individual firm will change. As the firm is a monopsony, the supply of labour curve S_L will have a positive slope. This implies that the firm has to pay higher wages to enhance employment. As wage increase with additional employment the marginal expense on labour curve ME_L will be above the supply of labour curve as in fig. 7.7. The point of equilibrium will be point e where ME curve intersects the MRP_L curve. At e, the marginal expense of labour which is the marginal cost will be equal to the MRP_L. At equilibrium, OW wage is determined and OL labour is employed.



CHECK YOUR PROGRESS

Q.6: What is meant by marginal expense on labour? (Answer in about 10 words)

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7.7 EXPLOITATION OF LABOUR AND TRADE UNION

The existence of imperfections in market leads to exploitation of labour. To explain the inherent concepts, we may refer to the figures 7.8 and 7.9 In fig. 7.8, we may note that the monopolist firm is in equilibrium at point e with OW wages. The firm has paid to the labour its MRP and not the VMP. This causes wages to be short by the extent ee/. This is termed as the monopolist exploitation.

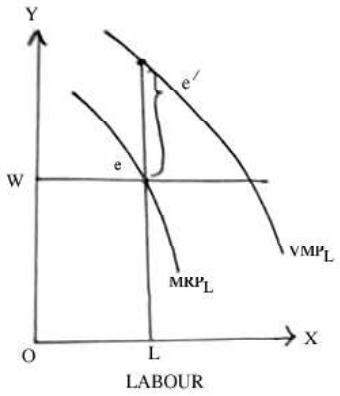


Fig. 7.8 : Equilibrium of monopolist firm

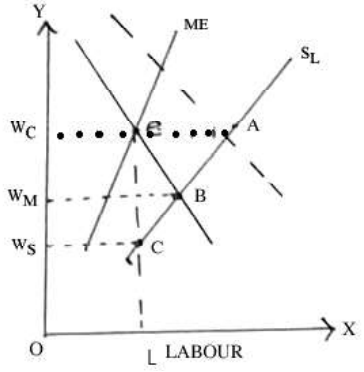


Fig. 7.9 : Equilibrium of firm in bilateral monopoly

As in fig. 7.8 a monopsonist firm pays wage not only less than the VMP_L but also less than the MRP_L. The perfectly competitive factor and product market equilibrium is point A in fig. 7.8. So, W_C wage is determined. Under monopolistic product market the equilibrium is at point B and W_m wage is determined which less than WC. Wage is lower and so also the level of employment. Finally, under monopsonist factor market, equilibrium is at C with further lower wage W_s and lower employment.

In the above analysis labour were not unionised. If, however it is so we will have a case of bilateral monopoly. The bilateral monopoly model is indeterminate with the final outcome lying in the bargaining skills of the trade or labour union and the firms (who join together to form a monopsony). The analysis is contained in the fig. 7.9.

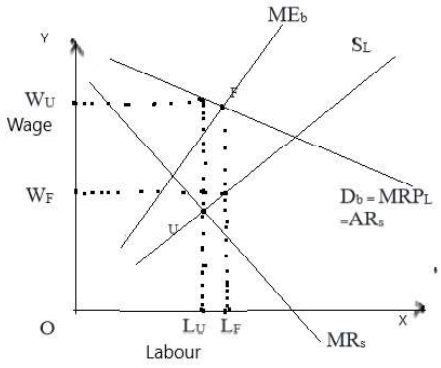


Fig. 7.10 : Equilibrium of monopsonist firm

For the monopsonist firm, the demand curve of labour is MRP_L (demand curve of buyer D_b) which is his average revenue curve and the supply of labour curve is S_L which shows his average revenue. Thus, his equilibrium will be point F where MRP_L cuts the marginal expense curve the ME_b curve. Accordingly, OL_F labour will be employed at OW_F wage. But the monopolist labour union views MRP_L as the average revenue curve (AR_S). The marginal supply curve of seller therefore is the MR_s which lies below AR_s. S_L is viewed by them as the marginal cost. So, their equilibrium is at point U. They expect OW_U wage for OL_U employment. Which wage will hold in the end is indeterminate and rest on the bargaining power of the two parties.



CHECK YOUR PROGRESS

Q.7: What is meant by bilateral monopoly? (Answer in about 10 words)

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7.8 WAGE DIFFERENTIAL

The analysis contained in the above sections consider that all units of labour are homogeneous. The theory as in the above, is therefore, determinant of a unified wage across all labour types. But in reality, all labour is not homogeneous. A doctor, a teacher, a writer is all different. In

economics, we consider both mental service or physical service as labour. The wages of each type of workers is different. This difference in wages across labour is called wage differential. The existence of wage differential does not make wage theories invalid. It is not one market for labour but many and there may be many within a market each having its own set of demand and supply forces. Different factors act causing wage differentials. They may be classified into four broad categories. These are discussed below.

- **Workers differ in abilities, skill and training:** Some works need special skills while others do not. If there is no wage differential then no one will be attracted to spend time and resources to gain the skill. When high skill is involved, the demand is high against unskilled labourers for the productivity of the later is low. The supply is high for the later as no training and resources thereof is required. So, the wages of skilled labour are high. Besides, biologically the abilities of labours may be different.
- **Nature of jobs, job requirements and the working environment differs between different types of jobs:** This therefore necessitates that we compensate people who engage in harsh, unpleasant, risky jobs. This is despite that the skills are homogeneous across jobs or the demand is same. Only that the supply to these works are less because of the nature of work involved and so one. Thus, wages are more. This type of wage differential compensates for the differences in the job characteristics.
- **Labour market conditions:** Rigidity in social norms, racial discriminations, gender biasedness, etc. causes wages for special sections of the society to be less. For example, women, people of lower class, etc. have suffered from such exploitations.
- **Value of output:** The price of output influences the wages of the people engaged in the production of the output.



7.9 LET US SUM UP

- Wage is the price of labour for the services, mental or physical, rendered by him.
- Real wage is a measure of the luxuries, comforts and necessities that a labour can command in return of his services.
- Subsistence wage are the minimum wages that is necessary for the sustenance of the labour. The theory of subsistence wages suggests that in the long run it is the sustenance wages that prevail.
- Under perfect competition in the product market wage is given for a firm and the firm can choose to employ any labour at the given wage.
- The demand for labour in a competitive product market is the value of marginal product for labour curve and for an imperfect product market is the marginal product curve.
- The demand and supply of a factor (labour) determines its price, wages as per the marginal productivity theory of wages.
- The wages and the level of employment are lower under market imperfections as compared to a perfectly competitive market. The existence of trade unions or labour unions can influence wages determination at a higher wage rate.
- The wages in the real world differs for different labour types and are not homogeneous across labour. This is called wage differential.



7.10 FURTHER READING

1) Koutsoyiannis, A. (1979). *Modern Microeconomics.* McMillan Press Limited.
2) Dwivedi D.N. (2008). *Microeconomics, theory and Applications.* Pearson Education.



7.11 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Real wages are the command over luxuries, comforts and necessities that a worker has from his income. It measures the standard of living a worker can get access to.

Ans to Q. No. 2: Subsistence wages means the minimum level of wages that is required for the sustenance of life of a worker.

Ans to Q. No. 3: Value of marginal product is the value of the total output produced by an additional unit of labour. Mathematically it is marginal product of labour X price of the output.

Ans to Q. No. 4: In a perfectly competitive factor market, the wage is given for an individual firm. It can employ any labour at this wage. Thus, the supply of labour curve is perfectly elastic at the given wage.

Ans to Q. No. 5: A firm will employ labour till the cost of an additional unit adds more to the output than to the cost which means till wages equal the marginal revenue product. Marginal revenue product is marginal product X marginal revenue. Thus, the MRP_L is the demand for labour curve.

Ans to Q. No. 6: Marginal expense is the difference between the expenditures of a firm at successive higher levels of employment.

Ans to Q. No. 7: Bilateral monopoly arises when a single seller faces a single buyer in a market for exchange of any good or service.



7.12 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q.1: Differentiate between nominal and real wages.

Q.2: What is meant by marginal product of labour?

Q.3: Define value of marginal product of labour and marginal revenue product of labour.

Q.4: What is the shape of the demand for labour curve in a perfectly competitive factor and product market?

Q.5: What is meant by wage differential?

B) Easy type Questions (Answer each question in about 300-500 words)

Q.1: Mention the criticisms against the subsistence theory of wages.

Q.2: Discuss the wage determination under perfect competition in factor and product market.

Q.3: Discuss the wage determination in a perfectly competitive factor market but an imperfect product market.

Q.4: Explain the concept of monopsonist exploitation.

Q.5: Discuss the process of collective bargaining under bilateral monopoly.

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UNIT 8: THEORY OF RENT

UNIT STRUCTURE

8.1 Learning Objectives
8.2 Introduction
8.3 Ricardian Theory of Rent
8.4 The Modern Theory of Rent
8.5 Rent Elements in Other Factors of Production
8.6 Let Us Sum Up
8.7 Further Reading
8.8 Answer to Check Your Progress
8.9 Model Questions

8.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- know the meaning of rent
- explain the Ricardian theory of rent
- discuss the different types of rent
- explain the modern theory of rent
- know the rent element in other factors.

8.2 INTRODUCTION

In ordinary sense rent is nothing but the ownership price. For example, rent is paid by the lease holder or the tenant to the land lord or the land owner. That means, it is the hiring charge. e.g. rent of house, rent of a bus etc. But in economics, it's meaning is complex. In economics, rent means economic rent which is nothing but a payment for the use of land, the supply of which is unrealistic or fixed. In the words of Ricardo, "Rent is that portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible powers of soil." But this view is not accepted by the modern economists. According to the modern economists, economic rent can accrue to any factor of production, the supply of which is relatively less elastic.

To understand economic rent, we must know that contract rent is the total fined amount, which a tenant is bound to pay the owner of the factor i.e. land, capital, etc. for a given period of time. Contract rent includes economic rent, interest rent on capital, wage, maintenance cost, profit etc. Therefore it is normally more than economic rent.

Contract rent = Economic Rent + Interest on capital invested by the owner + Maintenance cost + wages for supervision + Profit (if any)

Economic Rent = Contract Rent - [Interest on capital invested by the owner + profit (if any)]

Economic Rent should also be differentiated from gross rent. Gross rent is a composite payment and it consists of: Economic Rent, Return on Capital, Compensation for risk and Implicit wages.

8.3 RICARDIAN THEORY OF RENT

An eminent classical economist David Ricardo, in his book, ''Principle of Political Economy and Taxation" gave his view on rent. This is popularly known as the Ricardian theory of rent. According to him, rent is that portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible powers of the soil.

Ricardian Theory can be explained under three different situations-

- **Rent under extensive cultivation:** All lands have not same productive power. According to Ricardo, initially people cultivate the best type of land. When population increases people have to cultivate inferior lands also to fulfill the increased demands for food grains. Ricardo believes that rent arises due to the excess of production on superior land in comparison to inferior land, i.e. differential surplus. This is explained in the following table and diagram.

Table: 1 Rent determination under extensive cultivation

Grade of land	Total production	Rent
A	40	40-10 =30
B	30	30-10 =20
C	20	20-10 =10
D (Marginal land)	10	10-10 =0

In the above table A, B, C, D are four different types of land where A is the best quality of land and D is the worst quality of land. When population increases, people will have to cultivate D type of land also. In this type of land there is no rent generated. Thus D is the marginal land or no rent land and A, B, C are intra marginal land. According to Ricardo, the excess of production over this marginal land on the other type of land are rent. Therefore A, B, C types of land have 30, 20 and 10 quintals of food grain as rent respectively, which is shown in the above table and below diagram.

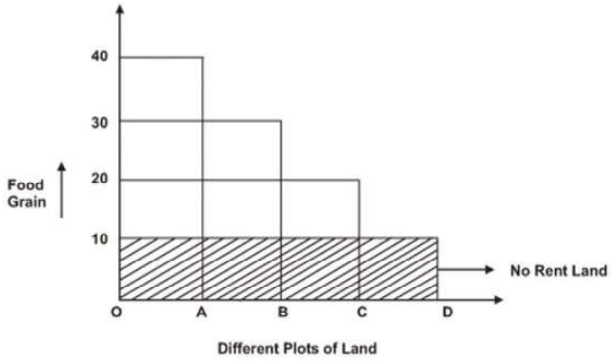


Fig. 8.1 : Determination of Rent

- **Rent under Intensive Cultivation:** When more units of labour and capital are used on the same type of land, it is called intensive cultivation. This is explained with the help of the following table. Ricardo assumes the operation of the law of diminishing return in the field of agriculture. Thus the marginal product of various uses of labour and capital diminishes with the increase of their quantity. Here also marginal unit is no rent unit.

Table 2: Rent determination under intensive cultivation

Dose of labour and capital	Total production	Rent (in capital quantity)
Dose I	40	40-10=30
Dose II	30	30-10=20
Dose III	20	20-10=10
Dose IV	10	10-10=0 (no rent unit)

- **Situation rent:** According to Ricardo rent also arises due to the differences in the situations of various type of land. This is called

situations rent. Particular type of land is located in the advantageous position, such as closer to the market, in comparisons to others and therefore they will earn rent as transportation cost will be less here.

- **Scarcity rent:** The concept Scarcity rent is used both by classical and modern economists. Ricardo did not explain scarcity rent directly but he assumed the that the supply of land is fixed and the demand for land depends upon the demand for crops. Thus Ricardo considers that demand for land is derived. According to Ricardo, over a long period, when population increases, the demand for corn increases. As a result demand for land also increases for cultivating more corn. Thus given the perfectly inelastic supply of land, rent tends to increase because there is increase in demand for land. Again, since there is fixed supply of land and the land have no alternative uses, therefore scarcity of corn leads to an increase in the demand for land for producing that product. As a result, rent increases. This is known as scarcity land.

  In the modern version, rent is determined by the demand for and supply of land. Since curve of land is more elastic, the excess demand for land or scarcity of land results in increase in rent. On the contrary, the excess supply of land over the demand can lead to a fall in rent. Therefore modern economists also explicitly involve rent to the scarcity principle.

Assumption: The theory is based on the following assumptions-

- There is no rent or marginal land.
- Rent is the result of original and indestructible powers of land.
- The law of decreasing returns prevails.
- The causes for the emergence of rent are the difference in fertility of land.
- Various pieces of land are cultivated in the declining order of their fertility.

Criticism: Following are the main criticisms of Ricardian theory-

- Ricardo's idea that there are some original and indestructible powers of land is not correct. Land can be both destroyed and made more productive using man made technology.
- Ricardo observed that superior land is cultivated first. However, critics point out that the land which is near to the human habitation is cultivated first, irrespective of the fact as to whether it is superior or not.

- According to Ricardo rent is not price determining but price determined. Today we know that rent is a part of cost of production that determines price.
- According to Ricardo, for emergence of rent in the land, existence of marginal land is necessary. But according to modern economists, this is not necessary.
- According to modern economists, rent arises not only in case of land but also in every factors of production.



CHECK YOUR PROGRESS

Q.1: What is meant by rent? (Answer in about 20 words)

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Q.2: What is meant by contract rent? (Answer in about 30 words)

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Q.3: Define differential rent. (Answer in about 10 words)

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Q.4: What is meant by scarcity rent? (Answer in about 10 words)

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8.4 MODERN THEORY OF RENT

Ricardian theory is based on the two prominent facts - rent is the differential surplus and rent is measured from the non rent margin. But Ricardian theory does not explain why rent arises. Actually rent is paid because the produce of land is scarce in relation to the demand for it. According to the modern economists, rent is not only limited to land but also applicable in all factors of production. According to them, supply of every factors of production

is not perfectly elastic. Because of this reason, they earn extra income. which is rent. Therefore rent is the leading species of a large genus.

According to Mrs. Joan Robinson, ''The essence of the concept of rent is the conception of a surplus earned by a particular part of a factor of production over and above the minimum earnings necessary to induce it to do its work.'' Thus, according to modern economists,

Economic rent = present earnings - transfer earnings

By transfer earnings we mean that minimum payment which is necessary to keep a factor of production in its production. In other words, it is the next best alternative to earnings. The other name of transfer earnings is the opportunity cost, supply price etc. According to the modern economists, economic rent arises due to the scarcity and specificity of the factors of production. In other words, rent of a particular factor actually depends on the elasticity of supply of that factor. When supply of a particular factor is perfectly elastic, then there will be no rent because its present earnings and transfer earnings will be equal. On the other hand if supply of a particular factor is perfectly inelastic, then transfer earnings will be zero. So the whole of present earning will be its rent. But in reality supply of factors are neither perfectly elastic nor perfectly inelastic. Thus rent is nothing but the difference between present and transfer earning. Hence rent is the excess of earnings of any factors of production over its minimum supply price. The minimum supply price of a factor is called their transfer earnings which is shown in the following diagram. The determination of rent when supply of the factor is perfectly elastic and inelastic is shown in the following Figure 8.3 and 8.4 respectively.

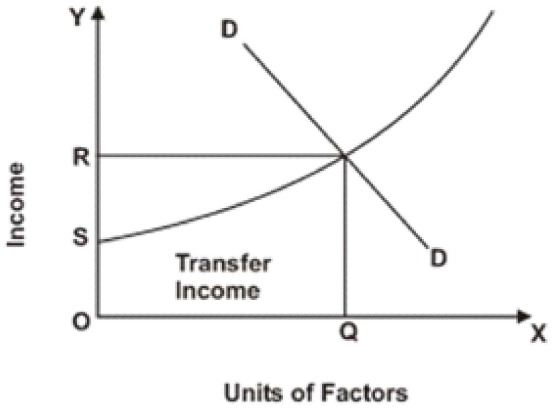


Fig. 8.2 : Determination of Rent

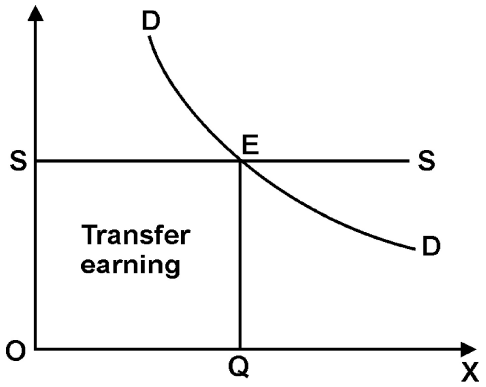


Fig. 8.3 : Determination of Rent when supply of factor is perfectly elastic

In the figure 8.2, the demand for and supply of quantity is OQ. SS is minimum supply price of the factor. It is clear from the figure that total earnings of factor is OQER and transfer earning is OQES. So, the economic rent = OQER - OQES = RES. In the above figure 8.3, it is clear that total earning and transfer earnings are equal, which is OMES. As the supply of factor can be changed according to requirement, there will be no economic rent.

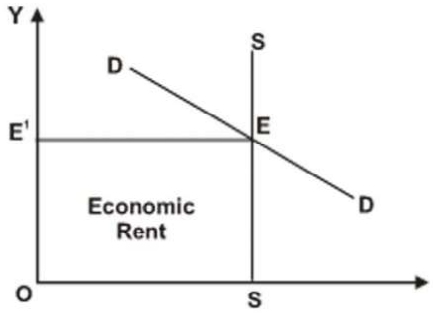


Fig. 8.4 : Determination of Rent when supply of factor is perfectly inelastic

Again, in figure 8.4 when supply of factor is perfectly inelastic then there will be no transfer earning and thus the amount of economic rent is OE/ES. As the supply of the factor cannot be changed all the earnings will be economic rent.

Modification made by the modern theory over the Recardian theory of Rent:

Following are the main modifications made by Modern theory of rent over classical theory:-

- **Main causes of the emergence of Rent:** The modern theory clearly and more scientifically explains the cause of the emergence of rent.

According to modern theory, the food supply reduces as the population grows. As a result, people are forced to cultivate inferior lands and the superior land starts earning a surplus over the marginal land. On the land the modern theory stats that rent arises because of the specificity of a factor. If a factor is perfectly specific, the entire earning can be treated as rent.

- **Quantitative measurement:** According to Ricardo, rent is the difference between produce from intra-marginal land. This is not true because no rent concept is imaginary. But modern theory measures rent through the excess of actual earning over the transfer earning i.e. it is a quantitative measurement.
- **Rent and price:** Ricardo assumes that rent is a surplus over and above the cost. Thus rent was not a part of price. On the other hand, according to modern theory, rent is included in the price because it is a part of actual earning which is determined through the price of the product.
- **General concept of Rent:** Ricardo said that rent arises only in the case of agricultural land. But according to the modern theory, rent arises not only on agricultural land but on all types of land, buildings, machinery, etc. It suggests that even these earnings of all the non–land factors of population have an element of rent in them. Therefore, the modern theory gives a general concept of rent.

***Quasi Rent*:** The concept of quasi rent was first introduced by Prof. Marshall. According to him, "quasi-rent is the income derived from machine and other appliances of production made by man.'' The term rent is used to mean income from land and other free gifts of nature, but quasi-rent stands for the whole of the income which some agents of production yield when demand for them has suddenly increased. It is earned during the period when their supply cannot be increased in response to increase in demand for them. Therefore Quasi rent exists in a short-period. Marshall used the concept of quasi rent to explain economic rent regarding man made machine, tools equipments and other goods, whose production was fixed during short period.

Silverman has explained the concept of quasi rent more clearly. According to him, ''the additional payment of those agents of production,

the supply of which though alterable in a long period, is fixed in a short period, is technically known as quasi rent." Thus it is the excess payment over and above the normal reward. Quasi rent arises due to emerging business activities of the short period.

Measurement of Quasi rent: When demand for machines and other man-made instruments are increased in the short period, they earn extra income. According to Marshal this extra income is the quasi rent. In the long run when Supply of the machine and other man made tool increase along with demand, then there will be no extra income. Hence quasi rent will also disappear.

But the modern economists' measurement of quasi rent is slightly different. According to them, if price is less than minimum short run average variable cost (SAVC), the production will be stopped. Thus rent is the excess of price over this minimum average variable cost.

$\therefore$ Per unit quasi rent = Price – AVC

Total quasi rent = TR – TVC

The concept of quasi rent is further explained with the help of the following diagram. In the diagram, it is considered that a competitive firm exists in the short period. 'E' is the equilibrium point. Where MR=AR and MC cuts AR from below. At 'E' the price is OP and the quantity is OQ. In the short period the firm must get FQ amount of the average variable cost. Since the price is OP= EQ, therefore the firm is getting additional reward i.e. EF= EQ-QF, which is nothing but Quasi rent.

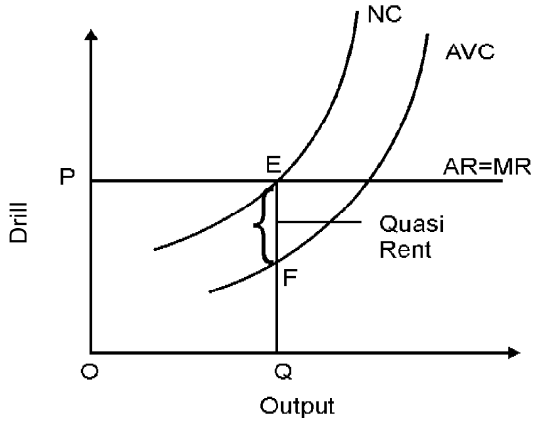


Fig. 8.5 : Measurement of Quasi rent



CHECK YOUR PROGRESS

Q.5: What is meant by transfer earning?(Answer in about 30 words)

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Q.6: What is meant by quasi rent? (Answer in about 30 words)

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Q.7: Distinguish between rent and quasi rent. (Answer in about 30 words)

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Q.8: Why marginal land is called no rent land. (Answer in about 40 words)

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8.5 RENT ELEMENTS IN OTHER FACTORS OF PRODUCTION

Ricardo assumes that rent arises only on land. But according to modern economists rent arises on all factors of production. Rent that arises in case of labour and entrepreneur is called rent of ability. Man made instrument like machine can also earn rent in the short run which is called quasi rent. We can explain both rent of ability and quasi rent with the help of the following example.

We know that rent arises on land because of the fix supply of land. This also happens in case of labour and entrepreneur. The supply of efficient

labour and entrepreneur are also scarce. Therefore they earn extra income in comparison to general labour. This extra income or surplus is known as rent of ability. Suppose in a factory, there are five labours and their wages are 200/- per month except one who gets 400/- per month due to his superior ability. So (400/— 200/-=200/-) is called rent of ability. Similar case may happen in case of an entrepreneur.

Again in case of manmade instrument like machine too, due to their fix supply in the short period, rent arises. This is called quasi rent, according to Marshall. Therefore rent arises in all four factors of production and hence it is said that rent of land is only a 'leading species of a large genus'.

Vilfredo Pareto gave a conceptually different meaning to rent. According to him, rent is an income earned by a factor over and above what it would earn in its next best alternative. For example, suppose a Ph.D. degree holder is working as a lecturer in a college where he earns Rs.75,000 per month. With his degree, his next best alternative employment is that of a researcher in a Research Institute where he is offered Rs.60,000 per month. Thus, as a lecturer he is earning a rent amounting to Rs.15,000 per month. Similar earnings can occur to land, and other factors of production as well.



8.6 LET US SUM UP

- In ordinary scene rent is nothing but the ownership price. For example, rent is paid by the lease holder or the tenant to the land lord or the land owner. It also means hiring charge.
- In economics, rent is used as economic rent. This is a part of contract rent. Actually contract rent is gross rent. Economic rent is that part of payment which is made for the use of land only. It is found out by deducting interest wage, profit, depreciation charges and so on from gross or contract rent.
- An eminent classical economist David Ricardo, in his book, ''Principle of Political Economy and Taxation gave his view on rent. This is

popularly known as Ricardian theory of rent. According to him, Rent is that portion of the produce of the earth, which is paid to the landlord for the use of the original and indestructible powers of the soil.

- According to Ricardo, initially people cultivate the best type of land. When population increases people have to cultivate inferior lands also to fulfil the increased demand for food grains. Thus, according to Ricardo, rent arises due to the excess of production on superior land in comparison to inferior land, i.e differential surplus.
- When more units of labour and capital are used on the same type of land, it is called intensive cultivation. This is explained with the help of the following table. Ricardo assumes the operation of the law of diminishing return in the field of agriculture. Thus the marginal product of various uses of labour and capital diminishes with the increase of their quantity. Here also marginal unit is no rent unit.
- According to Ricardo rent also arises due to the differences in the situations of various types of land. This is called situations rent. Particular type of land is located in the advantageous position in comparisons to others and therefore they will earn rent because locations of land are not uniform.
- Ricardian theory does not explain why rent arises. Actually rent is paid because the produce of land is scarce in relation to the demand for it.
- According to the modern economists, rent is not only limited to land but also applicable to all factors of production. According to them, supply of every factors of production is not perfectly elastic. Because of this reason, they earn extra income which is rent. Therefore rent is the leading species of a large genus.

  Thus, according to modern economists,

Economic rent = present earnings - transfer earnings

- By transfer earnings we mean that minimum payment which is necessary to keep a factor of production in its production. In other words, it is the next best alternative to earnings.
- According to the modern economists, economic rent arises due to the scarcity and specificity of the factors of production.
- The concept of quasi rent was first introduced by Prof. Marshall.

According to him, "quasi-rent is the income derived from machine and other appliances of production made by man."

- The term rent is used to income from land and other free gifts of nature but quasi - rent stands for the whole of the income which some agents of production yield when demand for them has suddenly increased.
- Ricardo assumes that rent arises only on land. But according to modern economists, rent arises on all factors of production. Rent arises in case of labour and entrepreneur is called rent of ability. Man made instrument like machine can also earn rent which is called quasi rent.



8.7 FURTHER READING

1) Siddique, S. A**. (**2002-2003). *Comprehensive Economic.* New Delhi: Laxmi Publications (P) Ltd.

2) Goal, J.P.& Goswami, H. (2008). *An Introduction to Economics*. Dibrugarh: Tushar Publishing House.

3) Goswami, N.G. (2006). *A text book of Higher Secondary Economics*. Guwahati: Jyoti Prakashan.

4) Verma, K.N (2018). *Introductory Micro Economic.* Jalandhar: Vishal Publishing.



8.8 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Rent is the price paid for the contribution of land and other free gifts of nature in the production of goods.

Ans to Q. No. 2: Contract rent is the rent which includes the investment made by the owner of land and the house, caretaker charges for land and building, earnings for undertaking risks. So, contract rent is gross rent.

Ans to Q. No. 3: Differential rent is the surplus obtained between more fertile and less fertile land.

Ans to Q. No. 4: Scarcity rent is a rent which arises due to scarcity of a factor of production

Ans to Q. No. 5: By transfer earnings, we mean that minimum payment which is necessary to keep a factor of production in its production. In other words, it is the next best alternative to earnings. The other name of transfer earnings is the opportunity cost, supply price etc.

Ans to Q. No. 6: The concept of quasi rent was first introduced by Prof. Marshall. According to him, ‘’quasi-rent is the income derived from machine and other appliances of production made by man.”

Ans to Q. No. 7: Rent is basically related with land, while quasi rent is only related with machines, tools equipments and other man-made use and all other factors of production. Again rent exists both in the short as well as the long period.

Ans to Q. No. 8: Ricardo assumes the operation of the law of diminishing return in the field of agriculture. Thus the marginal product of various uses of labour and capital diminishes with the increase of their quantity. Here also marginal unit is no rent unit. Since in case of marginal land there is no surplus, rent does not arise In marginal land.



8.9 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q.1: Explain the meaning of transfer earning.

Q.2: Write a note on the concept of quasi rent. Distinguish it also from rent.

B) Long Questions (Answer each question in about 300-500 words)

Q.1: Explain three main differences between the modern theory of rent and the Ricardian theory of rent.

Q.2: Explain economic rent, when supply of a factor of production is (a) perfectly elastic and (b) perfectly inelastic.

*** ***** ***

UNIT 9: THEORY OF INTEREST

UNIT STRUCTURE

9.1 Learning Objectives

9.2 Introduction

9.3 Classical Theory of Interest

9.4 Loanable Funds of Theory of Interest

9.5 Liquidity Preference Theory of Interest

9.6 Modern Theory of Interest: Hicks –Hansen Synthesis

9.7 Comparison of Keynesian Theory with Classical Theory and Loanable Funds Theory

9.8 Let us Sum Up

9.9 Further Reading

9.10 Answers to Check Your Progress

9.11 Model Questions

9.1 LEARNING OBJECTIVES

After going through this unit you will be able to-

- know about the classical theory of interest
- explain how interest rate is determined under loanable funds theory
- understand the meaning of liquidity preference
- know whether the Keynesian theory is an improvement over classical theory and loanable funds theory
- describe how rate of interest is determined under Hicks – Hansen synthesis.

9.2 INTRODUCTION

In common parlance, interest is the payment made by a borrower to the lender of money. But in economics, interest is regarded as the payment made for the use of capital. This payment may be used by the lender or capitalist for further production or improvement of technology. From time

to time, economists ranging from Marshal to Austrian school (John Rae and Bohm Bawerk), from Fisher to the Classical Economists, from Keynes to the Neo-Classical Economists, all put forwarded their definitions of interest and the methods for calculating the rate of interest. The views of some of the advocators of rate of interest are discussed below.

9.3 CLASSICAL THEORY OF INTEREST

The classical economists, Marshall and Fisher, propounded the classical theory of interest. Later on, economist like Pigou, Cassel, Knight and Tausig, also contributed to the modification of the theory. They envisaged that the rate of interest determined by the interaction of demand for and supply of capital. While supply of capital is governed by time preference, the demand for capital is governed by the expected productivity of capital. Again, time preference and productivity are dependent on waiting or savings. Hence, this theory is also known as the supply and demand theory of savings.

Assumptions: The key assumptions underlying the classical theory of interest are-

- **Perfect Competition:** The classical economists assumed that the market structure is perfectly competitive. This implies that the rate of interest is determined by the interactive forces of demand and supply. Besides, interest rates are flexible in the sense that any departure from the equilibrium rate will be automatically corrected and equilibrium will be restored.
- **Full Employment of resources:** The classical economists built their theory upon the assumption that there is full employment of resources. They believed that when a person saves, he/she sacrifices or postpones his/her consumption, and interest is the reward for this sacrifice or postponement. They maintained that only under a situation of full employment, people can be paid higher rates of interest to induce them to save more on one hand and abstain themselves from consuming on the other.

- **Rational Economic Agents:** The theory assumes that the economic agents are rational in the sense that they want to maximize their economic benefit.
- **Constant Price:** It is assumed that the price level remains constant. They further assumed that the savers and investors react only to changes in the interest rates and not to any changes in prices.
- **Money is neutral:** The classical economists assumed that the role of money is neutral and acts only as a medium of exchange and do not serve as a store of value.

Demand and Supply of Capital*:* According to the classical economists the equilibrium rate of interest is determined by the interaction of demand and supply.

Demand for capital: The demand for capital comes both from the consumers and the producers. Demand for capital is governed by various factors such as productivity of capital, growth of population, technological progress, changes in standard of living of the people, etc. But for producers the most important factor that influences demand for capital is the productivity of capital. Productivity of capital will vary and diminish with successive units. Suppose an investor borrows capital from bank at the rate of 10 percent. Let us suppose that he first invests Rs.5 lakhs in a factory with the expectation that the return would be at least 20 percent. Once the business takes off, another installment of Rs. 5 lakh is invested. However, this time the investment yields only 15%. Next, before investing another 5 lakh rupees, he estimates and finds that his third batch of investment will yield only 10 percent, the rate at which he has to borrow from the bank. Therefore, there will be no profit and he won't have any incentive to invest. However, if the rate of interest is lowered, he would be interested to borrow and invest. Thus, at lower rate of interest, the demand for capital will be higher and vice versa. Hence demand for capital and rate of interest are inversely related to each other and thereby the demand curve of capital slopes downward from upper left hand corner to lower right hand corner.

Supply of capital: According to the classical economists, the supply of capital depends upon savings, which in turn depends upon the willingness and ability to save of the community. People are induced to save when they are offered a good rate of interest on savings. However, there are exceptions as some people will save even if the rate of interest is zero. But generally, according to classical economists, the people will be inclined to save more if the rate of interest is higher and save less if the rate of interest is lower. Thus, savings and rate of interest are positively related. Therefore, the supply curve of capital will have a positive slope, i.e., it will be upward slopping from lower left hand corner to upper right hand corner.

Determination of Equilibrium Rate of Interest: Assuming the constancy of the level of income of the community, the equilibrium rate of interest is determined by the interaction of the demand and supply curve of capital. This is depicted in the following figure.

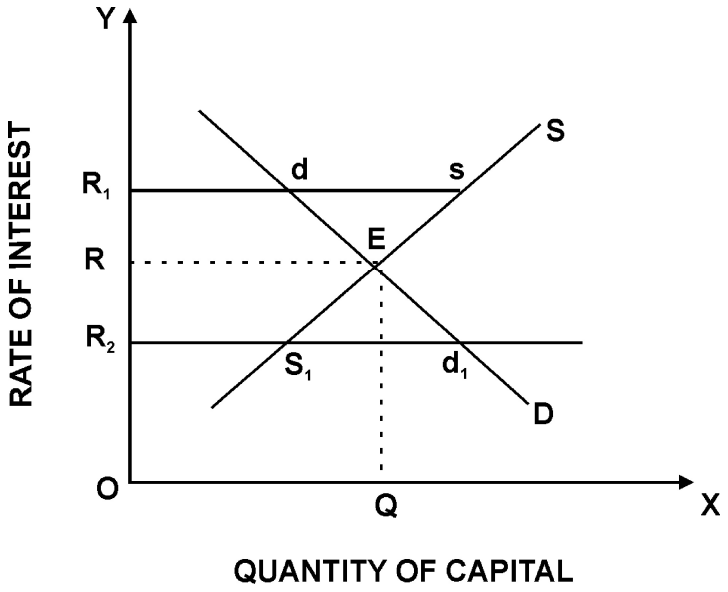


Fig. 9.1 : Determination of Equilibrium Rate of Interest

In the above figure, the quantity of capital is measured in the X-axis and the rate of interest is measured in the Y-axis. DD Is the demand curve for capital and SS is the supply curve of capital. The equilibrium is

at E, where the demand for capital curve and supply of capital curve intersect each other. The equilibrium rate of interest OR and demand and supply of capital are equal to each other at OQ. If for any reason, the rate of interest increases to R_1, the supply of capital will be greater than demand for capital by DS. This will push down the rate of interest to R. Further, if the rate of interest falls to R_2, here the demand for capital is higher than the supply of capital by d_1s_1. Since demand is greater than supply, the rate of interest will move up to R. Thus, R is the equilibrium rate of interest.

Criticisms: Some of the important criticisms of the Classical theory are noted below-

- The classical economists assumed that income of the community remains fixed. But Keynes pointed out that income is a variable factor and do not remain constant and the saving investment equality is brought about by variation in income and not by rate of interest.
- Keynes further maintained that investment has an effect of income. But this factor was ignored by the classical economists.
- Keynes called the classical theory of interest as indeterminate. This is because, savings is a factor of income and hence without knowing the level of income the rate of interest cannot be known. But income level can be known only by already knowing the rate of interest.
- The assumption of full employment is unrealistic. According to Keynes, underemployment is more prevalent than full employment and when resources are unemployed, high interest rate cannot essentially induce to save.
- Monetary factors are very much influential in determining the rate of interest. But the classical economist limited the function of money to only a medium of exchange. But money has a store of value as well. Keynes pointed out that the classical economist ignored this important role of money.

The classical theory was, therefore, dismissed by Keynes as an inadequate, incomplete and inappropriate theory.



CHECK YOUR PROGRESS

Q.1: Who propounded the classical theory of interest?

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Q.2: What governs the supply of capital? (Answer in about 20 words)

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Q.3: What governs the demand for capital? (Answer in about 20 words)

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Q.4: From whom does the demand for capital come? (Answer in about 10 words)

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9.4 LOANABLE FUNDS THEORY OF INTEREST

The loanable funds theory was expounded in the 1930s by Denis Robertson, a British economist and Bertil Ohlin, a Swedish economist. However, Ohlin credited its origin to Johan J. S. Wickshell, a Swedish economist and the so-called Stockholm school, which included economists like Eric Lindahl and Gunnar Myrdal. It was further elaborated by the neo-classical economists like Ohlin, Robertson, Pigou and others. According to this theory the price for credit is the rate of interest and this rate of interest is determined by the demand for and supply of loanable funds. By loanable funds they mean all forms of credit, such as bonds, saving deposits and loans. Thus, unlike the classical economists, who limited the role of money to only savings and investment, the neo-classical economists considered the various forms in which money can be held. In the words of Prof. Learner, "It is the price which equates the supply of 'credit', or saving plus the net

increase in the amount of money in a period, to the demand for 'credit', or investment plus net 'hoarding' in the period."

Demand for Loanable Funds: There are three primary sources that generate the demand for loanable funds. They are government, businessmen and consumers whose demand arises for the purpose of investment, hoarding and consumption. The neo-classical economists believed that the government demands money for carrying out the construction work and to meet war expenses. To them, the businessmen borrowed money from the bank for purchasing capital goods and for starting investment projects. Again, the consumers demanded money for purchasing durable goods. The neo-classical economists maintained that the tendency to borrow is interest elastic, i.e., it is lower at higher rate of interest and higher at lower rate of interest.

Supply for Loanable Funds: The advocates of loanable funds theory believed that supply of funds comes from savings, dishoarding and bank credit. The main sources of savings are private savings, individual savings and corporate savings. Taking the level of income as given, since personal savings depends on the level of income, they are regarded as interest elastic. The higher the rate of interest, the greater will be the inducement to save and vice versa. Corporate savings are the undistributed profits of a firm which also depends on the current rate of interest to some extent. Higher rate of interest will act as a deterrent to borrowing and thus encourage savings. The second source of supply of credit is dishoarding is also positively related to the rate of interest. Higher rates of interest will encourage greater dishoarding and lower rate of interest will encourage lower dishoarding. Lastly, the third source of supply is bank credit. Banks are inclined to lend higher credits at higher rates of interest and vice versa.

The summation of three types of demand will give the demand curve for credit and the summation of three types of supply will give the supply curve of credit. The intersection of the two summed up curves will give the equilibrium rate of interest, as shown in the following figure.

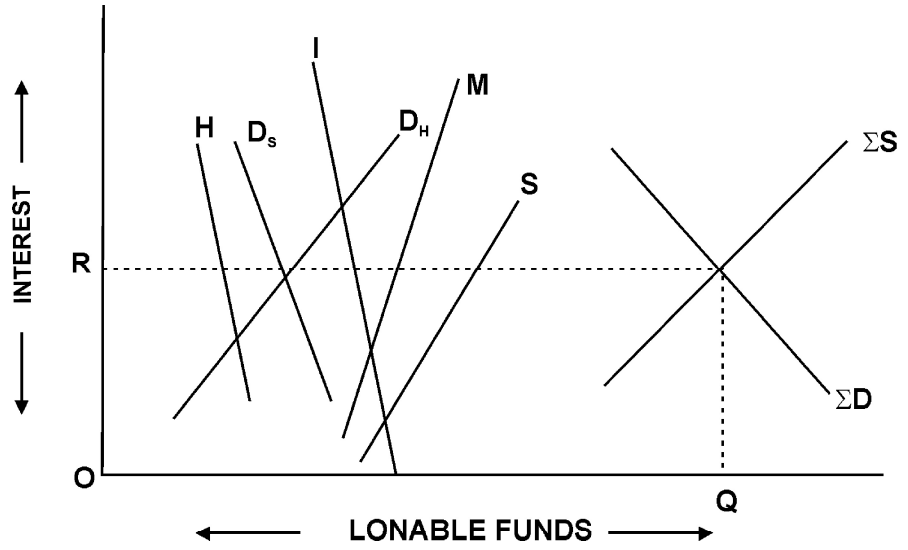


Fig. 9.2 : Determination of Rate of Interest

In the above figure, the individual demand curves H (Hoarding), Ds (Dissaving or Consumption) and I (Investment by government and businessmen) sum up to give the demand curve ΣD. The individual supply curves D_H (Dishoarding), M (Bank Credit) and S (Savings) together sum up and give the supply curve ΣS. The demand curve ΣD and the supply curve ΣS intersect each other at E and generates the interest rate OR where OQ amount of funds are borrowed and lent.

Criticisms: Although Prof. Robertson described it as a "commonsense explanation of the determination of the rate of interest", yet it is not free from criticisms.

- The neo-classical economists considered savings, which is one of the components of the supply schedule, to be a function of present income only. But savings depends not only on present income but is also a function of past income. This fact was ignored by this theory.
- The loanable funds theory states that supply of loanable funds can be varied by varying the cash balances. However, cash balances in a community remains fixed and is equal to the supply of money in the economy. Concept like velocity of circulation of money, which affects the money supply is not taken into consideration by the theory.
- The precautionary motive behind savings is ignored by the theory and saving is presented only as interest driven.



CHECK YOUR PROGRESS

Q.5: Who propounded the loanable funds theory of interest?

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Q.6: How is the demand for loanable funds generated? (Answer in about 30 words)

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Q.7: From where does the supply of funds come? (Answer in about 20 words)

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9.5 LIQUIDITY PREFERENCE THEORY OF INTEREST

Keynes defines the rate of interest as "the reward for parting with liquidity." Here money is termed as liquid since money can be most easily converted into any types of economic goods and services. To him, rate of interest is determined by the demand for money and supply of money. As such the Keynesian theory of interest is termed as a monetary theory of interest.

DEMAND FOR MONEY

According to Keynes, people demands money for three specific motives: transaction motive, precautionary motive and speculative motive.

The transaction motive implies the need of cash to meet the everyday needs – both personal and business. Thus Keynes further divides it into income motive and business motive. To Keynes, a person prefers to hold cash to bridge the interval between the receipt of income and its disbursement. If this interval is small they will hold less cash and if it is big,

they will demand more cash. To Keynes, the amount of cash demanded by the community for transaction motive depends upon the level of income, employment and prices, the business turnover, the normal period between the receipt and disbursement of income, the amount of salary or income and on the possibility of getting a loan.

The precautionary motive implies that people demand cash to meet unforeseen expenses such as expenditure on medical and treatment. Also, sometimes, advantageous opportunities may crop up which will require money. Thus people want to hold cash as a precaution. In the same way, businessmen desire to keep cash in reserve to tide over unfavorable conditions or to gain from unexpected deals. To Keynes, the precautionary demand for money depends upon the level of income and business activity, opportunities for unexpected profitable deals, availability of cash, the cost of holding liquid assets in bank reserves, etc.

Keynes maintains that transaction and precautionary motives are relatively interest-inelastic, but are highly income elastic. The amount of money held under these two motives (M_1) is a function (L_1) of the level of income (Y) and is expressed as $M_1 = L_1(Y)$.

Money held under **speculative motive** is for "securing profit from knowing better than the market what the future will bring forth." Individuals and businessmen desires to earn profit from the money that remains after spending on transactions and keeping to meet future speculations. The amount of money held under this motive is dependent on the interest rate. To Keynes, people invest in bonds to earn profit. The bond prices and interest rates are inversely related. This again is responsive to speculations. When people speculate bond prices to rise (and interest rates to fall), they purchase bonds with the intension to sell them in the future when their prices rise and thereby gain profit. Conversely, when bond prices are expected to fall (the rate of interest to rise), they will buy less bonds. Thus the speculative demand for money will be less at a higher rate of interest because businessmen will convert their cash into bonds in the expectation of a rise in the price of the latter. On the other

hand, if the interest rate is low, businessmen would prefer to hold more cash and spend in the future. Thus speculative demand for money is responsive to interest rates. Algebraically, the speculative motive is expressed as $M_2=L_2(r)$.

Thus, Keynes summed up the total demand for money as

$M = M_1 + M_2$

where, M_1 = money held for transaction and precautionary motive

M_2 = money held for speculative motive

And, M = L (Y, r)

Since, M_1 = L (Y), where L= function, Y = income

M_2= L (r), where r=rate of interest

SUPPLY OF MONEY

The supply of money is considered to be fixed here. It is given by the government. Hence, we have a perfectly inelastic or vertical curve.

DETERMINATION OF RATE INTEREST

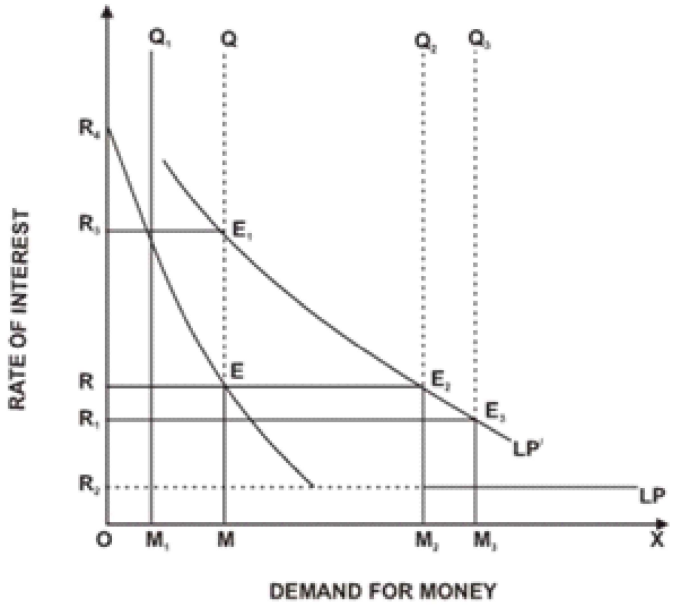


Fig. 9.3 : Determination of Rate of Interest

Just as price of a commodity is determined by demand and supply of the commodity, in the same way the rate of interest is determined at

the equilibrium level where demand for money and supply of money intersect. In the above figure QM is the supply curve which is a perfectly elastic vertical line. The curve LM represents the liquidity preference curve. The equilibrium point is E, where both the lines intersect and the rate of interest is determined at OR. Any deviation from this equilibrium position will lead to an adjustment via the rate of interest. Increase in supply of money by the monetary authority and unchanged liquidity preferences will lead to a fall in the rate of interest and vice versa. On the other hand, an increase in liquidity preference with unchanged supply of money will lead to a rise in rate of interest and vice versa. In the above figure, with the upward shifting of the liquidity preference curve to $LP^{/}$ the quantity of money QM remaining the same, the rate of interest rises to OR_3 at the equilibrium point E_1. If with the increase in the liquidity preference to $LP^{/}$, the quantity of money is also increased in the same proportion to Q_2M_2, there is no change in the rate of interest OR, except that the new equilibrium point is E_2. On the other hand, if the quantity of money increases to Q_3M_3, the rate of interest falls to OR_1 at the equilibrium point E_3.

CRITICISMS

- According to Robertson, Keynes presumes the presence of wealthy and shrewd people and has developed his theory based on them. But Robertson points out that bonds are not alternative for money, and that the present theory lacks realism and comprehensiveness.
- Keynesian theory has not proven true in reality. This is because Keynes advocates a very high rate of interest at the time of depression, but in reality interest rates are very cheap since investment opportunities are temporarily closed and the lenders have no reason to part with liquidity.
- The Keynesian theory is also indeterminate.
- If saving is independent of rate of interest then people will save even at zero rate of interest. This is inconceivable, as pointed out by Pigou.
- There is no empirical evidence to suggest the existence of 'liquidity trap'.

- Keynes makes interest a purely monetary phenomenon. Modern theorists dispute this.



CHECK YOUR PROGRESS

Q.8: Who propounded the liquidity preference theory of interest?

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Q.9: State the three motives for liquidity preference. (Answer in about 10 words)

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Q.10: For which motive do people get interest? (Answer in about 10 words)

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9.6 MODERN THEORY OF INTEREST: HICKS-HANSEN'S SYNTHESIS

A modern theory of interest rate determination was presented by Sir J. R. Hicks and A. H. Hansen. In this theory the different variables of classical theory and Keynesian theory are combined. In other words, interest, saving, investment, liquidity preference and quantity of money are integrated at various levels of income for a synthesis of the loanable funds theory with liquidity preference theory. The four variables of the two theories are combined to frame two curves – the IS curve and the LM curve. The IS curve represents the flow variables of the classical theory – savings and investment and the LM curve represents the stock variables of money and rate of interest of the loanable funds theory. The IS-LM equilibrium provides a determinate rate of interest.

The IS curve and the goods market equilibrium

The IS curve shows the equality of savings (S) and investment (I) at various levels of income (Y) and rate of interest, which brings about an equilibrium in the goods market. The IS curve involves the following goods market relationships:

I = *f*(r) ……. (Investment Function)

S = I…… (Equilibrium condition in real/goods market)

S = *f*(Y)…… (Saving Function)

The derivation of the IS curve is shown in the following figure.

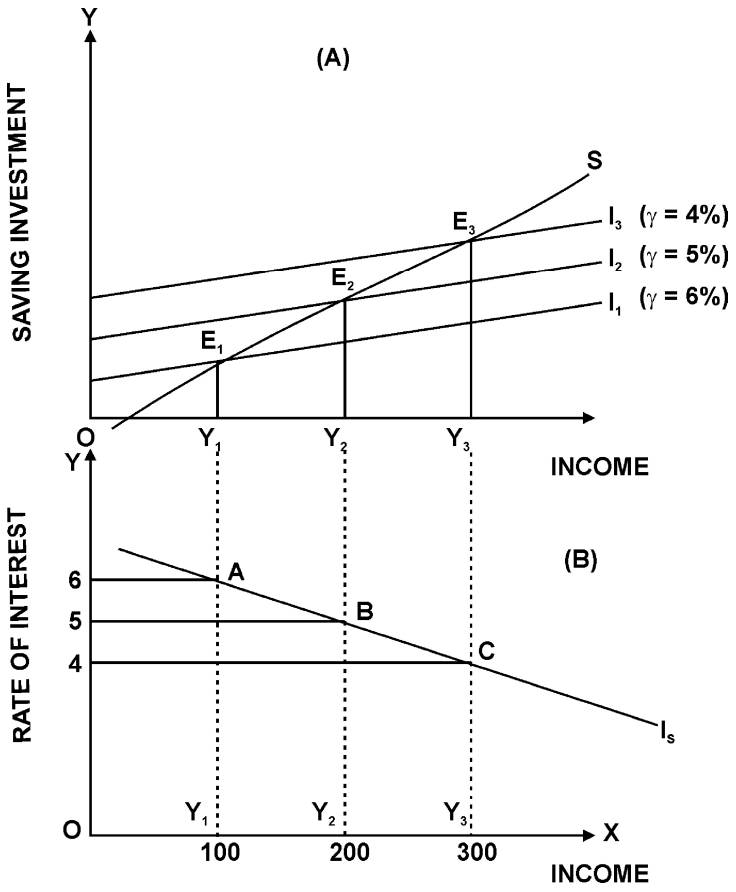


Fig. 9.4 : Derivation of the IS curve

In the above figure 9.4, the saving and investment is measured on the vertical axis and income is measured on the horizontal axis. The saving

curve S is a straight line and is assumed to be not much influenced by the rate of interest. The curve is an upward rising one, depicting a positive saving to be a positive income. Investment, on the other hand is influenced by rate of interest. As the rate of interest rises from 4% to 5% and then to 6%, the investment curve also rises from I_1 to I_2 and then to I_3, respectively. The intersection of investment and savings curve at different points corresponding to a particular rate of interest gives different equilibrium points E_1, E_2 and E_3. The figure shows that at higher level of investment, say I_3, higher income, Y_3, is generated. Thus, as interest rate rises, investment also rises and this increase in investment also increases the income level.

In part 'B' of the above figure, the rate of interest is measured on the vertical axis and income is measured on the horizontal axis. Corresponding to various levels of interest and income, the IS curve is generated. The IS curve slopes downward from left to right because, as the interest rate falls, investment increases and so does income.

The LM curve and the money market equilibrium

The LM curve is derived from the Keynesian formulation of liquidity preference schedules and the schedule of money, which give the money market equilibrium. A family of liquidity preference curves L_1Y_1, L_2Y_2 and L_3Y_3 is drawn at various income levels.

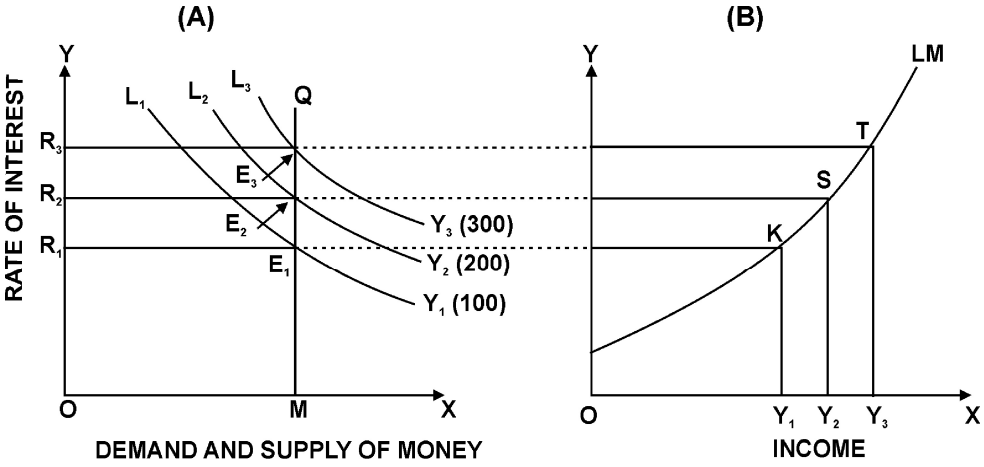


Fig. 9.5 : Determination of LM curve

The three curves, together with the perfectly inelastic money supply curve MQ gives us the LM curve. The LM curve consists of a series of

points, each point representing an interest income level at which the demand for money (L) equals the supply of money (M). Corresponding to income level Y_1, the rate of interest is R_1, which is generated through the interaction of L_1 with the perfectly inelastic money supply curve MQ. Likewise, corresponding to income level Y_2, rate of interest is R_2 and at income level Y_3, rate of interest is R_3. This curve relates different income levels to various interest rates. The points of intersection of L_1, L_2 and L_3 with MQ generate the points K, S and T. By joining the three points we get the LM curve.

Determination of Rate of Interest: The IS curve depicts the various combinations of income and rate of interest at which savings and investment are in equilibrium. And the LM curve depicts the various combinations of interest and income at which demand for money equals supply of money. The intersection of the IS curve and the LM curve gives the equilibrium rate of interest, where the entire economic system can achieve equilibrium. This is shown in the following figure.

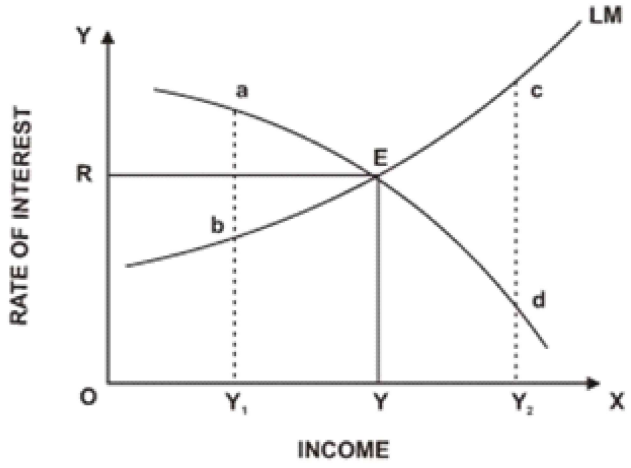


Fig. 9.6 : Determination of Rate of Interest

In the above figure, the IS curve and the LM curve intersect at point E and we get the equilibrium rate of interest OR and the equilibrium income level Y. This equilibrium position is termed as stable equilibrium by Hicks and Hansen because if there is any deviation from this point, the different market forces will act and react in such a way that the equilibrium will be restored.

The shift or change in the IS curve or the LM curve or in both, change in the equilibrium position and the rate of interest is determined accordingly. This is shown in the following figure.

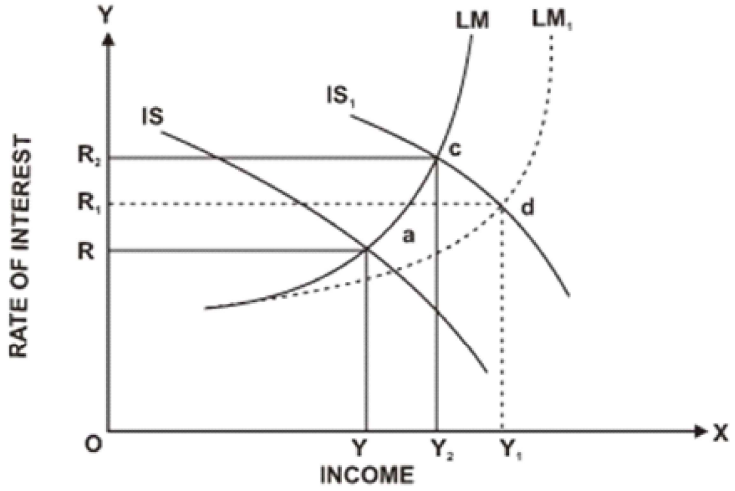


Fig. 9.7 : Shift in the IS curve or the LM curve

In the above figure, the IS and the LM curve intersect each other at point 'a' where the rate of interest is OR and income level is OY. An increase in investment and decrease in savings will shift the IS curve to the right to IS_1. Given the LM curve, the new equilibrium will be at 'c'. Now, the rate of interest will be OR_2 and the new income level will be OY_2. On the other hand, an increase in the supply of money will shift the LM curve to the right, and the new equilibrium rate of interest will be OR_1 with OY_1 level of income. Thus, with a given LM curve, when the IS curve shifts to the right, income increases and along with it the rate of interest also rises. Given the IS curve, when the LM curve shifts to the right, income increases but the rate of interest falls. In other words, the Hicks–Hansen analysis can be termed as a determinate theory of rate of interest since it considers the four major components influencing interest rates – savings, investment, demand for money or liquidity preference and supply of money.



CHECK YOUR PROGRESS

Q.11: Who propounded the modern theory of interest?

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Q.12: What does the IS curve depicts? (Answer in about 20 words)

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9.7 COMPARISON OF KEYNESIAN THEORY WITH CLASSICAL THEORY AND LOANABLE FUNDS THEORY

The Keynesian theory of interest can be said to be an improvement over the classical theory and the loanable funds theory. While the classical economists envisaged that the rate of interest is determined by the interaction of demand and supply for capital, according to loanable funds theory the price for credit is the rate of interest and this rate of interest is determined by the demand for and supply of loanable funds. But these two theories did not specify as for which type of money demand, interest is paid. Keynes pointed out that interest is the reward for parting with liquidity, and people hold money for three motives – transaction motive, precautionary motive and speculative motive. And interest is paid for the money held for speculative motive. Further, he also pointed out that supply of money is fixed and is determined by the monetary authority. This fixed money supply curve concept was ignored by the classical theorist and the advocators of loanable funds theory. The Keynesian theory is also free from the unrealistic full employment assumption.



9.8 LET US SUM UP

- The classical economist, Marshall and Fisher, propounded the classical theory of interest.
- They envisaged that the rate of interest determined by the interaction of demand and supply for capital.
- Supply of capital is governed by time preference.
- The demand for capital is governed by the expected productivity of capital.
- Time preference and productivity are dependent on waiting or savings and hence, this theory is also known as the supply and demand theory of savings.
- The loanable funds theory was expounded in 1930s by Denis Robertson, a British economists and Bertil Ohlin, a Swedish economist.
- There are three primary sources that generate the demand for loanable funds. They are government, businessmen and consumers whose demand arises for the purpose of investment, hoarding and consumption.
- The advocators of loanable funds theory believed that supply of funds comes from savings, dishoarding and bank credit.
- Keynes defines the rate of interest as “the reward for parting with liquidity.”
- According to Keynes, people demands money for three specific motives: transaction motive, precautionary and speculative motive.
- The Hicks –Hansen theory is also known as the IS-LM framework.
- The IS curve shows the equality of savings (S) and investment(I) at various levels of income(Y) and rate of interest, which brings about a equilibrium in the goods market.
- The LM curve is derived from the Keynesian formulation of liquidity preference schedules and the schedule of money, which gives the money market equilibrium.



9.9 FURTHER READING

1) Ahuja, H.L. (2017). *Advanced Economic Theory, Microeconomic Analysis*. New Delhi: S. Chand.

2) Maddala, G.S. and Ellen, Miller. (2004). *Microeconomics:Theory and Applications.* New Delhi:Tata McGraw-Hill.

3) Mukherjee, Sampat. (2009). *Analytical Microeconomics.* New Delhi:New Central Book Agency.



9.10 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: The classical economists, Marshall and Fisher, propounded the classical theory of interest. Later on, economist like Pigou, Cassel, Knight and Tausig, also contributed to the modification of the theory.

Ans to Q. No. 2: According to the classical economists, the supply of capital depends upon governed by savings, which in turn depends upon the willingness and ability to save of the community.

Ans to Q. No. 3: Demand for capital is governed by various factors such as productivity of capital, growth of population, technological progress, changes in standard of living of the people, etc.

Ans to Q. No. 4: The demand for capital comes both from the consumers and the producers.

Ans to Q. No. 5: The loanable funds theory was propounded in 1930s by Denis Robertson, a British economists and Bertil Ohlin, a Swedish economist.

Ans to Q. No. 6: There are three primary sources that generate the demand for loanable funds. They are government, businessmen and consumers whose demand arises for the purpose of investment, hoarding and consumption.

Ans to Q. No. 7: The supply of loanable funds comes from savings, dishoarding and bank credit.

Ans to Q. No. 8: J.M.Keynes propounded the liquidity preference theory of interest.

Ans to Q. No. 9: The three motives of liquidity preference are: transaction motive, precautionary motive and speculative motive.

Ans to Q. No. 10: People get interest for the speculative motive.

Ans to Q. No. 11: The modern theory of interest rate determination was propounded by Sir J.R.Hicks and A.H.Hansen.

Ans to Q. No. 12: The IS curve depicts the equality of savings(S) and investment(I) at various levels of income(Y) and rate of interest, which brings about a equilibrium in the goods market.



9.11 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words).

Q.1: Name two classical economists.

Q.2: State the meaning of speculative motive.

Q.3: How does Keynes define interest rate?

Q.4: Briefly explain how interest is determined according to Keynes.

B) Long Questions (Answer each question in about 300-500 words).

Q.1: Critically discuss how interest rate is determined according to the classical theory.

Q.2: Discuss how interest rate is determined under loanable funds theory.

Q.3: Discus the Hicks –Hansen theory of interest.

Q.4: Compare the classical theory and the loanable funds theory with the Keynesian theory of interest.

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UNIT 10: THEORY OF PROFITS

UNIT STRUCTURE

10.1 Learning Objectives

10.2 Introduction

10.3 Profits as a Dynamic Surplus: Clark's Dynamic Theory

10.4 Schumpeter's Innovation Theory of Profits

10.5 Knight's Theory of Profits

10.6 Let Us Sum Up

10.7 Further Reading

10.8 Answers to Check Your Progress

10.9 Model Questions

10.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- know the meaning of profit
- understand how profit arises due to dynamic factors
- explain the innovation theory of profit
- Understand the relation between uncertainty and profit.

10.2 INTRODUCTION

Profit is a non contractual income earned by the entrepreneurs. In this sense, profit appears as a residue of sales revenue after other contractual costs such as wage, interest, and rent are deducted from it. From time to time there has been conflicting views about the term 'profit' and therefore Taussig considered it as a mixed and vexed income. Some have opined that entrepreneurs earn profits for organizing and coordinating the other factors of production. Some others think that the entrepreneur earns profits because he bears risk and uncertainty. Some have declared profits as a reward for innovations while some have emphasized uncertainty in the economy as a factor which gives rise to profits. So this unit tries to highlight some theories in which the economists focus their viewpoints regarding the concept of profits.

10.3 PROFITS AS A DYNAMICS SURPLUS: CLARK'S DYNAMIC THEORY

The dynamic theory of profits was propounded by J B Clark, who believed that profits are a dynamic surplus, i.e. profits arise in the dynamic economy not in the static economy. According to him, the entrepreneur must get some surplus over and above the cost as he has to operate his enterprise in highly risky, uncertain and dynamic conditions.

Clark believed that those entrepreneurs who successfully take the advantage of the changes that takes place in dynamic economy make pure profit, which is an addition to the normal profit. In his opinion the major dynamic changes in the economy which give rise to profits are-

- Changes in population
- Changes in capital stock
- Changes in methods or techniques of production
- Changes in quality and quantity of human wants
- Changes in business organization

The dynamic changes, on one hand, tend to increase productivity and on the other hand, lower costs. Thus a surplus of price over average cost is formed.

Clark opined that pure profit is momentary. In the long run the competitors imitate the changes initiated by the leading firms. Consequently the demand for the factors of production increases, thereby increasing the factor prices and the overall cost of production. On the other hand, with an increase in the output, the price of a product declines for a given level of demand as a result of which the pure profit disappears.

It is here worth mentioning that Clark's dynamic theory of profit should not be misinterpreted as the profits in the dynamic economy remains for a short period of time and then disappears forever. But, however, generic changes take place frequently, and the entrepreneur through his foresight must capitalize on it and continue to make a profit in excess of the normal profit. So emergence, disappearance and re-emergence of profit is a continuous process.

Thus, we have seen above that profit is a reward for inventing products and techniques of production and for managing the functions of entrepreneurs under dynamic conditions. Profit is recognition of dynamic entrepreneurs under dynamic conditions.

Criticisms: Knight asserted that the continuous change taking place in the economy creates uncertainty in the system. Profits, therefore, is essentially a reward of facing uncertainty. Clark's theory has also been criticized on the ground that it is not possible to have exact measurement of dynamic and continuous change taking place in the economy. It is difficult to provide explanation why the firms receive larger or smaller amount of profits at the same time.



CHECK YOUR PROGRESS

Q.1: Distinguish between dynamic economy and static economy. (Answer in about 50 words)

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Q.2: State the major changes in the economy, as stated by Clark, which lead to rise in profits. (Answer in about 50 words)

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10.4 SCHUMPETER'S INNOVATION THEORY OF PROFITS

According to Schumpeter, the principal function of the entrepreneur is to make innovations and profits are a reward for performing this important

function. Schumpeter used the term innovation in a wider sense. Innovation simply means the commercial exploitation of technical inventions and new ideas related to business organization, management and marketing. He opined that discovery of a new material or a new technique of production resulting in the lowering of the cost of production or improving the quality of the product is an innovation.

Innovations may be of two types:

- Those which change the production function and reduce the cost of production, and
- Those innovations which stimulate the demand for the product, i.e. which change the demand or utility function.

In the first type are included the introduction of new machinery, improved production techniques or processes, exploitation of a new source of raw material or a new and better organizational pattern for the firm. The second type of innovations are those which are calculated to increase the demand for the product by introducing a new product or a new variety of an old product, new and more effective mode of advertisement, discovery of new markets, etc. Success of any of these innovations brings a handsome increase in profits.

The technical innovations can speed up the process of production and economic costs. Thus the entrepreneur finds opportunity to make large profits. Hence profits, according to Schumpeter, are the reward for making innovations.

It may be pointed out that this theory suggests that profits are temporary. Initially, a few more enterprising producers introduce innovations and reap large profits. This induces other firms to enter the market and imitate the innovations. The intensified competition causes the reduction and elimination of profits due to price reduction and consequent slump in the market. After sometime, the pioneering entrepreneurs again make some innovations and start getting profits. In this way, the innovation theory explains that profits appear, disappear and reappear in the economy.

Criticisms: Schumpeter's innovation theory can be criticized on the same ground as Clark's dynamic theory-

- Schumpeter also like Clark ignores uncertainty as a source of profit.
- He also denies that risk-bearing plays any role in the determination of profit.

10.5 KNIGHT'S THEORY OF PROFITS

Frank Knight in his book 'Risk, Uncertainty and Profit' (1921) considered profit as a residual return to uncertainty bearing, not to risk bearing, as in the case of the theory of Hawley. According to him, "It is not dynamic change, or any change as such which causes profits, but divergence of actual conditions from those which have been expected and on the basis of which business arrangements have been made".

Knight segregated risk into two types:-

- **Insurable Risk:** There are certain risks whose probability of occurrence can be statistically estimated on the basis of available data. Examples of these types of risks are loss of property due to fire, floods, theft, accidents, riots, war and the like. Such risks can be offset through insurance. It signifies that the insurable risks are actually not borne by the entrepreneurs, rather borne by insurance companies.
- **Non-insurable Risk:** These are certain risks in which the probability of its occurrence is non-calculable, such as change in tastes and fashion, variation in market prices of materials or finished products, certain elements of production cost that cannot be accurately calculated. Hence, these are not insurable. The incalculable risks are represented by 'uncertainty'. The entrepreneur has to take decisions in this region of uncertainty. He earns profit if he takes right decisions.

  The uncertainty arises essentially because of the following reasons-

  - **Competition:** The forces of competition always tend to create much uncertainty in the market. The competition sometimes leads to the elimination of certain firms. That results in very uncertain conditions in the market. The rival firms cannot exactly

anticipate the reactions of one another to price or output variations. The intensity of competition too cannot be anticipated accurately by the business firms.

- **Market conditions:** There may be unexpected variations in demand because of changes in tastes, fashions, population and income distribution. Similarly, there may be unintended changes in supply. These market forces cause unanticipated changes in prices of raw materials or finished products and consequent conditions of uncertainty.
- **Business cycle:** The business cycles are also responsible for continuous variations in production activities. These variations do not permit the exact anticipation of the level of economic activity in future.
- **Technical change:** The introduction of new machinery, equipment, raw materials and production processes greatly influence costs, output, prices and profits. But the character of technical changes and their impact upon the working of the business firms remain highly uncertain.
- **Political and international factors:** The political environments, state of war or peace, political stability, economic policies and conditions related to international trade and foreign capital also create a lot of uncertainty in the economic system and it is not possible to quantify with exactness the extent of uncertainty.

If the changes were foreseen and predictable or if there were no changes, there would have been no uncertainty about the future and no profits. Profits crop up because of uncertainty of future. If the future conditions could be completely foreknown in the present, then people would certainly adjust things to the ideal state where all prices would equal costs and profits would not emerge. Ignorance about the future and uncertainty of it gives rise to profits.

We thus observe that entrepreneurs have to carry out the work of production under a situation of uncertainty. They have to make estimates

of the future conditions regarding demand for the product and other factors that affect price and costs in advance. On the basis of their estimates and anticipations, they make contract with the suppliers of factors of production in advance at fixed rates of remuneration.

Knight believes that there is a proportional relation between profit and uncertainty. The greater the uncertainty, the more profits must be ensured to the entrepreneurs, otherwise they cannot be induced to set up new enterprises and vice-versa.

In the opinion of Knight, uncertainty is unavoidable. Each industry and firm has to live with it. It can influence production in almost the same way as other factors of production do. Therefore, Knight maintains that uncertainty should be treated as a separate factor, the remuneration for which is paid in the form of profits.

Criticisms: Knight's theory has been criticized for the lack of scientific precision. Uncertainty is not an easy phenomenon. Uncertainty cannot be considered as the solitary cause of profit. The practical situations don't certify Knight's theory. If uncertainty brings profit and higher uncertainty brings more profit. The real life situations don't always conform to this theory.



CHECK YOUR PROGRESS

Q.3: What is meant by Innovation? (Answer in about 20 words)

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Q.4: What is meant by Insurable and Non-Insurable risk? (Answer in about 50 words)

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10.6 LET US SUM UP

- The dynamic theory of profits was propounded by J B Clark.
- According to Clark, the entrepreneur must get some surplus over and above the cost as he has to operate his enterprise in highly risky, uncertain and dynamic conditions.
- The innovation theory of profit was developed by Joseph A Schumpeter.
- It has been held by Schumpeter that the main function of the entrepreneur is to introduce innovations in the economy and profits are reward for his performing this function.
- Knight is of the view that unpredictable, unforeseen changes and uncertainty about the future give rise to profits.



10.7 FURTHER READING

1) Ahuja, H.L. (2017). *Advanced Economic Theory, Microeconomic Analysis*. New Delhi: S. Chand.

2) Koutsoyiannis, A. (1979). *Modern Microeconomics*. London: Macmillan Education Limited.

3) Madala, G.S. and Miller, Ellen. (2018). *Microeconomics Theory and Applications*. McGraw Hill Education (India) Pvt. Ltd.



10.8 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: The static economy is one in which things do not change significantly or remain unchanged. For example, population and capital etc. remain stationary. Dynamic economy is characterized by the generic changes such an increase in population, improvement in production techniques, etc.

Ans to Q. No. 2: In the opinion of Clark, the major dynamic changes in the economy which give rise to profits are-

- Changes in population
- Changes in capital stock
- Changes in methods or techniques of production
- Changes in quality and quantity of human wants
- Changes in business organization

Ans to Q. No. 3: Innovation means the commercial exploitation of technical inventions and new ideas related to business organization, management and marketing.

Ans to Q. No. 4: Insurable risks are certain risks whose probability of occurrence can be statistically estimated on the basis of available data. Examples of these types of risks are loss of property due to fire, floods, theft, accidents, riots, war and the like.

Non-Insurable risks are certain risks in which the probability of its occurrence is non-calculable, such as change in tastes and fashion, variation in market prices of materials or finished products, certain elements of production cost that cannot be accurately calculated.



10.9 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q.1: What are the essentials of Knight's uncertainty theory of profit?

Q.2: How do innovations result in the emergence of profits?

Q.3: What causes uncertainty in the economy?

B) Long Questions (Answer each question in about 300-500 words)

Q.1: Profits are a dynamic surplus. Discuss.

Q.2: Explain the Schumpeter's innovation theory of profits.

Q.3: Profits are a reward of uncertainty bearing. Discuss.

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UNIT 11: ECONOMICS OF INSURANCE

UNIT STRUCTURE

11.1 Learning Objectives
11.2 Introduction
11.3 Measuring risk: Probability, Expected Value and Variability
11.4 Attitude Towards Risk and Expected Utility Hypothesis
11.5 Risk Aversion and Insurance
11.6 Risk Lover and Gambling
11.7 Choice between Insurance and Gambling: Friedman Savage Hypothesis.
11.8 Measures for Risk Reduction
11.9 Problems of Insurance
11.10 Risk Pooling and Spreading
11.11 Let Us Sum Up
11.12 Further Reading
11.13 Answers to Check Your Progress
11.14 Model Questions

11.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- know the different behaviours of people towards risk
- understand why people prefer to invest in insurance
- learn about different methods of risk reduction
- learn about how people make choices between gamble and insurance.

11.2 INTRODUCTION

In the theory of consumer behaviour, we normally assume that consumer's decisions do not face any uncertainty. However, in the real world, uncertainty is a fact of life and therefore risk is inevitable in case of any economic transactions. Here it is important to point out the difference between 'risk' and 'uncertainty'. Risk signifies a situation when the probability of each

possible outcome of an event can be specified. Consumer's decision-making involving risk requires that the individual is aware of all the possible outcomes and also the probabilities of each outcome. For example, in tossing of a coin, there are two possible outcomes and if one individual chooses Head, his possibility of winning or losing is equal to ½. On the other hand, uncertainty signifies a situation when probability of the possible outcomes of an event is unknown or there is no past information on the basis of which the chance of occurring of an outcome can be estimated. Different people have different attitude towards risky and uncertain situations which affect their choices. In real life, most of the people try to avoid risk and are called **risk averters**. They have incentives to buy insurances and pay premiums to avoid risky situations. There are some other individuals who have preference towards risk and are called **risk lovers**. Some individuals are indifferent in their choice towards risky situations and they are called **risk neutral** individuals.

11.3 MEASURING RISK: PROBABILITY, EXPECTED VALUE AND VARIABILITY

Probability is the possibility that a particular outcome will occur in a given experiment. It can be calculated by dividing favourable number of events (i.e. the total number of times the event occurred) by the total number of events of the experiment. For instance, when we throw a dice, the probability of getting a six is 1/6 and the probability of not getting a six is 5/6. Probabilities have two different concepts: **subjective probability** and **objective probability**. The interpretation of objective probability is dependent on long run experiences of the frequency of occurrence of an event. Suppose in an experiment, 25 is the number of success and the rest 75 is the number of failures. Thus, probability of success is ¼ and probability of failure is 3/4. Both these probabilities are calculated using past experiences. In cases where there are no past experiences, we use the concept of subjective probability which is not based on any long-term frequencies of occurrence of an event. Rather subjective probability depends on people's perception or judgement regarding the happening of an outcome. In case of subjective probability, people's judgement may vary in between different

outcomes which may result in variation in assigning probabilities by different individuals. Thus, choice of persons may also be different. These two concepts of probability help to make comparison among different risky and uncertain situations in order to make choices among them.

All the possible outcomes of an event and their probability of occurrence are known as **probability distribution**. The probability distribution of an uncertain event allows in measuring two important values, which are necessary for making choices under risky and uncertain situations: (i) **expected value** and (ii) **variability**.

The **expected value** of a probability distribution is the weighted average of all the possible outcomes and the probabilities of each outcome being the weights. If there are two possible outcomes X_1 and X_2 of any experiment with respective probabilities P_1 and P_2, then expected value is calculated as

$E(X)= P_1X_1+P_2X_2$

For instance, in a game of tossing of a coin between two players, the first player receives Rs.80 if a head turns up and has to pay Rs. 40 if it is a tail, the expected return of this game is

E(return) = 0.5 x Rs. 80+0.5 x Rs.(-40) = Rs. (40-20) = Rs.20

The **variability** of outcomes of an event is the extent to which the possible outcomes deviate from the actual values. The simplest measure of variability is calculating the difference of each outcome from their expected value. This difference is called **deviation**. Greater the deviation, greater is the risk involved in that situation. See the example in table 11.1

Table 11.1: Expected value and variability from two different experiments

	Outcome 1			Outcome 2			Expected Value
	Probability	Value	Deviation	Probability	Value	Deviation	
Experiment 1	0.5	1000	-250	0.5	1500	250	1250
Experiment 2	0.2	500	-1200	0.8	2000	300	1700

The deviation does not really serve the purpose as a measure of variability because they are sometimes positive and sometimes negative and if we calculate the average or expected value of deviations of all the

possible outcome of an event, the value will be always zero. For instance, in the experiment 1, average value of deviation is 0.5 x (-250) + 0.5 x (250)=-125+125=0.

The most widely used measure of variation is the standard deviation which is the square root of average of squared deviations of each outcome from their expected values. The calculation of standard deviation for our example cited in table 11.1 is given in table 11.2.

Table 11.2: Calculation of standard deviation

	Outcome 1		Outcome 2		Average squared deviation	Standard deviation
	Deviation	Squared Deviation	Deviation	Squared Deviation		
Experiment 1	-250	62500	250	62500	0.5x62500+0.5x62500 = 62500	250
Experiment 2	-1200	1440000	300	90000	0.2x1440000+0.8x90000 = 3,60000	600

The standard deviations of the two experiments show that the second experiment has more variability and therefore it is riskier. This concept of standard deviation is equally applicable if there are lot of probable outcomes of an experiment rather than just two as shown in the above example.



CHECK YOUR PROGRESS

Q.1: What is probability? (Answer in about 20 words)

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Q.2: What is the difference between objective and subjective probability? (Answer in about 30 words)

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Q.3: Briefly discuss the concepts of risk and uncertainty. (Answer in about 40 words)

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11.4 ATTITUDE TOWARDS RISK AND EXPECTED UTILITY HYPOTHESIS

A person's attitude towards risk is normally based on his preferences for fair gamble. A fair gamble is a type of gamble where the monetary return of the gamble is equal to the cost of playing the gamble. For example, when a coin is tossed, a player wins Rs. 1000 if a 'head' comes and lose Rs. 1000 if a 'tail' occurs. These two possible outcomes have equal possibility of occurrence i.e. probability of winning Rs.1000 or losing Rs.1000 are equal and the value of probability is ½. The expected return is ½ x 1000+1/2 x (-1000) = 500 +(-500) =0. This is the example of a fair gamble, where expected monetary value or return from a gamble is zero. We can distinguish between three different types of people based on their attitude towards risk by their acceptance or rejection to accept a fair gamble.

- A person who does not accept a fair gamble is called a risk averse.
- An individual is said to be risk neutral if he is indifferent between accepting and rejecting a fair gamble.
- If a person willingly undertakes a fair gamble, then he is called a risk lover.

According to expected utility hypothesis, any individual with rational behaviour will undertake their decision in risky and uncertain situations not on the basis of expected monetary value but depending on his expected utility from the additional money earned. As individual acquires more and more money, its marginal utility diminishes. The expected utility hypothesis was first put forward by Daniel Bernoulli. He observed different reactions from different individuals towards a same gamble. However, Bernoulli assumed utility to be measured cardinally which was one of the major points of limitation of his theory. J Von Neumann and O Morgenstern adopted a

new approach of constructing utility index which is known as N-M utility index. This N-M utility index can be used for assigning numerical values to the utility earned as his stock of money gets increased and this can be used for making rational choice under conditions of risk and uncertainty. Based on the expected utility theory, we can draw the utility functions of risk averse, risk loving, and risk neutral individuals as shown in figure 11.1, 11.2 and 11.3.

Consider a game where a coin is tossed, and players are paid Rs. 100 if a 'head' occurs and Rs. 100 is taken away from him, if a tail occurs, both the two outcomes having probabilities ½. This is a fair gamble because expected monetary value of the gamble is zero[100x1/2+(-100) x1/2=0]. Suppose an individual having income of Rs. 500 is offered this gamble. The initial utility without any uncertainty is U(Rs.500), if he does not accept the gamble. If he plays the gamble, the individual will get either Rs. 600, if he wins or Rs. 400 if he loses. Therefore, the expected utility is

EU=1/2 U(Rs.600) + ½ U(Rs.400)

The expected utility is the weighted average of utility from money income obtained from different outcomes, weights being the respective probabilities. In our example, if expected utility (EU) is smaller than U (Rs. 500), the individual will not accept the gamble, and this is the case of a risk averse person. The utility function of the risk averter is concave as depicted in figure 11.1 where marginal utility of the individual decreases along with the increase in his money income.

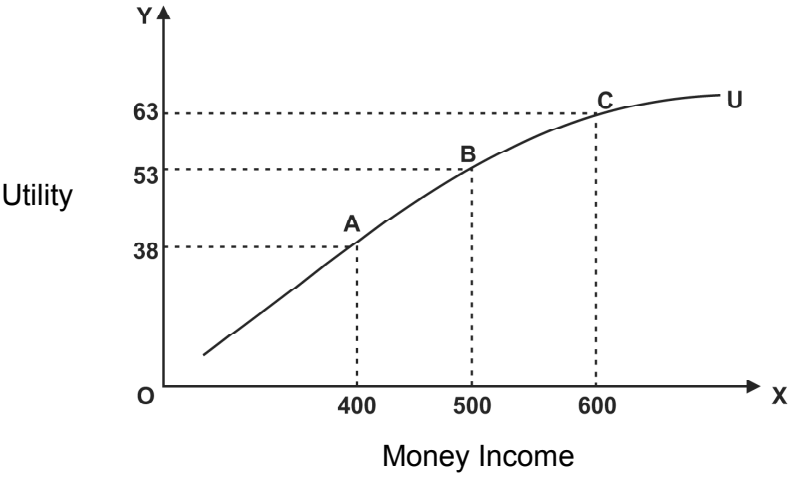


Fig. 11.1: Utility function of a risk averse individual

In figure 11.1, Utility from certain income of Rs.500 is

U (Rs 500) = 53

Expected utility from the gamble is

$$EU = \frac{1}{2}U\ (Rs.600) + \frac{1}{2}U\ (Rs\ 400)$$

$$= \frac{1}{2} \times 62 + \frac{1}{2} \times 38$$

$$= 31+19$$

$$= 50$$

As the expected utility from the risky gamble is less than the utility from certain income, the risk averse person will not accept this fair gamble. Now consider the case of a risk lover. In this case, marginal utility of money income increases as the individual earns more money and therefore his utility function is convex as shown in figure 11.2.

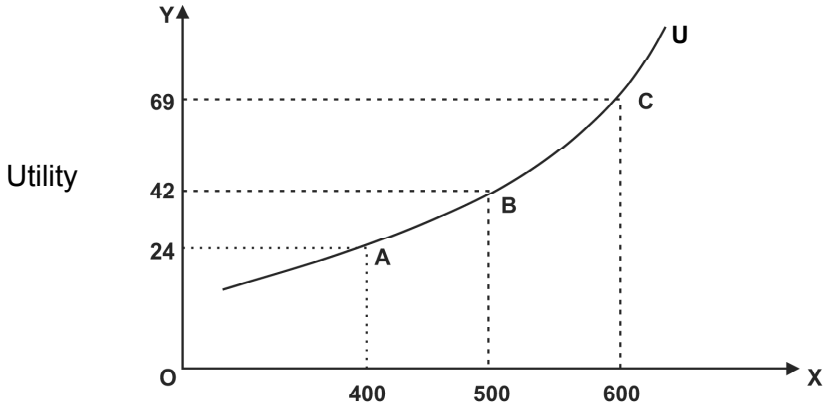


Fig. 11.2: Utility function of a risk lover individual

It can be seen from figure 11.2 that utility from certain income of Rs. 500 is

U(Rs.500) = 42

Expected utility from the gamble is

$$EU = \frac{1}{2}U(Rs.400) + \frac{1}{2}U(Rs.600)$$

$$= \frac{1}{2} \times 27 + \frac{1}{2} \times 69$$

$$= 13.5+34.5$$

$$= 48$$

Since the gamble or the uncertain situation offers more expected utility than the utility from the certain income of Rs. 500, the risk lover will

get indulged in this fair gamble. Now we take the case of a risk neutral individual. In case of a risk neutral person, the marginal utility of money remains constant. The total utility function of a risk neutral person is shown in figure 11.3

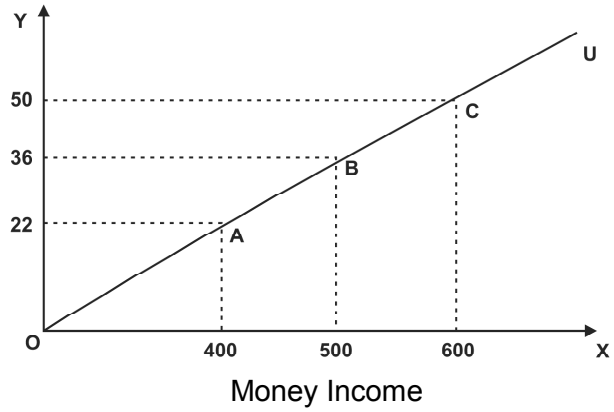


Fig. 11.3: Utility function of a risk neutral individual

Here utility from the certain income of Rs. 500 is

U(Rs.500) = 36

Expected utility from the risky gamble is

$EU = \frac{1}{2}U(Rs.600) + \frac{1}{2}U(Rs.400)$

$= \frac{1}{2} x\ 50+1/2x22$

= 25+11

= 36

It can be seen that in case of risk neutral person, the utility from a certain income is equal to expected utility of an uncertain income having the same expected value. Therefore, the risk neutral individual is indifferent between these two choices.

11.5 RISK AVERSION AND INSURANCE

Out of the three attitudes towards risk, risk aversion is the most common. Risk averse behaviour leads to willingness of individuals to pay for risk avoidance. In real life, most people buy different varieties of insurances like life insurance, health insurance, car insurance etc., indicating the fact that most people are risk averse. The important question that arises here is that how much money an individual is ready to pay as insurance premium or risk premium. The risk premium is the highest amount which a

risk averter is willing to pay in order to avoid a risky situation. To determine the risk premium, let us re-consider the utility function of a risk averter of figure 11.1.In our example of the fair gamble of tossing of a coin, the individual gets Rs. 600 if a head occurs and gets Rs. 400 if a tail occurs, each of these situations having equal chance of occurring. Thus, his expected income from these two risky situations is Rs 500.

Expected income = 600x1/2 +400x ½

= 300+200

= 500

This expected income is the weighted average of the two uncertain situations, weights being their respective probabilities. If probabilities of the uncertain alternatives differ, the expected income will also change. Again, this expected income of Rs. 500 is not an actual income (return) the player will get, he will either get Rs. 600 if he wins the gamble or Rs.400 if he loses.

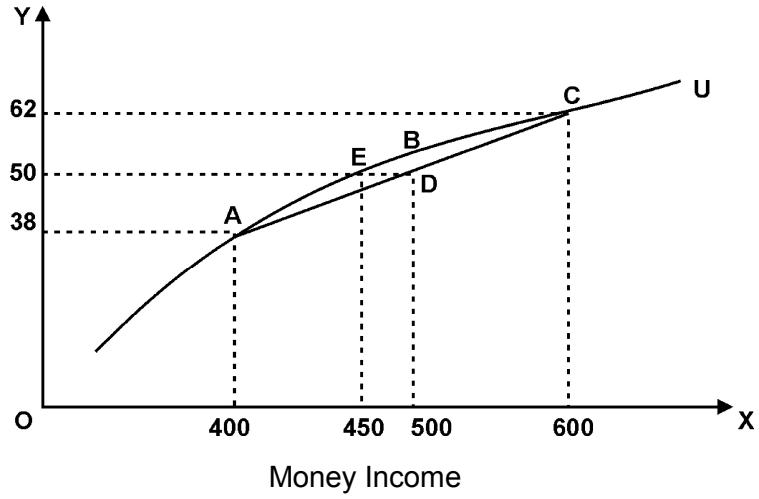


Fig. 11.4: Risk averter's preference for insurance

In figure 11.4, the expected utility of the individual in this risky situation is 50

Expected utility = ½ U (Rs. 600) + ½ U (Rs. 400)

= ½ x 62 + ½ x 38

= 31+19

= 50

In figure 11.4. we have drawn a straight line joining the points A and C representing utilities from the two uncertain alternatives of the gamble.

The expected utility 50 corresponding to the expected income of Rs. 500 is represented by point D on this line AC. From the concave utility function of the risk averter, it is seen that this expected utility 50 is equal to the utility obtained from a certain income of Rs. 460. This analysis has shown that the utility of an uncertain income of Rs 500 is same as the utility obtained from a certain income of Rs. 460. Therefore, the individual will be ready to forego Rs 40 or ED amount in figure 11.4 in order to get the assurance of a certain income of Rs. 460. Rs. 40 or ED is the amount of risk or insurance premium which the individual will pay to avoid this risky situation and get a certain income of Rs 460(Rs 500-Rs 40).

11.6 RISK LOVER AND GAMBLING

As explained already, a risk lover person accepts a fair gamble where expected monetary value or return from the gamble is always zero. For a risk loving person, the marginal utility of money increases as his money income increases and due to this, he has a convex utility curve. Consider the example where a person with a certain income of Rs. 500 is offered a fair gamble where he gains or lose Rs 100 with 50-50 chances. This means he will get Rs. 600 if he wins with probability ½ and will get Rs. 400 if he loses with the same probability. The expected monetary value of the gamble is 500.

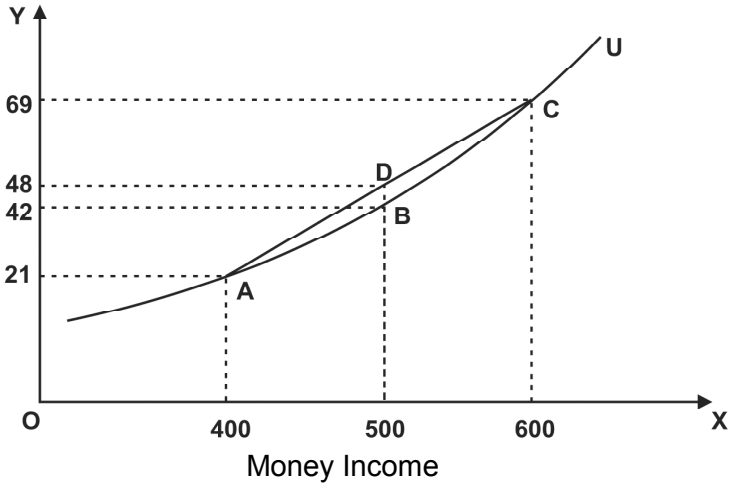


Fig. 11.5 Risk lover's preference for gambling

In figure 11.5, the convex utility curve of the risk lover is drawn. The utility from certain income of Rs 500 is 42. The expected utility from the

gamble can be calculated by joining the two points A and C on the utility curve representing utility from the two uncertain alternative outcomes of the gamble. On this line we have the point D which represents the expected utility form the expected monetary value of the gamble. Figure 11.5 shows that the expected utility from the expected income of Rs 500 or from the gamble is 48 and is greater than the utility obtained from the certain income. As the expected utility from the fair gamble is higher than the utility from the fixed income of Rs. 500, the risk loving person will be ready to accept this fair bet.



CHECK YOUR PROGRESS

Q.4: What is a fair gamble? (Answer in about 20 words)

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Q.5: State the expected utility hypothesis.(Answer in about 30 words)

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Q.6: What are the different attitudes of people towards risk? (Answer in about 40 words)

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11.7 CHOICE BETWEEN INSURNACE AND GAMBLING: FRIEDMAN-SAVAGE HYPOTHESIS

There are instances when it is seen that the risk loving and risk averse behaviour are present within the same individual. They buy insurance policies to secure risky situations and also get engaged in gambling. These are two completely contrasting behaviour which cannot be explained with

Bernoulli's hypothesis. Individual's choice between insurance and gambling depends on the type of insurance, the volume of premium and also on the type of gambling. Milton Friedman and L.J Savage, in their hypothesis provided answer to the question as to why the same person engage in gamble and buy insurance policies at the same time or why risk averse or risk loving behaviour are found in the same individual. The Friedman-Savage hypothesis is explained using figure 11.6.

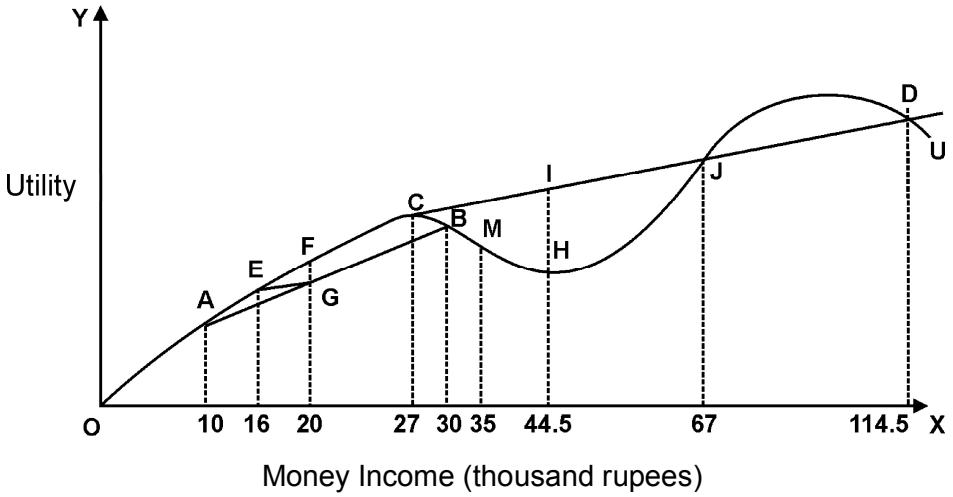


Fig. 11.6: Friedman-Savage Hypothesis

In the figure 11.6, the utility curve of the consumer has both convex and concave parts. The curve is concave up to point M, thereafter it becomes convex till point J and again turns concave when income increases beyond point J. This indicates that at lower level of money income, the consumer behaves like a risk averter, thereafter when his income reaches a particular level, he behaves as a risk lover and further increase in the level of money income again changes his attitude towards risk and he becomes a risk averter again.Thus, we have seen that with the changes in the income level, the attitude of the individual towards risk also changes. This implies that a same individual buys insurance policy and get engaged in gambling at different levels of money income earned by him. To show Friedman Savage's explanation of such behaviour of individuals, assume that a person has an income level of Rs 30,000 which he fears may get decreased to Rs 10,000 with 50% probability. The expected value of income is:

$$E(X) = 30000 \times \frac{1}{2} + 10000 \times \frac{1}{2}$$
$$= 15000+5000$$
$$= 20000.$$

In Figure 11.6, we observe that utility from income Rs. 20,000 is KF. The expected utility from the expected income of Rs. 20,000 is KG which is less than the utility KF of the certain income Rs 20,000. In order to avoid the risk, the consumer will pay EG or Rs. 4000 as insurance premium to attain a certain income of Rs. 16,000, utility from which is same as the expected utility from the expected income of Rs. 20,000.

Now suppose the same person with the income of Rs 30,000 is offered a gamble where he can increase his income up to Rs 1,14,500 if he wins with probability of 0.2 or may lose Rs 3,000 reducing his income to Rs 27,000 with probability 0.8. The expected monetary value of the gamble is E(X)=114500x0.2+27000x0.8=22900+21600=44500. As seen from the figure 11.6, the expected utility from the income level of Rs 44500 is IL which is more than the utility HL from the certain income Rs 44500. Therefore, the person will accept this gamble. At income levels higher than Rs 67000, the consumer's behaviour towards risk again changes and he becomes a risk averse again, which is shown by the concave portion of the consumer's utility curve beyond that income level.

11.8 MEASURES FOR RISK REDUCTION

As already mentioned, the majority of persons are normally risk averse and they try to avoid or reduce the risks involved in various situations. There are certain measures which can be adopted for risk reduction:

- **Diversification:** Diversification of one's resources to various alternative projects or activities can reduce the risk. For example, insurance companies reduce risk involved in their business by offering various types of insurances like life insurance, health insurance, car insurance etc. Similarly, a salesman can reduce his risk or secure his monthly commission by dividing his total time into selling of different commodities instead of concentrating in the sale of only one product. A share market investor can reduce the risk through diversification of his total fund into a variety of different stocks.

- **Insurance:** Risk averse persons prefer to buy insurance policies to avoid different risks such as death, theft, illness, property damage by fire, etc. When a person buys an insurance policy, he can remain assured of having the same income level whether there is a loss or not.
- **Complete information:** Incomplete information is the reason behind risky and uncertain situations that people face. If more information is available, the degree of risk involved is reduced. Complete information is therefore a valuable commodity and it can be acquired after payment of a price for it. The value of complete information is the difference between the expected value of a choice when there is complete information and the expected value when information is incomplete. Advertisement is a way to reduce the information gap. Suppose a firm spends on advertisement to disseminate complete information about its product among the customers. If the expected profit without complete information is Rs. 1,00,000 and with complete information is Rs. 1,70,000, then Rs. 70,000 is the value of complete information.

11.9 PROBLEMS OF INSURANCE

The insurance industry faces two major problems: moral hazard and adverse selection.

- **Moral Hazard** is a problem when the individual behaves in a careless manner after purchasing insurance policies which increases the probability of occurrence of the unfortunate event. For instance, after buying car insurance, the owner may drive his car recklessly or may not take care of the car as required or may behave carelessly while locking the vehicle. All these may increase the chances of an accident or theft. Similarly, a person insured by health policies may not take sufficient health care, which may increase the probability of illness. When insurance policies are purchased, the cost of damage to the object which is insured gets shifted from the customer to the insurance companies; therefore after buying insurance, individuals are less likely to take proper care of the insured object and this lack of incentive is

known as moral hazard problem. It creates divergence between private marginal cost and social marginal cost of any action taken up by individuals which leads to pareto efficiency or sub-optimal use of scarce economic resources.

- **Adverse Selection** occurs when there is lack of symmetric information between buyers and sellers, which may result in distortions in the working of market. In the case of insurance market, buyers normally have more accurate information than the sellers of insurance policies. For example, when health insurances are sold, buyers normally know more about their state of health than the sellers can know from their medical check-up. While fixing the premium, if the policy sellers consider some average health index, this can bring huge loss to the insurance company. This is because, healthy persons will find this premium to be too high for them compared to the risk of health issues which induces them not to buy the insurance policy. On the other hand, relatively unhealthy individuals will be very likely to buy health insurance because they find the premium charged to be low compared to the high risk of health hazard. As a consequence, individuals with high health risk will buy more health insurance policy than the people with good health which will increase the frequency of claims raising the cost to the company. This is the problem of adverse selection. In order to get rid of this problem, the sellers of insurance policies divide their customers into different sub- groups and charge different premiums from the sub-groups. In case of health insurance, different premium can be charged from different age groups; groups can also be divided based on the history of the individual's past health condition or family's heath background, occupation and nature of work of the individuals, etc.

11.10 RISK POOLING AND SPREADING

The main mechanism which is applied by most of the private insurance companies is risk pooling. In order to avoid the risk or to reduce it, they use the law of large numbers. When we toss one single coin, we cannot predict precisely about the outcome. But if 10000 coins are tossed, we can say with considerable confidence that approximately half of the

times a head will occur which implies that share of heads and tails are close to equal with probability of ½. Thus, when a large number of customers are insured, the insurance companies pool many independent risks and convert the risky, unknown, uncertain situation to an almost known situation. Through this practice, they minimise the cost impact of insured persons who are at highest risk by insuring both low and high-risk customers together and thereby the overall cost is reduced. For instance, when life insurance is sold to a large group of individuals, the insurance company almost know with a certainty that all insured persons will not claim the insurance at the same time unless there is a catastrophic situation like war, earthquake, epidemics etc. They can estimate the risk and the predictability of the situation as the number of insured person increases. This is the law of large number. In this way the insurance companies are capable of calculating the premium to be collected from its customers which can ensure their required profit margin.

The mechanism of risk pooling does not work when risks are not independent. For example, in case of major catastrophic events like earthquakes, wars, floods, famines, epidemics etc. the same incident affect a large group of person causing huge insurance claims. This is the reason why many insurance companies do not insurance property or life damage caused by such calamities. But it does not mean that such risks cannot be insured. Risk spreading can be done by providing insurance covers to such catastrophic incidents because each and every person are sure not going to be affected by the incident, there are going to be some which remain unaffected. So, from the point of view of social welfare, spreading risks by covering such incidents will enhance total welfare of the society; because taking away small amount of money from many individuals as insurance premium will indicate lower social costs than huge loss to few without insurance covers. Sometimes, the government can also spread risk by providing insurance covers to sectors where private parties are unwilling to participate and thereby enhancing overall social wellbeing.



CHECK YOUR PROGRESS

Q.7: Mention various measures for reduction of risk (Answer in about 20 words).

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Q.8: What is meant by risk pooling? (Answer in about 20 words).

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Q.9: What is the problem of moral hazards that arises in the insurance market?(Answer in about 30 words).

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Q.10: What is the value of complete information? Why is complete information important? (Answer in about 40 words)

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11.11 LET US SUM UP

- Uncertainty is a fact of life and therefore risk is inevitable in case of any economic transactions. In real life most of the economic decisions are to be taken in the presence of risk and uncertainty.
- Risk signifies a situation when the probability of each possible outcome of an event can be specified.On the other hand, uncertainty signifies a situation when probability of the possible outcomes of an event is unknown or there is no past information on the basis of which the chance of occurring of an outcome can be estimated.
- Probability of an uncertain or risky experiment is the possibility that a particular outcome will occur in the given experiment. It can be calculated by dividing favourable number of events (i.e. the total number

of times the event occurred) by the total number of events of the experiment. All the possible outcomes of an event and their probability of occurrence are known as probability distribution. The probability distribution of an uncertain event allows measuring two important values which are necessary for making choices under risky and uncertain situations: (i) expected value and (ii) variability. The expected value of a probability distribution is the weighted average of all the possible outcomes, probabilities of each outcome being the weights. The variability of outcomes of an event is the extent to which the possible outcomes deviate from the actual values. Standard deviation is mostly used to measure variability.

- Different people have different attitude towards risky and uncertain situation which affect their choices. In real life, most of the people try to avoid risk and are called risk averters. They have incentives to buy insurances and pay premium to avoid risky situations. There are some other individuals who have preference towards risk and are called risk lovers. Some individuals are indifferent in their choice towards risky situations and they are called risk neutral individuals.
- A person's attitude towards risk is normally based on their preferences for fair gamble. A fair gamble is a type of gamble where the monetary return of the gamble is equal to the cost of playing the gamble. A person who does not accept a fair gamble is called a risk averse.An individual is said to be risk neutral if he is indifferent between accepting or rejecting a fair gamble.If a person willingly undertakes a fair gamble, then he is called a risk lover.
- According to expected utility hypothesis, any individual with rational behaviour will undertake their decision in risky and uncertain situations not on the basis of expected monetary value but depending on his expected utility from the additional money earned.
- Out of the three attitudes towards risk, risk aversion is the most common. Risk averse behaviour leads to willingness of individuals to pay for risk avoidance. In real life, most people buy different varieties of insurances like life insurance, health insurance, car insurance etc paying insurance premiums indicating the fact that most people are risk averse. The risk

premium or insurance premium is the highest amount which a risk averter is willing to pay in order to avoid a risky situation.

- There are instances when it is seen that the risk loving and risk averse behaviour are present within the same individual. They buy insurance policies to secure risky situations and also get engaged in gambling. Individuals' choice between insurance and gambling depends on the type of insurance, the volume of premium and also on the type of gambling. Milton Friedman and L.J Savage, in their hypothesis provided answer to the question as to why the same person accept gamble and buy insurance policies at the same time or why risk averse or risk loving behaviour are found in the same individual.
- Diversification of portfolios, buying insurance policies, acquiring complete information are different measures people use for risk reduction.
- Insurance markets face two major problems: moral hazard and adverse selection. Moral Hazard is a problem when the individual behaves in a careless manner after purchasing insurance policies which increases the probability of occurrence of the event. Adverse Selection occurs when there is lack of symmetric information between buyers and sellers which may result in distortions in the working of market.
- Risk pooling is a method used by insurance companies where a large number of customers with different probability of risk are insured together to get capable of estimating the risk and predictability of the situation and also calculating the premium to be collected from its customers which can ensure their required profit margin. Risk spreading is done, especially by government to cover those incidents which are not normally covered by private insurance markets to increase the overall welfare of the society.



11.12 FURTHER READING

1) Ahuja, H.L(1970*). Advanced Economic Theory:Microeconomic Analysis.*18th Revised Edition. New Delhi: S Chand & Company Ltd.

2) Pindyck, S.R & Rubinfield D.L.(2001)*Microeconomics.*Fifth Edition. Pearson Education.

11.13 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Probability is the possibility that a particular outcome will occur in a given experiment. It can be calculated by dividing favourable number of events (i.e. the total number of times the event occurred) by the total number of events of the experiment.

Ans to Q. No. 2: Probabilities have two different concepts: *subjective probability* and *objective probability*. The interpretation of objective probability is dependent on long run experiences of the frequency of occurrence of an event. When past information are not available, the concept of subjective probability is used which is dependent on people's judgement or perception regarding happening or non-happening of an event.

Ans to Q. No. 3: Risk signifies a situation when the probability of each possible outcome of an event can be specified. On the other hand, uncertainty signifies a situation when probability of the possible outcomes of an event is unknown or there is no past information on the basis of which the chance of occurring of an outcome can be estimated.

Ans to Q. No. 4: A fair gamble is a type of gamble where the monetary return of the gamble is equal to the cost of playing the gamble.

Ans to Q. No. 5: According to expected utility hypothesis, any individual with rational behaviour will undertake their decision in risky and uncertain situations depending on his expected utility from the additional money earned.

Ans to Q. No. 6: Based on the attitude towards risk, we can find three different type of individuals: risk averter, risk lover and risk neutral individuals.

Ans to Q. No. 7: Diversification of portfolios, buying insurance policies, acquiring complete information are different measures people use for risk reduction.

Ans to Q. No. 8: Risk pooling is a method used by insurance companies where a large number of customers with different probability of risk are insured together to get capable of estimating the risk and predictability of the situation and also calculating the premiums to be collected from its customers which can ensure their required profit margin.

Ans to Q. No. 9: Moral Hazard is a problem when the individual behaves in a careless manner after purchasing insurance policies which increases the probability of occurring the event.

Ans to Q. No. 10: The value of complete information is the difference between the expected value of a choice when there is complete information and the expected value when information is incomplete. Incomplete information is the reason behind risky and uncertain situations that people face. If more information is available, the degree of risk involved is reduced. Complete information is therefore a valuable commodity and it can be acquired after payment of a price for it. The value of complete information is the difference between the expected value of a choice when there is complete information and the expected value when information is incomplete.



11.14 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words).

Q.1: Briefly discuss why people pay insurance premiums.

Q.2: What are the different measures of risk?

Q.3: Write short notes on risk pooling and risk spreading.

B) Long questions (Answer each question in about 300-500 words)

Q.1: Discuss Bernoulli's expected utility hypothesis to show different attitude of people towards risk? What is the limitation of this theory?

Q.2: Do you think it is possible for the same individual to behave as risk averter and risk lover? Justify your answer.

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UNIT 12: WELFARE ECONOMICS

UNIT STRUCTURE

12.1 Learning Objectives

12.2 Introduction

12.3 Welfare Economics

- 12.3.1 Meaning and Definition

12.4 Three Concepts of Social Welfare

- 12.4.1 Pareto Improvement
- 12.4.2 Distributional Improvement
- 12.4.3 Paternalist Concept

12.5 Role of Value Judgments in Welfare Economics

- 12.5.1 Meaning and Definition
- 12.5.2 Role of Value Judgment

12.6 Pareto Optimality

- 12.6.1 Pareto Optimality and Economic Efficiency
- 12.6.2 Pareto Criterion of Social Welfare
- 12.6.3 Diagrammatical Explanation

12.7 Marginal Conditions of Pareto Optimum

- 12.7.1 Efficiency of Distribution of Commodities Among Consumers
- 12.7.2 Efficiency of Allocation of Factors Among Firms-Producers
- 12.7.3 Efficiency in the Composition of output (product-mix)

12.8 A Critical Evaluation

12.9 Let Us Sum Up

12.10 Further Reading

12.11 Answers to Check Your Progress

12.12 Model Questions

12.1 LEARNING OBJECTIVES

After going through this unit, you will be able to—

- put forward the meaning of the terms 'Social Welfare', 'Value Judgments' and 'Pareto Optimum'
- discuss the concepts of social welfare
- explain diagrammatically about the marginal conditions of Pareto optimal.

12.2 INTRODUCTION

Welfare means the state of well being of the people. The ultimate purpose of the economic activities is to promote the welfare of the society in a sustainable manner, and not the growth for growth's sake. In this unit, we discuss the origin and development of welfare economics including Pareto optimum.

12.3 WELFARE ECONOMICS

The purpose of welfare economics is to explain how a socially efficient allocation of resources can be identified and achieved. Welfare economics is gaining more importance in recent years. But the origin started with the talks of utilitarians. They referred welfare in terms of the formula, 'the greatest happiness of the greatest number'. However, Prof. Robbins' ethical neutrality view about economics had led to the development of welfare economics as an important field of economic studies. Now the literature on welfare economics has two broad distinctions depending on comparability of utility — 'old' and 'new' welfare economics. The old welfare economists assumed measurable and interpersonal comparison of utility. On the other hand, the new welfare economics is based on Pareto's principle of excluding interpersonal comparison of utility.

12.3.1 Meaning and Definition

Welfare economics is that branch of economics which is mainly concerned with the promotion of the welfare of a society. The subject

matter of welfare economics is the economic well-being of persons as consumers and as producers, and the possible ways of improving that well-being or welfare. The major task of welfare economics is to define an *ideal* situation and then to suggest ways and means of achieving that *ideal.*

Scitovsky defined welfare economics as 'that part of the general body of economic theory which is concerned primarily with policy'. In the words of Prof. M. Reder, "Welfare economics is the branch of economic science that attempts to establish and apply criteria of propriety of economic policies". According to Prof. Baumol, "Welfare economics has concerned itself mostly with policy issues which arise out of the allocation of resources, with the distribution of inputs among the various commodities and the distribution of commodities among various consumers".



CHECK YOUR PROGRESS

Q.1: State whether True(T) or False (F):

(i) Socially efficient allocation of resources is an aim of welfare economics. (T/ F)

(ii) The new welfare economics is based on interpersonal comparison of utility. (T/ F)

(iii) Economic welfare includes satisfaction from both economic and non-economic goods and services. (T/ F)

Q.2: State the basic difference between old and new welfare economic. (Answer in 50 words)

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Q.3: What is the main concern of welfare economics? (Answer in 50 words)

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12.4 THREE CONCEPTS OF SOCIAL WELFARE

General welfare refers to all economic and non-economic goods and services that provide utilities or satisfaction to individuals living in a community. Since, general welfare is a complicated notion, so economists have discussed mainly about economic welfare. It implies the satisfaction or utility derived by an individual from the use of economic goods and services or those that can be exchanged for money. Again, social welfare is derived from the aggregation of the satisfaction or utilities of all individuals in a society. The central problem of welfare economics is related with increase or decrease of social welfare as a result of a particular change in resource allocation. There are three concepts of social welfare — *Pareto improvement*, *distributional improvement* and the *paternalist concept.* Generally, the first two concepts are mainly used for measuring welfare.

12.4.1 Pareto Improvement

The first concept of social welfare was used by Pareto and his followers. This concept accepts that welfare of the society is simply the sum total of the welfare of different individuals comprising it. *Pareto Improvement* states that social welfare increases when society as a whole is better off without making any individual worse off. Conversely, if no one is better off and at least one worse off due to a change, then there is a decrease in social welfare. However, if some are made better off and some worse off, then, Paretian concept is unable to answer whether there is increase or decrease in social welfare. This

concept accepted the ethical view that 'it is good to make somebody better off while making nobody worse off'. It is, thus, free from making interpersonal comparisons of utility. The Paretian concept is used by economists like Hicks, Kaldor (in their *compensation principle*) and Scitovsky.

12.4.2 Distributional Improvement

The second concept is propounded by Bergson and Samuelson in their well-known theory of social welfare function. According to this concept, social welfare is increased when the distribution of welfare is better in some sense. It makes some persons in society better off than others so that the distribution of welfare is more equitable. This is known as *distributional improvement.* This concept involves interpersonal comparison of utility which is to be made by introducing an explicit set of value judgements in the form of a social welfare function. A social welfare function is analogous to the individual consumer's utility function. It provides a ranking of alternative states in which different individuals enjoy different utility levels. This concept of social welfare is able to judge the welfare implications of even those changes in economic organizations and policies that make some people better off and others worse off.

12.4.3 Paternalist Concept

Prof. Graff had referred the third concept of social welfare which he called the *paternalist concept.* This concept describes the views of paternalist authority and not of the individuals in the society. A state or a paternalist authority maximizes social welfare according to its own notion of welfare without any regard to the views of individuals. The preferences of the individual members of the society may be ignored and the state or a paternalist authority or a dictator uses its own ideas about social welfare. Social welfare increases when that paternal authority or the dictator thinks it so. However, the economists do not

make use of this concept to measure social welfare because it is related to a dictatorial regime and does not fit in a democratic set-up.



CHECK YOUR PROGRESS

Q.4: State whether True(T) or False (F)

(i) General welfare includes satisfactions derived only from non-economic goods and services. (T/ F)

(ii)More equitable distribution of welfare increases social welfare. (T/ F)

(iii)Paternalist concept recognizes the views of individuals. (T/ F)

Q.5: What is the main concern of the central problem of welfare economics? (Answer within 40 words)

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Q.6: How does the distributional improvement concept judge the welfare in changes which makes some people better off and others worse off? (Answer within 40 words)

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12.5 ROLE OF VALUE JUDGMENTS IN WELFARE ECONOMICS

Let us now discuss the role of value judgement in welfare economics. Value judgment is important as welfare economics is concerned with desirability of economic policies. It plays a crucial role.

12.5.1 Meaning and Definition

Value judgments mean the conceptions or ethical beliefs of the people about what is good or bad. The values are very little based on scientific logic or scientific laws. They are the result of ethical, religious, philosophical and political beliefs of the people. Value judgments describe facts in an emotive way and tend to influence people by altering their beliefs or attitudes. Thus, all ethical judgments and statements which perform recommendatory, influential and persuasive functions are value judgments.

According to R. B. Brandt, "A judgment is a value judgment if it entails or contradicts some judgment which could be formulated so as to involve any one of the following terms in an ordinary sense: 'is a good thing that' or 'is a better thing that'; 'is normally obligatory'; 'is reprehensible'; and 'is normally praiseworthy'.

12.5.2 Role of Value Judgment

Welfare is an ethical term. Hence, all welfare propositions are also ethical and involve value judgments. The terms used in welfare economics like 'satisfaction', 'utility', 'social', 'community' etc. are ethical in nature. Since, welfare economics is concerned with policy measures, it involves ethical terminology, such as increase of 'social welfare' or 'social advantage' or 'social benefit'. Thus, welfare economics and ethics cannot be separated. In spite of that, there is a great controversy regarding whether value judgments should have any role to play in welfare economics.

The neo-classical economists were concerned with the measurability of utility and the inevitable interpersonal comparisons of utility. Robbins attacked this view and discarded interpersonal comparisons. Robbins and his followers were of the opinion that economists should refrain from making value judgments. According to them, the inclusion of value judgments would make our study unscientific. On the other hand, majority of modern economists are

of the view that economists should not fight shy of making value judgments if there is a wide consensus about them among the community. Using his knowledge of economics together with these value judgments he should comment upon desirability or otherwise of certain policies and issues.

The individual welfare is possible to measure in ordinal terms and by observing the act of choice of the individual. Choice by an individual is an objective test for knowing and comparing his welfare in different economic states. Therefore, what promotes individual welfare or not can be tested and verified. But the same is not possible in case of social welfare. The society cannot be regarded as an organic whole, having its own mind. Therefore, social welfare, unlike individual welfare, is not something which resides in the mind of the society. Deriving propositions of social welfare from choice of individuals comprising the society is not possible because various individuals choose differently and, therefore, there is no unanimous social choice. Since, the vital issues in welfare economics are concerned with social welfare and devising certain criteria to judge the social welfare, therefore, welfare economics cannot be purely objective or free from value judgments.

Pareto developed the concept of social welfare which is claimed to be free from any value judgments, because it is not based upon any interpersonal comparison of utility. But contrary to the claim, this is also not value-free. The Paretian optimum states that if any reallocation of resources makes at least one person better off without making others worse off, then the welfare of the society is said to have increased. These are all value judgments which Pareto could not avoid despite the fact that he used the method of ordinal measurement of utility.

Again, Kaldor and Hicks by propounding a 'compensation principle' laid the foundations of *New Welfare Economics* which is supposed to be free from value judgments. According to this compensation principle, if a change in economic organization increases the welfare of some and reduces the welfare of others,

and those who gain in welfare are able to compensate the losers and still be better off than before, then that change will increase social welfare. But this test which is based on economic efficiency also involves in value judgments because the gainers from a change are able to compensate the losers. The very idea of compensation involves value prescriptions.

Modern economist Prof. Bergson has propounded the concept of social welfare function in which a set of value judgments is explicitly introduced. His followers such as Samuelson, Little, Boulding etc. are in the opinion that welfare economics cannot be purged of value judgments. In fact, the study of welfare economics has been developed to make policy recommendations to promote social welfare. And for doing so economists cannot escape from introducing ethical norms or value judgments since we all take interest in the question concerning happiness and welfare of the society.

Thus, from the above discussion it is obvious that welfare economics and value judgments are inseparable.



CHECK YOUR PROGRESS

Q.7: State whether True(T) or False (F)

(i) Value judgment is ethical consideration. (T/ F)

(ii) Modern economists accept role of value judgment in welfare economics. (T/ F)

(iii) Social welfare can be tested and verified. (T/ F)

Q.8: Why welfare economics and value judgment are inseparable? (Answer in 40 words)

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Q.9: What is the basis of controversy regarding the question whether value judgments should have any role to play in welfare economics? (Answer in 40 words)

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12.6 PARETO OPTIMALITY

Now let us discuss the situation of maximum social welfare. Pareto optimality and its conditions are important in determining the maximum situation.

12.6.1 Pareto Optimality and Economic Efficiency

According to Pareto optimality criterion any change that makes at least one individual better off and no one worse off is an improvement in social welfare. Conversely, a change that makes no one better-off and at least one worse-off is a decrease in social welfare. A situation in which it is impossible to make any one better off without making someone worse off is said to be Pareto-optimal. The Pareto optimum is often called Economic Efficiency because in that situation resources are allocated in the most economically efficient manner. Thus, when a certain economic state is reached, when through any reorganization it is not possible to make at least one individual better off with no one being worse off then, this is called the state of maximum social welfare or Pareto optimum.

12.6.2 Pareto Criterion of Social Welfare

Pareto criterion states that if any reorganization of economic resources does not harm anybody and makes someone better off, it indicates an increase in social welfare. If any reorganization or change makes everybody in a society better off, it will undoubtedly mean increase in social welfare.

12.6.3 Diagrammatical Explanation

Pareto criterion can be explained with the help of Edgeworth Box diagram as shown in figure 12.1, which is based on the assumptions of ordinal utility and non-interpersonal comparison of utilities. Suppose two persons A and B form the society and consume two goods X and Y. Their various levels of satisfaction are represented by the indifference curves I_{a1}, I_{a2}, I_{a3}, I_{a4} and I_{b1}, I_{b2}, I_{b3}, $I_{b4.}$ In the figure, O_A and O_B are the origins for the utilities of A and B respectively. Suppose the initial distribution of goods between A and B is at point K. The level of satisfaction of individual A is represented by I_{a3} where he consumes O_A G of X and GK of Y. Similarly, individual B's level of satisfaction is represented by I_{B1} and consumes KF of X + KE of Y. Now it can be shown that any movement from point K to a point S or R or any other point in the shaded region will increase social welfare.

Any movement from K to S through redistribution of two goods between the two individuals increases the level of satisfaction of A as he moves to higher indifference curve I_{a4} without any change in the satisfaction of B. Thus, according to Pareto criterion, social welfare has increased following the movement from K to S, and therefore K is not the position of economic optimum. Similarly, the movement from K to R is also desirable from the point of view of social welfare because in this movement individual B becomes better off without any change in the level of satisfaction of individual A. The tangency points of the various indifference curves of the two individuals of the society are the Pareto optimum points and the locus of these points is called *contract curve* or *conflict curve.*

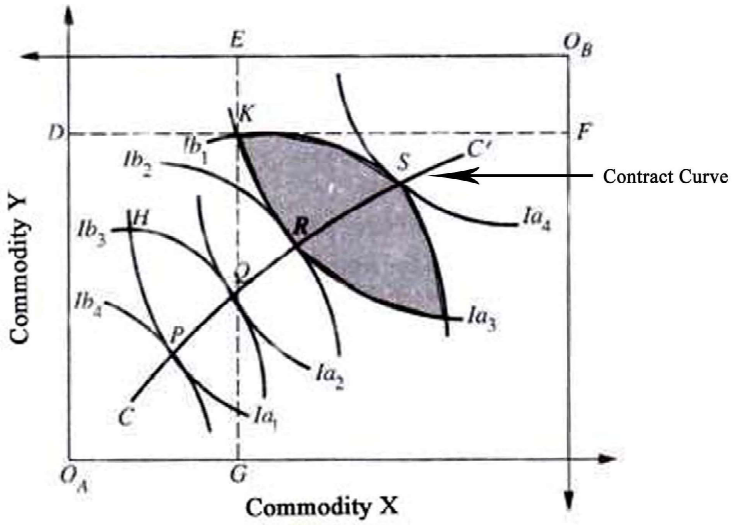


Fig. 12.1 : Pareto Criterion



CHECK YOUR PROGRESS

Q.10: State whether True(T) or False (F)

(i) Pareto optimality is also known as Economic Efficiency. (T/ F)

(ii) After achieving Pareto optimality it is possible to increase welfare of somebody without reducing the welfare of anybody. (T/ F)

Q.11: What is meant by Pareto criterion? (Answer in 40 words)

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Q.12: What does a contract curve represent? (Answer in 40 words)

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12.7 MARGINAL CONDITIONS OF PARETO OPTIMUM

For the attainment of Pareto efficient situation in an economy three marginal conditions must be satisfied: (a) Efficiency of distribution of commodities among consumers (efficiency in exchange); (b) Efficiency of the allocation of factors among firms (efficiency of production); (c) Efficiency in the allocation of factors among commodities (efficiency in the product mix or composition of output).

12.7.1 Efficiency of distribution of commodities among consumers

A distribution of the given commodities X and Y between the two consumers A and B is efficient if it is impossible by a redistribution of these goods to increase the utility of one individual without reducing the utility of the other. This is shown in figure 12.2. Only points on the contract curve satisfy Pareto optimality condition. Any other distribution off the contract curve is inefficient. For example, point z is inefficient as a redistribution of the commodities either to reach point a or b would increase utility of one individual. A movement from z to a increases the utility of B without reducing the utility of A. Similarly, movement to b increases the utility of A without reducing that of B. Thus, the contract curve shows the locus of Pareto efficient distribution of goods between consumers where the slopes of indifference curves are equal. At each point of the contract curve the following condition is satisfied—

$$MRS^{A}_{xy} = MRS^{B}_{x,y}$$

Thus, the marginal condition for a Pareto optimal or efficient distribution of commodities among consumers requires that the MRS between two goods be equal for all consumers.

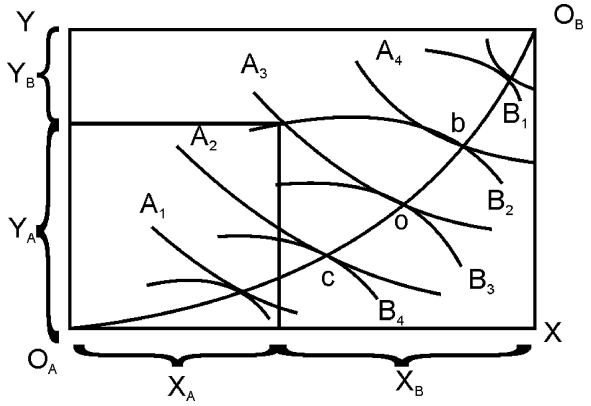


Fig. 12.2 : Efficiency of distribution of commodities among consumer

12.7.2 Efficiency of allocation of factors among firms-producers

The second condition for Pareto optimum requires that the available factors of production should be utilized in the production of different goods in such a manner that it is impossible to increase the output of one good without a decrease in the output of another or to increase the output of both the goods by any reallocation of factors of production. This situation would be achieved if the marginal rate of technical substitution between any pair of factors must be the same for any two firms producing two different products and using both the factors to produce the products. This is explained with the help of the figure 12.3 where two firms A and B producing goods X and Y by using two factors labour (L) and capital (K). Only the points on the contract curve of production are Pareto efficient. Other points, such as H is inefficient, since a reallocation of the given K and L between the producers of X and Y would be able to reach any point from c to d with the results in the increase of at least one commodity without a reduction in the other.

The contract curve is the locus of points of tangency of the isoquants of the two firms which produce X and Y, that is, points where the slopes of the isoquants are equal. Thus, at each point—

$$MRTS^{x}_{L,K} = MRTS^{y}_{L,K}$$

Therefore, the marginal condition for a Pareto optimal allocation of factors requires that the $MRTS_{L, K}$ be equal for all commodities produced by different firms.

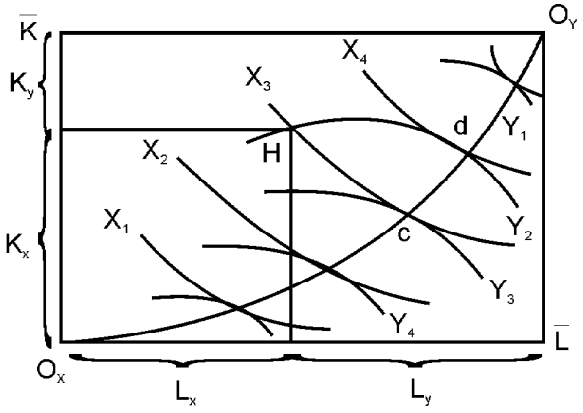


Fig. 12.3 : Efficiency of allocation of factors among firms-producers

12.7.3 Efficiency in the composition of output (product-mix)

The third condition relates to the technical conditions of production and the state of consumer's preferences. It states that a possible way of increasing social welfare is a change in the product-mix. To define the third condition the production possibility curve is used. The slope of the PPC is called the 'marginal rate of (product) transformation' ($MRPT_{x,y}$), and it shows the amount of Y that must be sacrificed in order to obtain an additional unit of X. The marginal condition for a Pareto efficient composition of output requires that the MRPT between any two commodities be equal to the MRS between the same two goods:

$$MRPT_{x,y} = MRS^{A}_{xy} = MRS^{B}_{x,y}$$

Since the MRPT shows the rate at which a good can be transformed into another (on the production side), and the MRS shows the rate at which consumers are willing to exchange a good for another, the rates must be equal for Pareto optimal situation to be attained. Suppose that these rates are unequal. For example—

$MRPT_{x,y} = 2Y/1X$ and $MRS_{xy} = 1Y/1X$

that is, $MRPT_{x,y} > MRS_{xy}$

The above inequality shows that the economy can produce two units of Y by sacrificing one unit of X, while the consumers are willing to exchange one unit of Y for one unit of X. clearly the economy produces too much of X and too little of Y relatively to the tastes of consumers. Welfare, therefore, can be increased by increasing the production of Y and decreasing the production of X.



CHECK YOUR PROGRESS

Q.13: State whether True (T) or False (F)

(i) Efficient distribution of commodities requires the MRSxy to be equal. (T/ F)

(ii) The second condition states that reallocation of factors of production increases the output of both the goods. (T/ F)

Q.14: What is meant by efficiency in exchange? (Answer in 40 words)

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Q.15: What happens if $MRPT_{xy}$ and MRS_{xy} are not equal? (Answer in 40 words)

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12.8 A CRITICAL EVALUATION

The Pareto welfare criterion possesses certain substantial merits like—

- The Paretian criterion of judging welfare changes is a better and more scientific criterion because it does not depend upon interpersonal comparison of utility.

- This analysis is significant because it was the first-ever attempt made to evolve and formulate a value free criterion of welfare.
- The main merit of this analysis lies in the explicit distinction that it has made between ambiguous and unambiguous changes in social welfare. The former refers to those changes which increase the welfare of some while reducing the welfare of others. The latter refers to those changes which benefit some without harming others.

However, the Paretian welfare analysis is not free from drawbacks—

- The Pareto criterion cannot evaluate a change that makes some individuals better off and others worse off. Since most government policies involve changes that benefit some and harm others, the Pareto criterion is of limited applicability in real world situation.
- A Pareto optimal situation does not guarantee the maximization of the social welfare. There can be an infinite number of Paretian optima, each with a different level of welfare.



12.9 LET US SUM UP

- Welfare economics has gained importance in recent times. It is defined as that branch of economics which is mainly concerned with the promotion of the welfare of a society.
- The purpose of welfare economics is to explain how a socially efficient allocation of resources can be identified and achieved.
- Social welfare is the aggregation of the satisfaction or utilities of all individuals in a society.
- There are three concepts of social welfare for measuring welfare — *Pareto improvement, distributional improvement* and *paternalist concept.*
- Value judgments mean the conceptions or ethical beliefs of the people about what is good or bad and are the result of their ethical, religious, philosophical and political beliefs.
- Pareto optimality refers to a situation in which it is impossible by a redistribution to make any one better off without making someone worse off.

- It is often called Economic Efficiency because in that situation resources are allocated in the most economically efficient manner.
- A Pareto optimal state in the economy can be attained if three marginal conditions are fulfilled—

  1. $MRS_{x,y}$ between any two goods be equal for all consumers.
  2. The $MRTS_{L,K}$ between any two inputs be equal in the production of all commodities.
  3. $MRPT_{x,y} = MRS_{x,y}$ for any two goods.
- Although Pareto criterion has certain drawbacks, it is one of the most important concepts of welfare economics.



12.10 FURTHER READING

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12.11 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: (i) True (ii) False (iii) False

Ans to Q. No. 2: The basic difference between 'old' and 'new' welfare economics lies on comparability of utility. The old welfare economists assumed measurable and interpersonal comparison of utility. On the other hand, the new welfare economics excluded interpersonal comparison of utility.

Ans to Q. No. 3: The Welfare economics is mainly concerned with the promotion of the welfare of a society. The major task of welfare economics is to define an *ideal* situation and then to suggest ways and means of achieving that *ideal.*

Ans to Q. No. 4: (i) False (ii) True (iii) False

Ans to Q. No. 5: The central problem of welfare economics is related with increase or decrease of social welfare due to a particular change in resource allocation.

Ans to Q. No. 6: According to *distributional improvement* concept, social welfare is increased when the distribution of welfare is better in some sense. It makes some persons in society better off than others so that the distribution of welfare is more equitable.

Ans to Q. No. 7: (i) True (ii) True (iii) False

Ans to Q. No. 8: Welfare itself is an ethical term. Welfare economics is mainly concerned with policy measures and it involves ethical terminology, such as increase of 'social welfare' or 'social advantage' or 'social benefit'. So, welfare economics and ethics cannot be separated.

Ans to Q. No. 9: There is controversy regarding inclusion of value judgments in welfare economics. Robbins and his followers maintained that inclusion of value judgment would make our study unscientific. But others are of the opinion that the study of welfare economics has been developed to make policy recommendations to promote social welfare and for doing so economists cannot escape from introducing ethical norms or value judgments.

Ans to Q. No. 10: (i) True (ii) False

Ans to Q. No. 11: Pareto criterion states that if any reorganization of economic resources does not harm anybody and makes someone better off, it indicates an increase in social welfare. Similarly, there is an increase in social welfare if a change makes everybody in a society better off.

Ans to Q. No. 12: A contract curve is the locus of the Pareto optimum points i.e, the tangency points of the various indifference curves of the two individuals of the society.

Ans to Q. No. 13: (i) True (ii) False

Ans to Q. No. 14: Efficiency in exchange implies a state where it is impossible by a redistribution of the goods to increase the utility of one individual without reducing the utility of the other.

Ans to Q. No. 15: The inequality between $MRPT_{x,y}$ and MRS_{xy} shows that the sacrificing rate one unit of X for producing one unit of Y is not equal to the willing exchange rate of consumers to one unit of Y for one unit of X. It means the economy either produces too much or too little of one good in relative to the tastes of consumers. Welfare therefore can be increased by increasing or decreasing the production.



12.12 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q.1: Define welfare and welfare economics.

Q.2: "Economic welfare is always conceived to be a part to total welfare." Comment.

Q.3: What is Pareto's social optimum?

Q.4: Critically evaluate Paretian welfare economics.

B) Essay type Questions (Answer each question in about 300-500 words)

Q.1: What is meant by value judgment? Analyse its role in welfare economics.

Q.2: Discuss the three concepts of social welfare.

Q.3: Explain the conditions for the attainment of Paretian optimum.

Q.4: Discuss with the help of a diagram the Pareto criterion of social welfare.

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UNIT 13: NEW WELFARE ECONOMICS

UNIT STRUCTURE

13.1 Learning Objectives

13.2 Introduction

13.3 Assumptions of Compensation Principle

13.4 Kaldor-Hicks Welfare Criterion: Compensation Principle

13.5 Scitovsky's Paradox

13.6 Scitovsky's Double Criterion of Welfare

13.7 Let Us Sum Up

13.8 Further Reading

13.9 Answers to Check Your Progress

13.10 Model Questions

13.1 LEARNING OBJECTIVES

After going through this unit you will be able to-

- know what welfare economics is about
- know about the New Welfare Economics
- understand various criterions of New Welfare Economics.

13.2 INTRODUCTION

Establishment of welfare state is the fundamental objective of most of the economies of the world, especially in the modern democratic countries.Welfare economics examines the conditions of economic efficiency in the production of output, exchange of commodities and equity in the distribution of income. The central problem of welfare economics is concerned with whether a particular allocation (reallocation) of resources will lead to increase or decrease in the social welfare.If any reallocation of resources cannot make at least one individual better-off without making some other individual worse off, it will lead to decrease in social

welfare.However, if any reallocation of resources can make at least one individual better-off without making some other individual worse off, it will lead to increase in social welfare. This state of maximum social welfare is known as the Pareto Optimality. Pareto's concept of social optimum draws heavily from the concept of ordinal utility. It is free from interpersonal comparison of utilities and value judgements. There are no unique points in Pareto Optimality and is indeterminate. Economists like Kaldor, Hicks and Scitovsky attempted to do away with the indeterminacy of Pareto optimality and gave the criterion of '*Compensation Principle'*. They believed that any reallocation will make at least someone worse off to make someone better off. Hence the losers need to be duly compensated so that welfare of the society as a whole increases.

13.3 ASSUMPTIONS OF COMPENSATION PRINCIPLE

The '*Compensation Principle'* is based on the following assumptions-

- An individual is the best judge of his welfare.
- The satisfaction of an individual is independent of other's satisfaction and his tastes remain constant.
- Utility is ordinally measurable.
- Interpersonal comparisons of utilities are not possible.
- The level of social welfare is a function of the level of production.

Given these assumptions, the compensation principle as given by Klador, Hicks and Scitosvsky are discussed in the subsequent sections.



CHECK YOUR PROGRESS

Q.1: Mention the primary objective of the economies. (Answer in about 20 words)

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Q.2: What does welfare economics examine? (Answer in about 20 words)

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Q.3: Define Pareto Optimality. (Answer in about 20 words)

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13.4 KALDOR-HICKS WELFARE CRITERION: COMPENSATION PRINCIPLE

Nicholas Kaldor stated welfare criterion based on '*compensating payments'*. According to Kaldor's welfare criterion if a certain change in policy or reallocation makes some people better off and others worse off, then it will increase social welfare if those who gain from change compensates those who lose and still be better off than before.Kaldor, in his "Welfare Propositions of Economics and Interpersonal Comparison of Utility" states that,

"*In all cases..... where a certain change policy leads to an increase in physical productivity and thus in aggregate real income.... it is possible to make everybody better off without making anybody worse off. It is quite sufficient.... to show that even is all those who suffer as a result are fully compensated for their loss, the rest of the community will still be better off than before."*

Prof. J.R. Hicks also supported Kaldor for employing the compensation principle in evaluating changes in social welfare resulting from any reallocation making some people better off and some others worse off. J.R.Hicks, in his "The Foundations of Welfare" states that,

"If A is made so much better by the change that he could compensate B for his loss and still have something left over, then the reorganisation is unequivocal improvement".

Thus the two criterions are basically the same and are generally known as Kaldor-Hicks Criterion. The Criterion can also be explained through the figure 13.1 with the help of utility possibility curve.

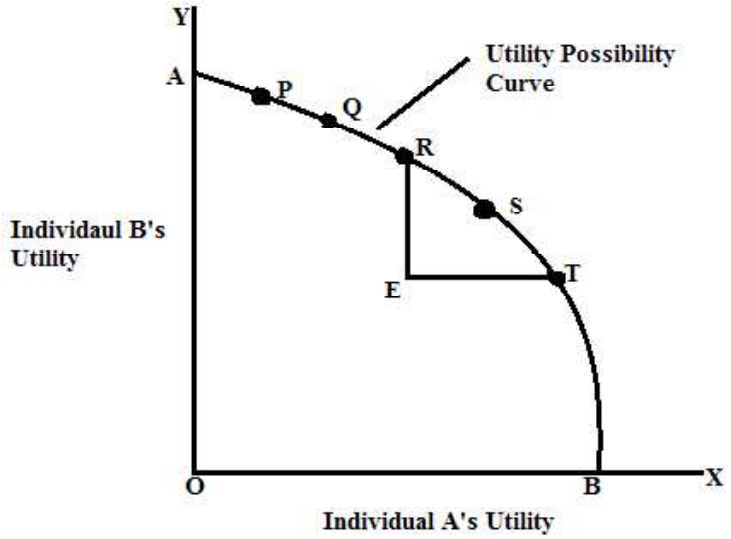


Fig. 13.1 : Kaldor-Hicks Criterion with Utility Possibility Curve

In the figure the ordinal utilities of two individuals A and B are depicted on the X-axis and Y-axis respectively. AB is the utility possibility curve representing the various combinations of utilities derived by the individual. Let us suppose that the utility derived by the individuals is at point E inside the Utility Possibility Curve. Now if due to some reallocation the two individuals move to point Q from point E, then individual B's utility goes up while that of individual A goes down. Thus, as one moves upward along the AB utility curve individual B's utility goes up, and if one moves downward along the utility curve individual A's utility goes up while that of B's goes down. A movement along any direction on the curve involves in comparison of inter-personal utilities and it cannot be said whether there is a change in the welfare (increased or decreased) on the basis of Pareto Criterion. However according to Kaldor- Hicks, if individual B who has gained due to the reallocation is willing to compensate A, and still be better off than before.

In figure 13.1 if due to redistribution of income, individual B compensates individual A and moves from point Q to point R, individual A is still as good as he was in E. But individual B has now become better off than he was at E. As such according to Kaldor-Hicks Criterion social welfare increases with a movement from point E to point Q, because

from position Q both the individuals could move to point R through redistribution of income and the society can be better off.

Let us consider the case where due a change in economic policy, the utility possibility curve moves from AB to A_1B_1 outward and both the individuals move to a point on the higher utility possibility curve A_1B_1. This is shown in the figure 13.2 whether such movement represents improvement in social welfare or not, according to Kaldor- Hicks Criterion.

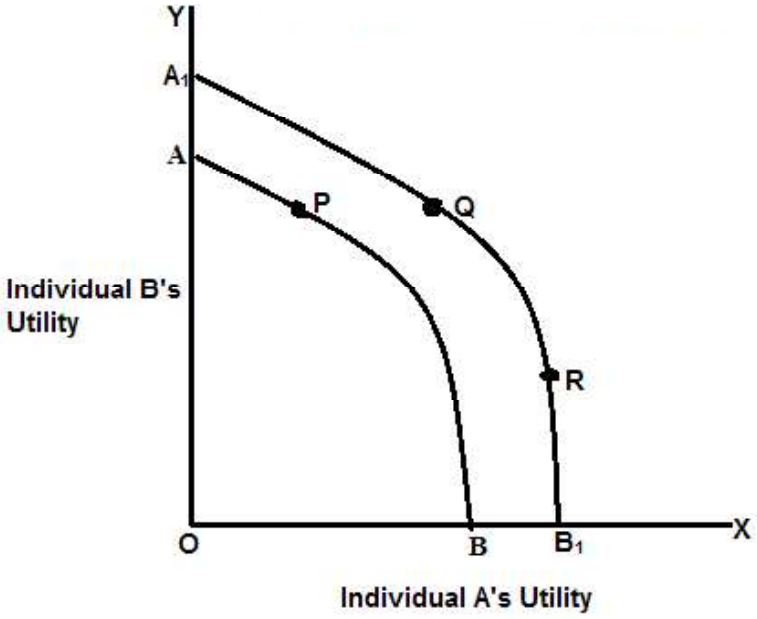


Fig. 13.2 : Kaldor-Hicks Welfare Criterion

In the utility possibility curve AB, position P represents the initial positions of the individuals. Now if the curve shifts to A_1B_1 and the individuals are now at point R where the utility of individual A has increased and that of individual B has decreased. But still position R compared to position P represents a greater social welfare according to Kaldor-Hicks compensation principle. This is because in the new curve utility possibility curve A_1B_1, it is possible to reach position Q from position R where the society consisting of the two individuals will be better off through reallocation if individual A compensates individual B for his loss. At position Q, individual B has been fully compensated, while individual A is still better off as compared to position P. Thus as a higher utility possibility curve increases social welfare.



CHECK YOUR PROGRESS

Q.4: What is the difference in the criterion stated by Kaldor and Hicks? (Answer in about 20 words)

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Q.5: State the Compensation Principle.(Answer in about 30 words)

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13.5 SCITOVSKY'S PARADOX

Scitovsky pointed out that in some situations Kaldor-Hicks Criterion might lead to contradictory results. He pointed out that if in a situation say position X is shown to be an improvement over another situation say position Y by Kaldor-Hick's criterion; then by the same criterion position Y can be shown as an improvement over another situation say position X. This, according to Scitovsky, leads to contradictory and inconsistent results. This is known as 'Scitovsky's Paradox'.

How Kaldor-Hicks's criterion leads to contradictory results is explained with figure 13.3 with the help of two utility possibility frontiers AB and CD. It can be seen from the figure 13.3 that both the utility possibility curves intersect each other.

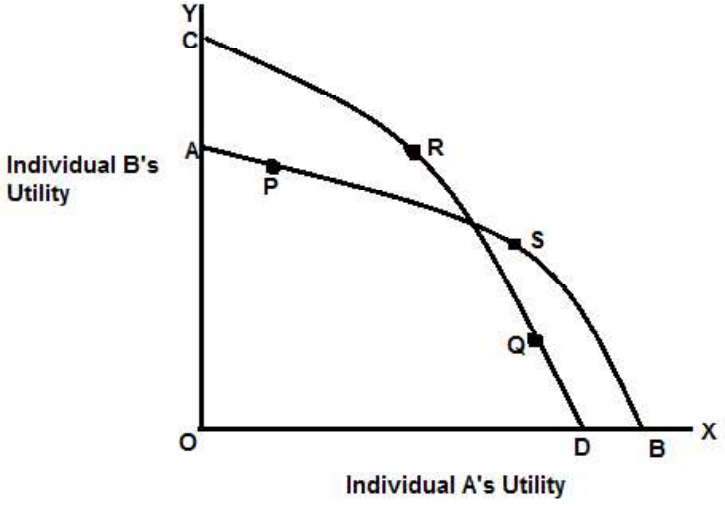


Fig. 13.3 : Scitovsky Paradox

Let AB be the initial utility possibility curve where the individuals A and B were at position P. Now due to some policy change and reallocation of resources, the utility possibility curve shifts and takes a new position CD, and the individuals are at position Q on it. According to Kaldor-Hicks criterion, this is an improvement over the initial position P, because through reallocation it is possible to reach position R. At position R, according to Kaldor-Hicks Criterion, individual A is fully compensated for his loss and individual B is still at a better position as compared to original position P.

But Scitovsky pointed out that the Kaldor-Hicks Criterion is also satisfied by a reverse movement from Q in the new utility possibility curve CD to position P in the initial utility possibility curve AB. By a mere redistribution from position P it is possible to reach position S, thus making P socially desirable. At position S, individual A is better off than at position Q, and individual B is still better off than in position Q.

Thus, it is seen that a movement from position P to position Q and also the reverse movement from position Q to position P satisfies the Kaldor-Hicks Criterion.This means that Kaldor-Hicks criterion leads to contradictory and inconsistent results. These contradictory and inconsistent results are attained when due to policy changes the new utility possibility curve is obtained (i.e. CD in the figure) which intersects with the former utility possibility curve (i.e. AB in the figure).

Scitovsky formulated his own criterion known as 'Scitovsky Double Criterion of Welfare' to address the contradictory and inconsistent results in Kaldor-Hicks Criterion.

13.6 SCITOVSKY'S DOUBLE CRITERION OF WELFARE

To address the inconsistency and contradictory results of Kaldor-Hicks Criterion, Scitovsky formulated a criterion which required the fulfilment of Kaldor-Hicks test and also the fulfilment of the reversal test. This means that a change can be considered as an improvement in welfare, if those who gain from the change in the situation are able to persuade those who

lose to accept the change. On the other hand the losers are not able to persuade the gainers to remain in the original situation before the change. This situation can be explained with the help of Utility Possibility Curve as in figure 14.4.

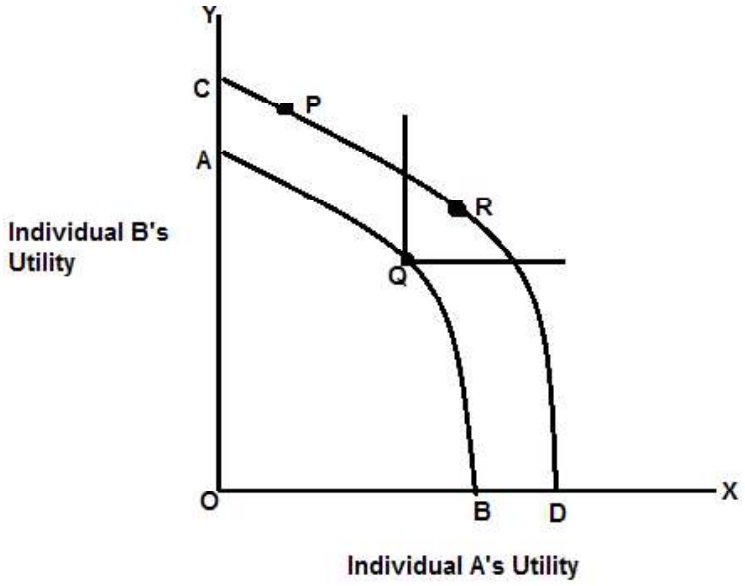


Fig. 13.4 : Scitovsky's Double Criterion

In the figure AB and CD are two utility possibility frontiers that do not intersect each other at any point. Suppose both the individuals were initially at position Q on the utility possibility frontier AB. Let there be a change in the policy and as a result the individuals find themselves at position P on the new utility possibility frontier CD. This movement from position Q to position P is an improvement according to Kaldor-Hicks Criterion. By redistribution of income both the individuals can reach position R on the utility possibility frontier CD and be better off than at position Q on utility possibility frontier AB. Thus, a change from position Q to position P represents social welfare as it satisfies Kaldor-Hicks Criterion.

However according to the reversal test of Scitovsky's Double Criterion a movement from position P in the new utility possibility frontier CD to the initial position Q on the utility possibility frontier AB should not pass by Kaldor-Hicks Criterion. In the figure 14.4 it is seen that by mere redistribution of income one cannot move from position Q on utility

possibility frontier AB to any other position that is socially better than position P in the utility possibility frontier CD. Thus a movement from position Q to position P is possible by Kaldor-Hicks Criterion, but a movement from position to P to position Q is not possible by Kaldor-Hicks Criterion. Thus a movement from position Q to position P satisfies Scitovsky's Double Criterion of Welfare.

Thus it can be concluded that when two utility possibility curves do not intersect each other, change results in a movement from a position in a lower utility possibility curve to a position on a higher utility possibility curve; the resultant increase in the social welfare implies fulfilment of Kaldor-Hicks and Scitovsky Criterion.



CHECK YOUR PROGRESS

Q.6: What is 'Scitovsky's Paradox'? (Answer in about 50 words)

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Q.7: Why are there contradictory and inconsistent results according to Scitovsky's Paradox? (Answer in about 50 words)

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Q.8: State the requirements of Scitovsky's Double Criterion of Welfare. (Answer in about 30 words)

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Q.9: When according to Scitovsky's Double Criterion of Welfare can a change be considered as an improvement in welfare? (Answer in about 40 words)

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Q.10: What is the implication of the change due to two non-intersecting utility possibility curves? (Answer in about 40 words)

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13.7 LET US SUM UP

- The central problem of welfare economics is concerned with the question whether a particular allocation (reallocation) of resources will lead to increase or decrease in the social welfare.
- If any reallocation of resources can make at least one individual better-off without making some other individual worse off, it will lead to increase in social welfare. This state of maximum social welfare is known as the Pareto Optimality.
- However, there are no unique points in Pareto Optimality and is indeterminate. Economists like Kaldor, Hicks and Scitovsky attempted to do away with the indeterminacy of Pareto optimality and gave the criterion of '*Compensation Principle'*.
- They believed that any reallocation will make at least someone worse off to make someone better off. The '*Compensation Principle'* is based on the fact that an individual is the best judge of his welfare.
- The Kaldor-Hicks Compensation principle states that it is possible to

make everybody better off without making anybody worse off; if all those who suffer as a result are fully compensated for their loss, the rest of the community will still be better off than before.

- However Scitovsky was able to show that contradictory and inconsistent results are attained when due to policy changes the new utility possibility curve is obtained and it intersects the former utility possibility curve.
- Scitovsky developed Double Criterion of Welfare that required the fulfilment of Kaldor-Hicks test and also the fulfilment of the reversal test to address the inconsistency and contradictory results of Kaldor-Hicks Criterion.
- Thus, a change according to Scitovsky's Double Criterion of Welfare can be considered as an improvement in welfare, if those who gain from the change in the situation are able to persuade those who lose to accept the change. On the other hand, the losers are not able to persuade the gainers to remain in the original situation before the change.



13.8 FURTHER READING

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13.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Establishment of welfare state is the fundamental objective of most of the economies of the world, especially in the modern democratic governments.

Ans to Q. No. 2: Welfare economics examines the conditions of economic efficiency in the production of output, exchange of commodities and equity in the distribution of income.

Ans to Q. No. 3: Pareto Optimality States that reallocation of resources cannot make at least one individual better-off without making some other individual worse off and will thus lead to decrease in social welfare.

Ans to Q. No. 4: Kaldor formulated his criterion from the view point of the gainers, while Hicks formulated his criterion form the point of view of the losers.

Ans to Q. No. 5: The Kaldor-Hicks Compensation principle states that it is possible to make everybody better off without making anybody worse off, if all those who suffer as a result are fully compensated for their loss, the rest of the community will still be better off than before.

Ans to Q. No. 6: Scitovsky pointed out that in some situations Kaldor-Hicks Criterion might lead to contradictory results. He pointed out that if in a situation say position X is shown to be an improvement over another situation say position Y by Kaldor-Hick's criterion,then by the same criterion position Y can be shown as an improvement over another situation say position X. This, according to Scitovsky, leads to contradictory and inconsistent results. This is known as 'Scitovsky's Paradox'.

Ans to Q. No. 7: Contradictory and inconsistent results are attained when due to policy changes the new utility possibility curve is obtained and it intersects the former utility possibility curve. In those situations a movement from one position in the utility possibility curve to another position and also the reverse movement satisfy the Kaldor-Hicks Criterion. This means that Kaldor-Hicks criterion leads to contradictory and inconsistent results.

Ans to Q. No. 8: Scitovsky Double Criterion of Welfare required the fulfilment of Kaldor-Hicks test and also the fulfilment of the reversal test to address the inconsistency and contradictory results of Kaldor-Hicks Criterion.

Ans to Q. No. 9: A change according to Scitovsky Double Criterion of Welfare can be considered as an improvement in welfare, if those who gain from the change in the situation are able to persuade those who lose to accept the change. On the other hand the losers are not able to persuade the gainers to remain in the original situation before the change.

Ans to Q. No. 10: When two utility possibility curves do not intersect each other, change results in a movement from a position in a lower utility possibility curve to a position on a higher utility possibility curve; the resultant increase in the social welfare implies fulfilment of Kaldor-Hicks and Scitovsky Criterion.



13.10 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q.1: How is the concept of New Welfare Economics: Compensation Principle different from Pareto Optimality?

Q.2: State the various assumptions of Compensation Principle Criterion.

Q.3: Does higher utility possibility curve represent an increased social welfare according to Kaldor-Hicks Principle. If so, why?

B) Long Questions (Answer each question in about 300-500 words)

Q.1: Discuss the Kaldor-Hicks Compensation Principle critically.

Q.2: Discuss critically the Scitovsky's Paradox as a critique to Kaldor-Hicks Compensation Principle.

Q.3: Discuss theScitovsky Double Criterion of Welfare.

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UNIT 14: SOCIAL WELFARE FUNCTION

UNIT STRUCTURE

14.1 Learning Objectives

14.2 Introduction

14.3 Bergson-Samuelson Social Welfare Function

14.4 Social Welfare Function and Value Judgements

14.5 Grand Utility Possibility Frontier and Point of Constrained Bliss

14.6 Let Us Sum Up

14.7 Further Reading

14.8 Answer to Check Your Progress

14.9 Modal Questions

14.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- know the main ideas behind Bergson-Samuelson social welfare function
- learn how value judgements are used to determine social welfare
- analyse how unique and maximum social welfare is attained at the point of constrained bliss.

14.2 INTRODUCTION

Welfare is a happy state of mind. It reflects the betterment and wellbeing of an individual. Individual welfare means personal happiness and betterment of a particular person. But social welfare is different from individual welfare in the sense that it refers to the happiness of the society as a whole. Social welfare is the sum total of the welfare of all individuals living in a society. In subsequent sections of this chapter, we shall discuss social welfare function formulated by Bergson and Samuelson, the use of the concept of value judgement while determining social welfare and the point of constrained bliss where maximum social welfare is attained.

14.3 BERGSON-SAMUELSON SOCIAL WELFARE FUNCTION

The concept of social welfare was propounded by Bergson-Samuelson. According to them, no meaningful proposition in welfare economics can be stated without the use of value judgment.Thus, with welfare we enter the arena of normative economics.Bergson defines social welfare as "a function either of the welfare of each member of the community or of the quantities of products consumed and services rendered by each member of the community". The original form of Bergson social welfare function was formulated in a general manner in which the relationship between social welfare and all possible variables effecting individual welfare such as services and consumption of all individuals were established. Social welfare function is regarded as a function of individual's welfare which depends on one's personal well-being. Thus, social welfare function may be termed as an ordinal index of society's welfare which is a function of the utility levels of all individuals constituting the society.Bergson-Samuelson social welfare function can be expressed as:

$$W = F (U_1, U_2, U_3 \ldots\ldots\ldots\ldots, U_n)$$

Where, W represents the social welfare, F denotes function and U_1, U_2, U_3, ..., Un represent the ordinal utility indices of individuals of the society, i.e. individuals 1, 2, 3.....n. The ordinal utility index of an individual depends mainly upon the goods and services consumed by him and also, the magnitude and kind of the work he does.

Assumptions: The Bergson social welfare function is based on the following assumptions-

- Social welfare function assumes that social welfare depends on each individual's wealth and income and each individual's welfare depends, in turn, on his wealth and income and on the distribution of welfare among the members of the society.
- Social welfare function assumes the presence of external economies and diseconomies with their consequent effects.
- Social welfare function is based on ordinal ranking of combinations of those variables which influence individual welfare.

- Interpersonal comparisons of utility involving value judgments are freely permissible.

Given the above assumptions, Bergson and Samuelson explained the social welfare function with the help of social indifference curves. A social indifference curve is a locus of various combinations of utilities of different individuals which results in the same level of social welfare. Let us assume a society of two individuals, A and B. In such case, a social welfare function can be represented with the help of social indifference curves. Each indifference curve shows various combinations of utility among the individuals which show the same level of social welfare.

In Fig. 14.1 the utilities of individuals A and B are represented on the horizontal and vertical axes respectively. In the figure, W_1, W_2, W_3 and W_4 are the social indifference curves which represent successively higher levels of social welfare. The nature and properties of social indifference curves are exactly as like as that of the individual consumer's indifference curves. The effect of an intended change in policy on social welfare can be expressed from a family of social indifference curves.In figure14.1 any change in policy that moves the economy from Q to T is regarded as an improvement in social welfare.

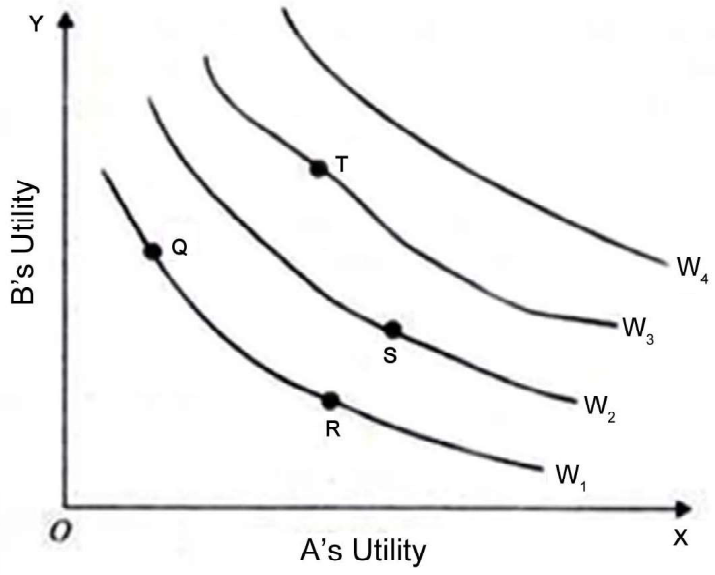


Fig. 14.1 : Social Welfare shown by Social Indifference

In the same way, the movement from Q to S or the movement from R to S also means an improvement in social welfare. But the movement from T to Q and T to S represents a fall of social welfare. Again, the movement along a same social indifference curve indicates no change in social welfare. The main significance of Bergson-Samuelson social welfare function is that it enables to find out a unique optimum position regarding social welfare which is best of all Pareto optimum positions and hence, it ensures maximum social welfare.

The main features of the Bergson-Samuelson Social Welfare function are as follows-

- This function is based on explicit value judgements and involves in interpersonal comparisons of utility ordinally.
- The maximum social welfare is completely determined by Bergson-Samuelson social welfare function by introducing value judgements in distribution of welfare among individuals.
- Bergson-Samuelson social welfare function changes with the change in value judgements.
- This social welfare function decided upon by value judgements, is Pareto optimum and also this function reflects the distribution of goods and services which is equitable and, hence, efficiency and equity are achieved and social welfare is maximised.
- Bergson-Samuelson social welfare function enables to find a unique optimum solution combining economic efficiency with distributive justice.

Bergson-Samuelson Social welfare function is not free from drawbacks. Most of the assumptions taken by Bergson-Samuelson paved the way of criticism of the social welfare function. Certain criticisms of Bergson-Samuelson Social welfare function are mentioned below:

- Economist like Little regards this social welfare function as inapplicable in a totalitarian state and more so in a democratic one-

"where there would be as many (vague) welfare functions as there are individuals. It can be regarded only as 'a formal device necessary to a perfectly general abstract system of welfare,' which bears no relation to practical policy."

- Economists regard construction and shaping of the welfare function to be a difficult task. This social welfare function is generally constructed by aggregating each individual's preferences. But the problem is, by doing so, whether individual preferences should be given equal or different weights is questionable.
- Social welfare function is determined in terms of either equations or a social indifference curve which is imaginary and arbitrary because individual welfare functions cannot be known.
- According to Little,

  "The maximum is a concept without any possible empirical significance, and therefore it seems preferable not to use it. It is more meaningful to derive the 'optimum' conditions as sufficient conditions for an improvement without attempting to define a maximum position."
- Prof. Arrow finds that,if the individuals have to make choices from among more than two alternatives, then, construction of a social welfare function on the basis of ordinal preferences is likely to lead to contradictory results.
- Prof. Baumol observes, "The social welfare function does not come equipped with a kit and a set of instructions for collecting the welfare judgments which it requires."



CHECK YOUR PROGRESS

Q.1: Mention Bergson's statement on social welfare. (Answer in 30 words).

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Q.2: Define Bergson-Samuelson's social welfare function. (Answer in 30 words).

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Q.3: Write the main assumptions of Bergson-Samuelson social welfare function. (Answer in 40 words).

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Q.4: Write the features of Bergson-Samuelson social welfare function. (Answer in 50 words).

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14.4 SOCIAL WELFARE FUNCTION AND VALUE JUDGEMENTS

Value judgment means judgment of the rightness or wrongness of something based on a comparison. A value judgement is a normative as well as subjective statement of opinion that can be tested by observing the available evidence. Some statements like 'this will increase social welfare', 'Social development is expected', 'inequalities in the society are to be reduced', are the examples of value judgments. By the term value judgement, we mean the ethical beliefs of the people about what is good or bad which is determined from outside economics and it is not obtained through any scientific methods.There is a controversy concerning whether value judgements should have any role to play in welfare economies. Prof. Robbins and his followers viewed that the inclusion of value judgements may turn the subject of welfare economics into most unscientific, hence,

economists should keep themselves refrain from making any such value judgements. But modern economists are on the view that value judgements should be considered and economists should comment upon the desirability of economic policies and issues.

The concept of value judgement has been explicitly used in Bergson-Samuelson's social welfare function. The form of social welfare function is determined by the concept of value judgement. For each different set value judgement, the form of social welfare would also be different. Hence, social welfare function is not unique; it varies with different value judgements that depend on the effect of which the utility level of each individual has on social welfare. According to Prof. Scitovsky, "The social welfare function can be thought of as a function of each individual's welfare which in turn depends both in his personal well-being and on his appraisal of the distribution of welfare among all members of the community".

Bergson-Samuelson's social welfare function is dependent on changes in economic situations that have a direct effect on individual welfares. So far as Bergson-Samuelson social welfare function is concerned, the ordinal utility level of a particular person is a function of consumption of goods and services of his own and not of the others. Moreover, the utility as well as the satisfaction level of a person depends on the value judgments of his own depending upon the composition of different goods and services consumed by him based on his tastes.

The formation of a social welfare function is a difficult task because utility is a psychological phenomenon and cannot be measured exactly by any person. Besides this, the addition and subtraction of utilities of different persons is also a very difficult task.It is quite a psychological phenomenon. The value judgements required to construct social welfare function may be obtained in two ways-

a) Dictatorial manners.

b) Democratic process.

In the dictatorial manner, the social welfare function depends upon the value judgements of the person or institution that has been assigned

by the society to do so. The authorised person or institution must be unbiased for true value judgements regarding the social welfare because changes in social welfare will depend upon his justifications.A social welfare function can be achieved by an authorised dictator. Social welfare based on value judgement is to be defined by a unanimous and unbiased authority. The authority possesses the responsibly of deciding social welfare via his justification. In this case, Bergson and Samuelson have introduced the concept of a “Superman” who undertakes the value judgements about the changes in social welfare.He takes the decisions in relation to the solution of various problems in the economy, for example, what should be produced in the society? Or how much should be produced? Or how should be the quality of the goods and so on. These issues of social welfare are to be answered by such assumed superman alone depending on his views on value judgements. The society, then, has to accept the solutions of all these questions as decided by the superman on the proposition that the superman provides value judgements and that will maximize social welfare. The superman plays the deciding role in determining social welfare. Here, people are free to from any sort of addition, subtraction and interpersonal comparisons of utilities at the existence of a super-man.

In the democratic process, the social welfare function is decided through the method of voting by individuals and majority rule and a common consensus is arrived among the individuals. This concept of value judgement is equally relevant in modern days also. The political system comes into the jurisdiction of determining social welfare by value judgement. The modern age witness people to elect their own representatives and these representatives constitute the Government by democratic process. The elected authority who owns the majority rules the society. The repre-sentative authority is responsible to take decisions regarding framing of various plans and policies on the basis of value judgements.It is expected that all the policy decisions taken by the Government are likely to maximise social welfare instead of maximising the welfare of a particular person.

Bergson and Samuelson expressed that social welfare function achieved either by dictatorial manner or by democratic process depending on value judgements must be consistent. Thus, once the social welfare function has been decided upon by value judgements, the maximisation technique is used to obtain maximum social welfare. Hence, efficiency and equity are achieved so that social welfare may be maximised. It is worth mentioning that Bergson-Samuelson's social welfare function incorporating explicit value judgements is an improvement over earlier attempts such as compensation principle advanced by Kaldor, Hicks and Scitovsky.



CHECK YOUR PROGRESS

Q.5: Define value judgement (Answer in about 20 words).

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Q.6: How is social welfare determined by value judgement according to Bergson and Samuelson. (Answer in about 40 words).

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14.5 GRAND UTILITY POSSIBILITY FRONTIER AND POINT OF CONSTRAINED BLISS

Grand utility possibility frontier is a locus of the various physically attainable utility combinations of two persons, let A and B, when the factor endowments, state of technology and preference orders of the individuals are given.

This means every point on the grand utility possibility curve refers to the optimum position in case of the allocation of the products among the consumers, allocation of factors among different products and the production direction. Hence, every point on the grand utility possibility curve is a Pareto optimum and as we move through the curve from one point to another, the

utility of one individual increases while the utility of the other falls.

Now, to find out the unique optimum position of social welfare, let us super impose grant utility possibility curve on the social indifference curves which repre-sent social welfare function. Fig. 14.2 shows that successively higher social indifference curves such as W_1, W_2, W_3 and W_4 reflect the social welfare functions. These are depicted along with the grand utility possibility curve VV/. All points on VV/ are equally efficient and hence are Pareto optimum points.

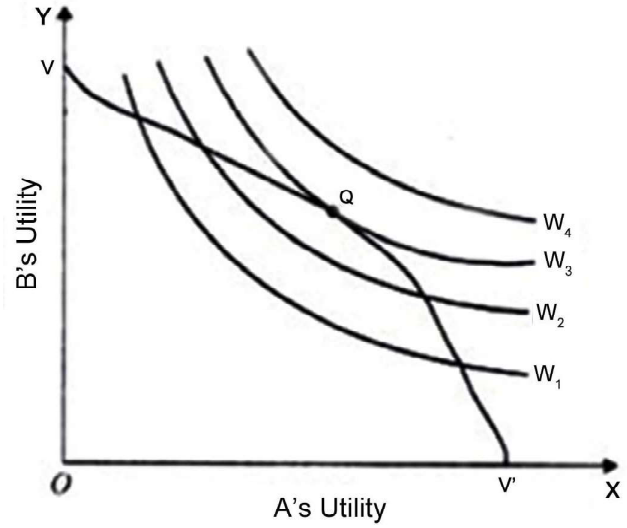


Fig. 14.2: Social Welfare function and Point of Constrained Bliss

Social indifference curve W_1 and W_2 are crossed by grand utility possibility curve VV/.But social indifference curve W_3 becomes tangent to the grand utility possibility curve VV/ at point Q which lies above W_1 and W_2 but below W_4. Thus, point Q shows the maximum possible point reflecting social welfare, given the factor endowments, technology and preference level. This is the maximum feasible point achievable grand utility possibility curve VV/ at point Q. Point Q is termed as the point of constrained bliss as per the given factor endowments and the state of technology is concerned. But the social welfare function indicated by the social indifference curve W_4, is at a higher position than social indifference curve W_3 which is beyond the reach of the individual with the given state of technology and factor endowment.Thus, from among lots of Pareto optimum points on the grand utility possibility curve along the curve VV/, the one and only unique optimum

point is Q at which the social welfare is the maximum. Hence, the point of constrained bliss means the unique (and hence maximum) point of production of goods, maximum distribution of goods between the individuals and unique (maximum) combination of factors employed to produce the goods.



CHECK YOUR PROGRESS

Q.7: Define grand utility possibility frontier. (Answer in about 30 words).

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Q.8: What is the significance of the point of constrained bliss. (Answer in about 50words).

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14.6 LET US SUM UP

- The concept of social welfare was propounded by Bergson-Samuelson.
- Bergson defines social welfare as "a function either of the welfare of each member of the community or of the quantities of products consumed and services rendered by each member of the community".
- Social welfare function is regarded as a function of individual's welfare which depends on one's personal wellbeing. Thus, social welfare function may be termed as an ordinal index of society's welfare which is a function of the utility levels of all individuals constituting the society.
- Bergson-Samuelson social welfare function can be expressed as:
  $W = F (U_1, U_2, U_3 \ldots\ldots\ldots\ldots , U_n)$

Where, W represents the social welfare, F refers for function and U_1, U_2, U_3, ..., Un represent the ordinal utility indices of individuals of the society, i.e. individuals 1, 2, 3.....n.

- Bergson-Samuelson social welfare function depends on value judgments.
- Value judgment refers to the judgment based upon a particular set or system of values. A value judgment is a normative as well as subjective statement of opinion that can be tested by observing the available evidence. By value judgments the ethical beliefs of the people about the concept what is good or bad is meant which are based on some scientific law or approach.
- Bergson and Samuelson expressed that social welfare function achieved either by dictatorial manner or by democratic process depending on value judgments must be consistent. Thus, once the social welfare function has been decided upon by value judgments, the maximization technique is used to obtain maximum social welfare.
- Bergson-Samuelson social welfare functionis defined by grand utility possibility frontier. Grand utility possibility frontier is a locus of the various physically attainable utility combinations of two persons when the factor endowments, state of technology and preference orders of the individuals are given.
- Every point on the grand utility possibility curve refers the optimum position in case of the allocation of the products among the consumers, allocation of factors among different products and the production direction. Hence, every point on the grand utility possibility curve is a Pareto optimum and as we move through the curve from one point to another, the utility of one individual increases while the utility of the other falls.
- Point of constrained bliss lies in the grand utility possibility frontier and it is the highest possible position of social welfare which the society is capable of attaining.Hence, the point of constrained bliss means the unique or maximum distribution of goods between the individuals and maximum combination of factors employed to produce the goods.



14.7 FURTHER READING

1) Ahuja, H. L. (1998). *Microeconomic Theory*. Delhi: S .Chand and Company Ltd.

2) Koutsoyiannis, A (1979). *Modern Microeconomics.* London: Macmillan Press Ltd.



14.8 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Bergson defines social welfare as "a function either of the welfare of each member of the community or of the quantities of products consumed and services rendered by each member of the community".

Ans to Q. No. 2: Bergson-Samuelson social welfare function can be expressed as:

$W = F (U_1, U_2, U_3 \ldots\ldots\ldots\ldots , U_n)$

Where, W represents the social welfare, F refers for function and U_1, U_2, U_3, ..., Un represent the ordinal utility indices of individuals of the society, i.e. individuals 1, 2, 3.....n.

Ans to Q. No. 3: Main assumptions of Bergson-Samuelson social welfare function are-

- Social welfare depends on each individual's wealth and income.
- Presence of external economies and diseconomies with their consequent effects.
- Social welfare function is based on ordinal ranking of combinations of those variables which influence individual welfare.
- Interpersonal comparisons of utility involving value judgments are freely permissible.

Ans to Q. No. 4: The main features of the Bergson-Samuelson Social Welfare function are as follows-

- This function is based on explicit value judgements and involves interpersonal comparisons of utility cordially.
- Introduction of value judgements in distribution of welfare among individuals.
- Social welfare function changes with the change in value judgements.
- This social welfare function decided upon by value judgements, is Pareto optimum.
- Social welfare function enables to find a unique optimum solution at the point of constrained bliss.

Ans to Q. No. 5: Value judgment is the ethical beliefs of the people about the concept of judgement of what is good or bad based on some scientific approach.

Ans to Q. No. 6: Bergson and Samuelson expressed that value judgements can be achieved either by a dictator i.e. a "Superman" who decides value judgements about the changes in social welfare or by common consensus of democratic rule. The society has to accept the solutions of all these questions decided by the superman on the assumption that he will give value judgements which maximizes social welfare. Similarly, people themselves can decide their values by majority rule through voting.

Ans to Q. No. 7: Grand utility possibility frontier is a locus of the various physically attainable utility combinations of two persons given factor endowments, state of technology and preference orders of the individuals.

Ans to Q. No. 8: Point of constrained bliss signifies highest possible position of social welfare which the society is capable of attaining.It is the Pareto optimal point.



14.9 MODEL QUESTIONS

A) Short Questions (Answer each question in 150 words)

Q.1: Briefly define the Bergson-Samuelson social welfare function.

Q.2: What are the mains drawbacks of Bergson-Samuelson social welfare function?

Q.3: Explain the two dimensions of value judgements for determining social welfare.

Q.4: Briefly explain the role of a 'Superman' while determining social welfare as defined by Bergson and Samuelson.

Q.5: Why is social welfare maximum at the point of constrained bliss?

B) Long Questions (Answer each question in about 300-500 words)

Q.1: Critically explain Bergson-Samuelson social welfare function.

Q.2: Explain the role of value judgements in determining social welfare.

Q.3: Explain how the maximum social welfare is attained by grand utility possibility curve.

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UNIT 15: ECONOMICS OF INFORMATION

UNIT STRUCTURE

15.1 Learning Objectives

15.2 Introduction

15.3 Markets with Asymmetric Information

- 15.3.1 Market Failure
- 15.3.2 Market Failure and Asymmetric Information Problem
- 15.3.3 Types of Asymmetric Information Problem

15.4 Quality Uncertainty and the Market for Lemons

- 15.4.1 Meaning
- 15.4.2 The Affected Party in the Market for Lemons
- 15.4.3 Lemons Problem and Market Failure
- 15.4.4 Markets with Lemons Problem
- 15.4.5 Mitigating Lemons Problem

15.5 Adverse Selection Problem

- 15.5.1 Meaning
- 15.5.2 Adverse Selection Problem in Different Markets
  - 15.5.2.1 Life and Health Insurance Market
  - 15.5.2.2 Credit Market
  - 15.5.2.3 Labour Market

15.6 Social Insurance

- 15.6.1 Meaning
- 15.6.2 A Brief History of Social Insurance
- 15.6.3 Features of Social Insurance
- 15.6.4 Social Insurance in India

15.7 Let Us Sum Up

15.8 Further Reading

15.9 Answers to Check Your Progress

15.10 Model Questions

15.1 LEARNING OBJECTIVES

After going through this unit, you will be able to-

- comprehend the concept of asymmetric information problem and how it is related to market failure
- understand the different types of asymmetric information problems and the similarities and differences between lemons problem and adverse selection problem
- gauge the importance of social insurance for the populace.

15.2 INTRODUCTION

Market failure is a problem the economists have to deal with and it happens due to various reasons. It adversely affects the participants of the market. Information asymmetry is one of the causes of market failure. There are two types of asymmetric information problem- adverse selection problem and moral hazard. The adverse selection problem happens when one party to a transaction have better information than the other. Lemons problem is one of the variants of adverse selection problem. In case of moral hazard problem the one party to the transaction takes risk since the costs of assuming the risk has to be borne by the other party to the transaction. The different types of asymmetric information problem are a bane for the market economies. Hence, it needs to be checked for a proper and efficient functioning of the market.



In case of moral hazard problem the one party to the transaction takes risk since the costs of assuming the risk has to be borne by the other party to the transaction.

Social insurance sometimes mitigates the problem of adverse selection. The schemes of social insurance are compulsory in nature and an individual with limited income is immensely benefitted by it. The topics to follow in the succeeding sections will discuss in detail about asymmetric information problem, its different types and social insurance.

15.3 MARKETS WITH ASYMMETRIC INFORMATION

15.3.1 Market Failure

The market's inability to attain a specific result in employing resources is market failure. Market failure obstructs the growth and



Tragedy of the commons is a scenario in which the limited resources are exhausted by the people despite knowing that in the long run the society has to bear the loss.

development of the economy. Under consumption and over consumption are the resultant effects of market failure.The monopolists restricting the supply of the products so as to increase the prices lead to under consumption. Over consumption is due to predatory pricing, negative externalities and the tragedy of the commons. Hence, it can be stated that imperfect competition causes market failure. Unearthing the causes and impacts of market failure is a concern for the economists in general and micro economists in particular. Market failure also takes place due to insufficient information problem. The problem of insufficient information is also known as *information asymmetry*.

15.3.2 Market Failure and Asymmetric Information Problem

Asymmetric information problem affects both the party to a transaction.Asymmetric information problem takes place when one party to a transaction has better information than the other. It may also be possible that the party having lesser information is aware of the fact that the other party has adequate information. Asymmetric information is a fundamental problem in market economies. Having said that it must not be misconstrued that the quality of goods/services dealt in an asymmetrically informed market is inferior to a fully informed market.

One of the primary requirements of a perfectly competitive market is to have symmetric information between the buyers and sellers. The absence of symmetric information gives rise to market imperfection and finally it results in market failure.

15.3.3 Types of Asymmetric Information Problem

The two types of asymmetric information problem present in market economies are:

- **Adverse Selection Problem:** The concept of adverse selection will be discussed in length in the successive section.

- **Moral Hazard:** Moral hazard problem arises when one party to a transaction takes risk because he is aware of the fact that in the event of any adverse consequence of the risks the other party will bear the loss. Moral hazard is very common in insurance and lending businesses.For example, when a person takes life insurance he thinks that he needn't take care of his health since he is insured. He accordingly continues consuming excessive alcohol and cigarettes believing that if he dies the life insurance company will pay the insured amount to the family and hence he can do anything with his life.This behaviour of the insured person is an act of moral hazard because the loss of the insured person will be borne by the insurance company and not by the person himself.



CHECK YOUR PROGRESS

Q.1: When does asymmetric information problem take place? (Answer in about 20 words)

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Q.2: Name the two types of asymmetric information problems. (Answer in about 30 words)

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15.4 QUALITY UNCERTAINTY AND THE MARKET FOR LEMONS

15.4.1 Meaning

The inability to decide about the value of an investment or product/service due to asymmetric information of the buyers is known as lemons problem. The theory was propounded by George A. Akerlofin the year 1970 to relate quality and uncertainty. Akerlof took

automobile market as a model to understand the problem of lemons. The theory states that,since a buyer can't distinguish between a good car and a bad car, also known as *"lemons",* hence the lemons drive out the good cars from the market. The situation arises when in a used car market both good cars and bad cars (lemons) are traded at the same price. Unable to distinguish between the two a buyer with asymmetric information tend to pay an average price for a used car. This average price is determined by averaging the value of a good car and a bad car.The seller knows the quality of the car whether it is a good or bad car (lemon) hence a seller with a bad car (lemon) will be willing to sell the lemon at the average price offered by the buyer. On the other hand, a seller with a good car will intend to sell the car at a premium price and not the average price offered by the buyer. In this scenario the buyer, due to asymmetric information about the quality of both the cars, will buy the lemon by paying the average price and thereby the good cars will remain unsold in the used car market.

15.4.2 The Affected Party in the Market for Lemons

Lemons problem arise when a buyer suffers from inadequate information about the quality of the products/service he intends to buy. The risk of lemons problem will be present whenever a seller will have better information about the product/services than the buyer. This mismatch of information between the buyers and sellers affect the buyers as he is unable to decide which product/service to buy. Due to this mistrust between the buyers and sellers at most cases the sellers with inferior quality goods are able to sell their goods in the market. This happens because the seller of inferior quality goods will be able to sell his goods at the same price that of superior quality goods.

The question now arises as to why if price for both superior quality goods and inferior quality goods are same then only inferior quality goods (lemons) are traded in the market? This happens when the buyer offers the same price (average price) for the goods whether it is a superior quality good or a lemon. The same price for the two

different qualities of goods discourages the seller of the superior quality goods to sell at the price offered by the buyer. The sellers of superior goods want a premium price for their products. But, the buyers are unwilling to pay that price because of asymmetric information. The seller of superior quality goods thereby leave the market without selling the goods at the average price offered by the buyer. Their exit from the market leaves only the inferior quality goods for trading and hence it can be stated that in the market for lemons only inferior quality goods are traded. The buyer, instead of buying a good quality product/ service, is satisfied by paying an average price to procure a lemon.

15.4.3 Lemons Problem and Market Failure

The seller of a lemon brings into the market its product to sell it at an average price knowing the fact that the buyers won't be able to identify that it is a lemon product and will thus be able to sell its product. This phenomenon continues till the point the buyers gets to know about the trick. The moment buyers understand that he is buying lemon good he will offer a lesser price than the price he offered earlier (the average price) for the goods available in the market.This will lead to sellers bringing into the market further lesser quality of goods to sell at the new low price offered by the buyers. Still the buyers would be unable to distinguish between the good product and a lemon product and will end up in buying a lemon product. Again the buyers will tend to offer a further lesser price for the available goods and in return the sellers will also fill the market with inferior (lemon) goods. This phenomenon continues till the point the market witnesses a complete stoppage of buying and selling of products resulting into market failure. The failure to acquire the full knowledge about the quality of a product restricts the buyers to procure the product. Thus, it leads to market failure. Hence, it can be stated that symmetric information between the buyers and sellers will correct the problem of lemons from the market.

The problem of lemons will always leave a group of less informed

buyers in the market. These buyers will learn about the features and qualities of the product only after its purchase. Till the time the problem exists there will be a negative association between the transactions speed and rate of return.

15.4.4 Markets with Lemons Problem

The problem of lemons is present in different types of market economies. Some of the markets where lemons problem exists are listed below-

- Insurance market
- Securities market
- Medical profession
- Online market
- Job market
- Fruit market
- Credit market

15.4.5 Mitigating Lemons Problem

One of the primary ways to correct the problem of lemons is to add *guarantees* and *warranties* in the product. The products with warranties or guarantees will encourage the buyers to acquire the product. This is because the guarantee or warranty in the product classifies a product to be a good product and not a lemon. This will be an incentive to the buyers to procure the same in spite of inadequate information about the product. Moreover, the risk of attaching warranty or guarantee with a product rests with the seller and not the buyer.

Another way to counter the problem is to have good brand name. This ensures quality of the product. After purchasing if the buyer realises that quality of the product is inferior then he may stop any future purchase from that brand. This will jeopardise the brand name of the product.

Chain business and licensing are the other two popular methods to encounter quality uncertainty.

CHECK YOUR PROGRESS



Q.3: What is meant by 'lemons problem'? (Answer in about 30 words)

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Q.4: Who and when propounded the theory of 'lemons problem'? (Answer in about 20 words)

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Q.5: What kind of information amongst the buyers and sellers will correct the problem of lemons from the market? (Answer in about 20 words)

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Q.6: Give some examples of the markets where lemons problem exists. (Answer in about 30 words)

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15.5 ADVERSE SELECTION PROBLEM

15.5.1 Meaning

Adverse selection problem arises when one party to a transaction has better information than the other. The party who has less

information will be at a risk while executing the transaction. The adverse selection problem may affect both the buyers and sellers of a transaction. Kevin Roberts in his research paper "Cartel Behaviour and Adverse Selection" has defined adverse selection as-*"adverse selection arises when it is the preferences of other agents which are unobservable"*. The lemons problem discussed above is a type of adverse selection problem. As already discussed, lemons problem affects the buyer whereas adverse selection problem affects both the buyer and seller of a transaction.

15.5.2 Adverse Selection Problem in Different Markets

The problem of adverse selection hampers different market economies. In this section we will try to put forward the affect of this problem across markets.

15.5.2.1 Life and Health Insurance Market

In case of life and health insurance market a prospective buyer approaches a life and health insurance company to insure his risk of life and health. The health condition is private information of the buyer and the company has to rely on the disclosures made by the buyer to accept his proposal of insurance. In this scenario the buyer has better information than the insurance company (seller). Hence, there is a challenge for the insurance company to gather as much information as possible to determine the insurability prospect of the buyer. The buyer may easily hide the private information and thus this private information led to the problem of adverse selection in an insurance market. Let us discuss it in detail to understand how this private information led to adverse selection problem.

Suppose there are two prospective buyers for a life or health insurance company. One is a smoker and the other is a non-smoker. This two buyer's mortality risk is not same. The person

with a habit of smoking is having more risk of life and health and hence an insurance company has to charge higher premium from him in comparison to the non-smoker buyer. The insurance company is aware that as it is private information of the buyer hence a smoker may also recognise himself to be a non-smoker to buy the policy by paying same amount of premium which a non-smoker pays.The insurance company say, intends to fix a premium of Rs. 20/- for a smoker and Rs. 15/- for a non-smoker buyer. But, recognising the fact that the company is unable to distinguish between a smoker and a non-smoker the company fixes an average amount of premium for the buyers. The average in this example comes to Rs. 17.5/-. Now the non-smoker buyer will be discouraged to pay higher amount to buy the policy. But there will be an incentive for the smokers to buy the policy at a lesser amount of premium. Hence, all the smokers will acquire the policy whereas the non-smokers will not buy the policies at a higher premium amount. Hence, due to adverse selection problem the company will end up in insuring only the smokers leaving out the non-smokers from the market. The resultant affect is that the insurance company ends up in taking more risks since smokers have more risk of life and health than the non-smokers. If suddenly all the smokers face problem of life and health and they submit their claims for return of insurance benefit then the company will be unable to meet their claims. This will happen because the company has insured the smokers at a lesser premium than what they should have actually charged which in this example is Rs. 20/-. Thereby the company's inability to meet the claims will result in market failure due to the problem of adverse selection. Thus,this problem of adverse selection indicates that the average price is not an actuarially fair price.

Adverse selection in life and health insurance can be corrected by asking the prospective buyers to undergo a Doctor's certificate in regard to his health condition. This can be done for

a certain age group of buyers who, as per the insurance company, is having high mortality risk factor. Another way, which may practically seem difficult, is to force everyone to have a life and health insurance. In that case in the pool of insured people both high risk and low risk people will be present and the company will be saved from adversely selecting only the high risk people for insurance.

15.5.2.2 Credit Market

- In a credit market the creditor may not be able to find out the private information about the borrower's ability to pay. Lending without being sure gives rise to adverse selection problem. If in future the loans turn bad then it will be proved that the creditor has adversely selected the borrowers. This will end up in loss for the credit market and will lead to market failure.
- Another example from credit market relates to financing an entrepreneur dealing in a project. The entrepreneur's ability to finish the project on time is private information and the banks may not be able to gauge that fact. The standard contracts for debt will bring into the bank both good and bad entrepreneurs. This standard contract may lead to banks granting loans only to the bad entrepreneurs and not the good ones resulting in adverse selection of entrepreneurs by the banks.

  In a credit market linking first contract of loan with an attractive second contact of loan may attract good entrepreneurs to the bank/credit institution. Thus the problem of adverse selection may be solved to an extent in a credit market.
- The risk type of a credit card holder is private information of the card holder. Hence, unable to find out the loan repaying capacity of a credit card holder may end up in issuing credit cards to risky borrowers due to adverse selection. The

problem can be mitigated provided the company is able to identify correctly the risk type of the credit card applicant.

15.5.2.3 Labour Market

- Due to absence of any mechanism to find out the productivity of an employee at the time of recruitment adverse selection problem takes place in a labour market. Same wage for the employees lead to better equipped employees opting out of the job and the employer is left only with average or poor quality workers.

  Performance linked wage is an answer to correct the problem of adverse selection in a labour market.



ACTIVITY 15.2

Study the problem of adverse selection in some other markets and thereby add to the literature of adverse selection problem.



CHECK YOUR PROGRESS

Q.7: What do you mean by adverse selection problem? (Answer in about 20 words)

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Q.8: Do you think that only buyers are always affected by the adverse selection problem? (Answer in about 20 words)

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Q.9: What can be one of the ways to correct the adverse selection problem in labour market? (Answer in about 20 words)

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15.6 SOCIAL INSURANCE

15.6.1 Meaning

The concept of providing social security against the economic changes because of old age and financial risks due to premature death, job related disabilities, loss of employment, income loss due to ill health and other emergencies is known as social insurance. The social insurance schemes are an utmost necessity to the individuals and families with limited income. The contribution to social insurance is compulsory. The types of social insurance vary from one nation to other. The social insurance schemes are implemented to safeguard against loss of income and thereby saving the individual from the clutches of poverty.

The contributors to the scheme of social insurance in some cases are the employee and the employer or an individual and the government or the employer and the government or only the employer, etc. In some cases government, employer and also the employees contribute to the common pool of fund. The benefits are paid as a right to the individual and also without conducting a *means test*. A means test is done to identify an individual's eligibility for government support. The test takes into consideration the resources (means) available with the individual. Then, based on the means, it determines whether the individual needs to be given the government support for survival or not.

15.6.2 A Brief History of Social Insurance

In Germany under the Chancellorship of Otto Von Bismarck health insurance in 1883, workmen's compensation in1884, and compulsory old-age and invalidity pensions in 1889 were introduced.

- In 1888 Austria and in 1891 Hungary introduced Sickness Insurance Law.
- In 1891 Denmark started the old age pension scheme.

- In 1905 France introduced voluntary unemployment insurance.
- Luxembourg and Austria introduced old age insurance in 1906, followed by France in the year 1910, Rumania in 1912, and Sweden introduced it in the year 1913.
- Compulsory state subsidy support to the departments providing pension was introduced in the year 1910 in France. From the year 1897 till 1910, this scheme was voluntary in nature.
- In 1910, Britain introduced national pension system followed by compulsory health insurance and unemployment insurance in 1911.
- In 1913, Netherland introduced a compulsory sickness insurance law.
- In India, The Employee's Compensation Act was enacted in the year 1923.
- In 1927, Germany started unemployment insurance.
- In 1930, France introduced compulsory sickness insurance law.
- In 1935, United States introduced Social Security Act covering retirement and survival benefit, health care to persons over 65 years of age and disability insurance coverage.
- In 1948, Employees' State Insurance Act was enacted in India.
- In India, first Employees' Provident Fund Scheme was launched on 1st November 1952 by Employees' Provident Fund organization (EPFO).
- In 1961, Maternity Benefit Act was introduced in India.

The history of social insurance depicts that social insurance have different variations and it is not a typical insurance only. Hence, the word social insurance and social security are often used interchangeably.

15.6.3 Features of Social Insurance

Social insurance schemes are compulsory in nature.

- The compulsory characteristic of social insurance schemes mitigates the adverse selection problem as both healthy and unhealthy individuals are covered.
- A common pool of fund is created by the contributions made by government, employer and the employees. Out of this fund the claims are being paid.
- The Major chunk of contribution is made by the government and the employer and employees' contribution is kept at the lowest. Hence, the claim amount paid to an individual is more than the contributions made by him.
- Social insurance takes care of those risks also which are not insurable with a commercial insurance company. For example, risk of unemployment cannot be insured with a commercial insurance company.
- The claim amount is considered to be a right to the individual and paid without conducting the means test.
- Social insurance is a corrective measure rather than a preventive one.
- Benefits of social insurance may be paid even to those individuals who have not contributed in the common pool of fund.
- Social insurance considers maintaining a minimum standard of living.
- Social insurance provides economic support to the whole population.

15.6.4 Social Insurance in India

The Government of India has introduced different social insurance/ social security schemes to take care of the needs of the country's population. India's social security schemes provide pension benefit, insurance, maternity benefit, disability benefit, gratuity, etc. Following are some of the social security measures implemented in India.

- **Employees' Provident Fund Organization:** The organization provides superannuation pension to the contributor and after

his death family pension to the spouse. The organization runs three schemes viz., The Employees'Provident Fund Scheme, 1952; The Employees' Pension Scheme, 1995; and, The Employees' Deposit Linked Insurance Scheme, 1976.

- **Employees' State Insurance Corporation:**The Corporation takes care of full medical expense of an insured person and his family members. It also provides sickness benefit, maternity benefit, disablement benefit, dependants benefit and other benefits such as funeral expenses and confinement expenses.
- **The Employee's Compensation Act, 1923:**The Act mandates an organization to compensate for the loss suffered by an employee at work which leads to either death or disability.
- **Maternity Benefit Act, 1961 as amended by Maternity Benefit (Amendment) Act, 2017:** The Act provides for paid maternity leave of 26 weeks for first two children to a woman engaged in organized sector. For the third child the leave is for 12 weeks.
- **Gratuity:** An amount paid by an organization to its employees for rendering service to the organization.
- **Pradhan Mantri Jan Dhan Yojana (PMJDY):** A bank account can be opened without the requirement of any minimum balance. The account holders are given a RuPay debit card with an inbuilt accidental coverage of Rs. 2 lakhs. Overdraft loan facility is also available in this account.
- **Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY):** It is a term insurance policy. The life cover is for Rs. 2 lakhs and renewable every year at a premium Rs. 330/- which gets directly debited from the policyholder's bank account.
- **Pradhan Mantri Suraksha Bima Yojana (PMSBY):** The insurance coverage is for Rs. 2 lakhs for accidental deaths or full disability and Rs. 1 lakh for partial disability. The insurance is auto renewed every year by debiting the bank account at a premium of Rs. 12/-

- **Atal Pension Yojana (APY):** The scheme's pension benefit depends upon the contributions made by the contributor. The pension starts at the age of 60 years. The scheme also has the feature of government's commitment to minimum guaranteed pension amount.
- **Pradhan Mantri Mudra Yojana:** Loans are given to the young, educated and skilled workers under three different schemes viz., Shishu, Kishore and Tarun. The loans are approved without any collateral.
- **Stand Up India Scheme:** Granting loans to at least one SC/ST and one woman borrower per branch to set up a Greenfield enterprise. The loan under this scheme is also sanctioned without any collateral.
- **Pradhan Mantri Vaya Vandana Yojana:** It is a scheme for providing social security at old age. A person over the age of 60 years and above is covered by the scheme for any future loss of interest income due to uncertain behaviour of the market.



CHECK YOUR PROGRESS

Q.10: What do you mean by social insurance? (Answer in about 40 words)

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Q.11: What is 'means test'? (Answer in about 60 words)

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15.7 LET US SUM UP

- The market's inability to attain a specific result in employing resources is market failure.
- Information asymmetry is one of the causes of market failure.
- Asymmetric information problem affects both the party to a transaction. Asymmetric information problem takes place when one party to a transaction has better information than the other.
- Adverse selection problem and moral hazard are the two types of asymmetric information problem.
- Lemons problem is a type of adverse selection problem.
- The inability to decide about the value of an investment or product/ service due to asymmetric information of the buyers is known as lemons problem. The theory was propounded by George A. Akerlof in the year 1970 to relate quality and uncertainty.
- The risk of lemons problem will be present whenever a seller will have better information about the product/services than the buyer. This mismatch of information between the buyers and sellers affect the buyers as he is unable to decide which product/service to buy.
- The problem of lemons is present in different types of market economies.
- Warranties, guarantees, brand name, chain business and licensing are some solutions for lemons problem.
- Adverse selection problem arises when one party to a transaction has better information than the other. The party who has lesser information will be at a risk while executing the transaction. The adverse selection problem may affect both the buyers and sellers of a transaction.
- Adverse selection problem is present in different market economies and insurance business is severely affected by this problem.

- The concept of providing social security against the economic changes because of old age and financial risks due to premature death, job related disabilities, loss of employment, income loss due to ill health and other emergencies is known as social insurance. The social insurance schemes are an utmost necessity to the individuals and families with limited income. The contribution to social insurance is compulsory.
- The benefits of social insurance are paid as a right to the individual and also without conducting a *means test*.
- Social insurance is different from commercial insurance. The term social insurance and social security are often used interchangeably.



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15.9 ANSWERS TO CHECK YOUR PROGRESS

Ans to Q. No. 1: Asymmetric information problem takes place when one party to a transaction has better information than the other.

Ans to Q. No. 2: The two types of asymmetric information problem present in market economies are adverse selection problem and moral hazard.

Ans to Q. No. 3: The inability to decide about the value of an investment or product/service due to asymmetric information of the buyers is known as lemons problem.

Ans to Q. No. 4: The theory was propounded by George A. Akerlof in the

year 1970 to relate quality and uncertainty.

Ans to Q. No. 5: Symmetric information between the buyers and sellers will correct the problem of lemons from the market.

Ans to Q. No. 6: Some of the markets where lemons problem exists are- Insurance market, Securities market, Medical profession, Online market, Job market, Fruit market, Credit market etc.

Ans to Q. No. 7: Adverse selection problem arises when one party to a transaction has better information than the other.

Ans to Q. No. 8: No.The adverse selection problem may affect both the buyers and sellers of a transaction.

Ans to Q. No. 9: Performance linked wage is an answer to correct the problem of adverse selection in a labour market.

Ans to Q. No. 10: The concept of providing social security against the economic changes because of old age and financial risks due to premature death, job related disabilities, loss of employment, income loss due to ill health and other emergencies is known as social insurance.

Ans to Q. No. 11: A means test is done to identify an individual's eligibility for government support. The test takes into consideration the resources (means) available with the individual. Then, based on the means, it determines whether the individual needs to be given the government support for survival or not.



15.10 MODEL QUESTIONS

A) Short Questions (Answer each question in about 150 words)

Q.1: What is meant by market failure?

Q.2: **'**Absence of symmetric information gives rise to market imperfection and finally it results in 'market failure'. Explain in brief.

Q.3: Discuss some of the ways to correct the problem of lemons.

Q.4: Explain the affect of adverse selection problem in credit market.

Q.5: Write some of the features of social insurance.

B) Long Questions (Answer each question in about 300-500 words)

Q.1: "Since a buyer can't distinguish between a good car and a bad car, also known as *"lemons",* the lemons drive out the good cars from the market". Explain the statement.

Q.2: Discuss about the affected party in the market for lemons.

Q.3: Explain how lemons problem leads to market failure.

Q.4: Elaborate the affect of adverse selection problem in life and health insurance market.

Q.5: Write a brief history of social insurance.

Q.6: Discuss about the different social insurance/social security schemes introduced by the Government of India.

*** ***** ***



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