

**Microeconomics III
MA ECONOMICS
First Semester
(CDOE-ECO-101-CC-5110)**



Rajiv Gandhi University
**CENTRE FOR
DISTANCE
AND ONLINE
EDUCATION** **CD**  **E**
ESTD. 2004

Arunachal Pradesh, India- 791112

About the University

Rajiv Gandhi University (formerly Arunachal University) is a premier institution for higher education in the state of Arunachal Pradesh and has completed twenty-five years of its existence. Late Smt. Indira Gandhi, the then Prime Minister of India, laid the foundation stone of the university on 4th February, 1984 at Rono Hills, where the present campus is located.

Ever since its inception, the university has been trying to achieve excellence and fulfill the objectives as envisaged in the University Act. The university received academic recognition under Section 2(f) from the University Grants Commission on 28th March, 1985 and started functioning from 1st April, 1985. It got financial recognition under section 12-B of the UGC on 25th March, 1994. Since then Rajiv Gandhi University, (then Arunachal University) has carved a niche for itself in the educational scenario of the country following its selection as a University with potential for excellence by a high-level expert committee of the University Grants Commission from among universities in India.

The University was converted into a Central University with effect from 9th April, 2007 as per notification of the Ministry of Human Resource Development, Government of India.

The University is located atop Rono Hills on a picturesque tableland of 302 acres overlooking the river Dikrong. It is 6.5 km from the National Highway 52-A and 25 km from Itanagar, the State capital. The campus is linked with the National Highway by the Dikrong bridge.

The teaching and research programmes of the University are designed with a view to play a positive role in the socio-economic and cultural development of the State. The University offers Undergraduate, Post-graduate, M.Phil and Ph.D. programmes. The Department of Education also offers the B.Ed. programme.

There are fifteen colleges affiliated to the University. The University has been extending educational facilities to students from the neighbouring states, particularly Assam. The strength of students in different departments of the University and in affiliated colleges has been steadily increasing.

The faculty members have been actively engaged in research activities with financial support from UGC and other funding agencies. Since inception, a number of proposals on research projects have been sanctioned by various funding agencies to the University. Various departments have organized numerous seminars, workshops and conferences. Many faculty members have participated in national and international conferences and seminars held within the country and abroad. Eminent scholars and distinguished personalities have visited the University and delivered lectures on various disciplines.

The academic year 2000-2001 was a year of consolidation for the University. The switch over from the annual to the semester system took off smoothly and the performance of the students registered a marked improvement. Various syllabi designed by Boards of Post-graduate Studies (BPGS) have been implemented.

VSAT facility installed by the ERNET India, New Delhi under the UGC-Infonet program, provides Internet access.

In spite of infrastructural constraints, the University has been maintaining its academic excellence. The University has strictly adhered to the academic calendar, conducted the examinations and declared the results on time. The students from the University have found placements not only in State and Central Government Services, but also in various institutions,

industries and organizations. Many students have emerged successful in the National Eligibility Test (NET). Since inception, the University has made significant progress in teaching, research, innovations in curriculum development and developing infrastructure.

About CDOE

The formal system of higher education in our country is facing the problems of access, limitation of seats, lack of facilities and infrastructure. Academicians from various disciplines opine that it is learning which is more important and not the channel of education. The education through distance mode is an alternative mode of imparting instruction to overcome the problems of access, infrastructure and socio-economic barriers. This will meet the demand for qualitative higher education of millions of people who cannot get admission in the regular system and wish to pursue their education. It also helps interested employed and unemployed men and women to continue with their higher education. Distance education is a distinct approach to impart education to learners who remained away in the space and/or time from the teachers and teaching institutions on account of economic, social and other considerations. Our main aim is to provide higher education opportunities to those who are unable to join regular academic and vocational education programmes in the affiliated colleges of the University and make higher education reach to the doorsteps in rural and geographically remote areas of Arunachal Pradesh in particular and North-eastern part of India in general. In 2008, the Centre for Distance Education has been renamed as “Centre for Distance and Online Education (CDOE)” Continuing the endeavor to expand the learning opportunities for distant learners, IDE has introduced Post Graduate Courses in 5 subjects (Economics, Education, English, Hindi, History, Sociology and Political Science) from the Academic Session 2013-14.

The CDOE is housed in the Physical Sciences Faculty Building (first floor) next to the University Library. The University campus is 6 kms from NERIST point on National Highway 52A. The University buses ply to NERIST point regularly.

Outstanding Features of Institute of Distance Education:

(i) At Par with Regular Mode

Eligibility requirements, curricular content, mode of examination and the award of degrees are on par with the colleges affiliated to the Rajiv Gandhi University and the Department(s) of the University.

(ii) Self-Instructional Study Material (SISM)

The students are provided SISM prepared by the Institute and approved by Distance Education Council (DEC), New Delhi. This will be provided at the time of admission at the IDE or its Study Centres. SISM is provided only in English except Hindi subject.

(iii) Contact and Counselling Programme (CCP)

The course curriculum of every programme involves counselling in the form of personal contact programme of duration of approximately 7-15 days. The CCP shall not be compulsory for BA. However for professional courses and MA the attendance in CCP will be mandatory.

(iv) Field Training and Project

For professional course(s) there shall be provision of field training and project writing in the concerned subject.

(v) Medium of Instruction and Examination

The medium of instruction and examination will be English for all the subjects except for those subjects where the learners will need to write in the respective languages.

(vi) Subject/Counselling Coordinators

For developing study material, the CDOE appoints subject coordinators from within and outside the University. In order to run the PCCP effectively Counselling Coordinators are engaged from the Departments of the University, The Counselling-Coordinators do necessary coordination for involving resource persons in contact and counselling programme and assignment evaluation. The learners can also contact them for clarifying their difficulties in then respective subjects.

CDOE-ECO-101-CC-5110: Microeconomics III		
Content		Page No.
INTRODUCTION		1
UNIT 1	Consumer's Choice	
	Utility and its relation to the value of goods, Utility maximization, Indirect utility maximization, Duality of utility and expenditure, Marshallian demand function – Indirect utility function and cost function – Hicksian demand function – Properties of demand function: Engel aggregation, Cournot aggregation, homogeneity -Linear expenditure system.	
UNIT 2	Uncertainty, Risk and Imperfect Information	
	Decision making under different conditions: Decision making under Risk, Expected Monetary value criterion, expected profit and value with perfect information, Expected Loss criterion; Decision making under uncertainty, probabilities and Expected values, Attitudes towards risk and expected utility theory; Asymmetric Information: The market for lemons, Adverse Selection, the problem of moral hazards.	
UNIT 3	Theory of Firms	
	The traditional theory of firm and its evaluation – Baumol's sales revenue maximization model: Static and dynamic model –Bian's Limit pricing theory, Marris's Model of Managerial Enterprise, Williamson's model of Managerial Discretion	
UNIT 4	Welfare Economics and General Equilibrium	
	Pareto Optimality: Its conditions - Consumption, production and exchange, critical evaluation of Pareto Optimality – Compensation tests: Kaldor, Hicks and Scitovsky– Bergson's Social welfare function. Brouwar's fixed point theorem - Principles of general equilibrium, existence, uniqueness and stability (Walrasian and Marshallian conditions of stability) – Walrasian general equilibrium system – Non-Walrasian equilibrium.	

UNIT I COSUMER'S CHOICE

1.0 INTRODUCTION

1.1 Utility and its Relation to Value of goods

1.3 Consumer Equilibrium through Utility Analysis

1.3.1 Conditions of Consumer's Equilibrium

1.4 Duality

1.5 HICKSIAN DEMAND FUNCTION

1.5.1 Example of Hicksian Demand

1.6 Engel Aggregation

1.7 Cournot Aggregation

1.8 Homogeneity

1.9 Summary

1.10 ANSWERS TO 'CHECK YOUR PROGRESS'

1.11 QUESTIONS AND EXERCISES

1.11.1 Short-Answer Questions

1.11.2 Long-Answer Questions

UNIT 2 UNCERTAINTY, RISK AND IMPERFECT INFORMATION

2.0 Introduction

2.1 Decision-Making Under Different Conditions (Under Different Atmosphere)

2.1.1 Decision Making Under Certainty

2.1.2.1.1 Decision Making Under Risk

2.1.3 Decision Making Under Uncertainty

2.2 Decision Making Under Risk

2.2.1 Expected Monetary Value (EMV) Criterion

2.2.1.1 The Core Elements Of EMV

2.2.1.2 Given Below Are The Steps For The Calculations Of This Criterion

2.2.2 Expected Opportunity Loss (EOL) Criterion

2.2.2.1 Steps To Calculate EOL Are Explained Below

2.3 Expected Profit And Value With Perfect Information

2.3.1 Expected Profit With Perfect Information (EPPI)

2.3.1.1 The Steps For Calculating Expected Profit With Perfect Information (EPPI)

2.3.2 Expected Value Of Perfect Information (EVPI)

2.3.2.1 There Are Several Characteristics Of EVPI That Always Hold

2.4 Decision Making Under Uncertainty

2.4.1 Probabilities And Expected Value

2.4.1.1 Benefits Of Using Expected Value In Decision Making

2.5 Decision Making Under Uncertainty Attitude Towards Risk

2.6 Expected Utility Theory

2.6.1 Utility Functions And Decision Behaviour

2.6.1.1 Risk Preferences In Expected Utility Theory

2.6.1.2 Limits Of Expected Value And Expected Utility

2.7 Asymmetric Information;

2.7.1 Adverse Selection

2.7.2 Problems Caused by Adverse Selection

2.7.3 Moral Hazard

2.7.4 Lemon Problems

2.7.5 The Lemons Principle

UNIT 3 THEORY OF FIRMS

3.0 Introduction

3.1 The Traditional Theory of Firm And Its Evaluation:

3.1.1 Criticisms of The Traditional Theory of The Firm Include

3.2 Baumol's Sales Revenue Maximization Model: (Static And Dynamic)

3.2.1 Static Model : Without Advertisement

3.2.1.1 Arguments In Support of The Theory

3.2.1.1.1 Criticism:

3.2.2 Dynamic Model:

3.2.2.1 Assumptions

3.2.2.1 The Multi-Period Model

3.3 Bain's Limit Pricing Theory

3.3.1 Assumptions of Bain's Model of Limit Pricing:

3.3.2 Diagrammatic Representation of The Limit Pricing Model

3.4 Marris 'S Model of Managerial Enterprise

3.4.1 Equilibrium of The Firm

3.5 Williamson Model of Managerial Discretion

3.5.1 Simplification of the Model:

3.5.1.1 Graphical Presentation of Williamson's Model of Managerial Discretion:

UNIT 4 WELFARE ECONOMICS AND GENERAL EQUILIBRIUM

4.0 Introduction

4.1 Pareto Optimality: Its Conditions- Consumption, Production and Exchange

- 4.1.1 The Optimum Distribution of Products among the Consumers: Efficiency In Exchange
- 4.1.2 Efficiency In Production
- 4.1.3 Product-Mix Efficiency
- 4.1.4 Critical Evaluation of Pareto Optimality
- 4.2 Kaldor-Hicks Welfare Criterion
 - 4.2.1 Compensation Principle
 - 4.2.1.1 Assumptions
 - 4.2.1.2 Scitovsky's Double Criterion of Welfare
- 4.3 Bergson's Social Welfare Function
- 4.4 Brouwer's Fixed-Point Theorem
 - 4.4.1 The Three Mandatory Requirements
- 4.5 General Equilibrium
 - 4.5.1 Principles of General Equilibrium
 - 4.5.2 Existence, Uniqueness And Stability
 - 4.5.2.1 Existence
 - 4.5.2.2 Uniqueness
 - 4.5.2.3 Stability
- 4.6 Summary

INTRODUCTION

Economics has two major branches: (i) Microeconomics, and (ii) Macroeconomics. Both micro and macro-economics are applied to business analysis and decision-making—directly or indirectly.

Operational issues are of internal nature. Internal issues include all those problems which arise within the business organization and fall within the purview and control of the management. Some of the basic internal issues are: (i) choice of business and the nature of product, i.e., what to produce; (ii) choice of size of the firm, i.e., how much to produce; (iii) choice of technology, i.e., choosing the factor-combination; (iv) choice of price, i.e., how to price the commodity; (v) how to promote sales; (vi) how to face price competition; (vii) how to decide on new investments; (viii) how to manage profit and capital; (ix) how to manage an inventory, i.e., stock of both finished goods and raw materials. These problems may also figure in forward planning. Microeconomics deals with such questions confronted by managers of business enterprises. The following microeconomic theories deal with most of these questions.

Demand theory deals with consumers' behaviour. It answers such questions as: How do the consumers decide whether or not to buy a commodity? How do they decide on the quantity of a commodity to be purchased? When do they stop consuming a commodity? How do the consumers behave when price of the commodity, their income and tastes and fashions, etc., change? At what level of demand, does changing price become inconsequential in terms of total revenue? The knowledge of demand theory can, therefore, be helpful in making the choice of commodities, finding the optimum level of production and in determining the price of the product.

Production theory explains the relationship between inputs and output. It also explains under what conditions costs increase or decrease; how total output behaves when units of one factor (input) are increased keeping other factors constant, or when all factors are simultaneously increased; how can output be maximized from a given quantity of resources; and how can the optimum size of output be determined? Production theory, thus, helps in determining the size of the firm, size of the total output and the amount of capital and labour to be employed, given the objective of the firm.

Price theory explains how price is determined under different kinds of market conditions; when price discrimination is desirable, feasible and profitable; and to what extent advertising can be helpful in expanding sales in a competitive market. Thus, price theory can be helpful in determining the price policy of the firm. Price and production theories together, in fact, help in determining the optimum size of the firm.

Profit making is the most common objective of all business undertakings. But, making a satisfactory profit is not always guaranteed because a firm has to carry out its activities under conditions of uncertainty with regard to: (i) demand for the product, (ii) input prices in the factor market, (iii) nature and degree of competition in the product market, and (iv) price behaviour under changing conditions in the product market, etc. Therefore, an element of risk is always there even if the most efficient techniques are used for predicting the future and even if business activities are meticulously planned. The firms are, therefore, supposed to safeguard their interest and avert or minimize the possibilities of risk. Profit theory guides firms in the

measurement and management of profit, in making allowances for the risk premium, in calculating the pure return on capital and pure profit and also for future profit planning.

Capital like all other inputs, is a scarce and expensive factor. Capital is the foundation of business. Its efficient allocation and management is one of the most important tasks of the managers and a determinant of the success level of the firm. The major issues related to capital are (i) choice of investment project, (ii) assessing the efficiency of capital, and (iii) most efficient allocation of capital. Knowledge of capital theory can contribute a great deal in investment-decision making, choice of projects, maintaining the capital, capital budgeting, etc. This book deals with the theories of microeconomics.

This book, Microeconomic Theory, is written in a self-instructional format and is divided into ten units. Each unit begins with an 'Introduction' to the topic followed by an outline of the 'Unit Objectives'.

The content is then presented in a simple and easy-to-understand manner, and is interspersed with 'Check Your Progress' questions to test the reader's understanding of the topic. A list of 'Questions and Exercises' is also provided at the end of each unit, and includes short-answer as well as long-answer questions. The 'Summary' and 'Key Terms' section are useful tools for students and are meant for effective recapitulation of the text.

UNIT I COSUMER'S CHOICE

1.0 INTRODUCTION

1.1 Utility and its Relation to Value of goods

1.3 Consumer Equilibrium through Utility Analysis

1.3.1 Conditions of Consumer's Equilibrium

1.4 Duality

1.5 Hicksian Demand Function

1.5.1 Example of Hicksian Demand

1.6 Engel Aggregation

1.7 Cournot Aggregation

1.8 Homogeneity

1.9 Summary

1.10 ANSWERS TO 'CHECK YOUR PROGRESS'

1.11 QUESTIONS AND EXERCISES

1.11.1 Short-Answer Questions

1.11.2 Long-Answer Questions

1.12 REFERENCE AND CREDITS

UNIT I CONSUMER'S CHOICE

1.0 INTRODUCTION

Utility is a psychological phenomenon. It is a feeling of satisfaction, pleasure or well-being experienced by the consumer from the consumption or possession of the commodity or availing of a service. In this sense, it is a subjective or relative concept i.e. level of utility derived from a product differs from person to person. Utility of a product can be 'absolute' in the sense that the want satisfying power is ingrained or embedded in it.

The following major points can be used to define utility:

- a) Utility is the want-satisfying power of a commodity
- b) Utility varies from person to person
- c) It varies from time to time, at different levels of consumption and at different moods of a consumer.

There are two concepts related to utility:

a) Total Utility- The utility derived by a person from the total number of units of a commodity consumed by the consumer is called total utility.

i.e. $TU_n = U_1 + U_2 + U_3 + \dots + U_n$

b) Marginal Utility- It means the addition made to total utility by consuming an additional unit of a commodity. It can be measured with the help of the following formula.

$$MU_n = TU_n - TU_{n-1}$$

1.1 Utility and its Relation to Value of goods

The value of a good is fundamentally in its utility or satisfaction. This relationship can be explained with the use of two frameworks:

1. Law of Diminishing Marginal Utility: The Law of Diminishing Marginal Utility is one of the most fundamental law of utility analysis. It explains the relationship between utility and quantity of a commodity. This law states that after a sufficient quantity of a commodity is consumed, the utility derived from each successive unit decreases, and consumption of all other commodities remains the same. Let us take an example to illustrate this law.

In the table 1.1, the total and marginal utilities derived by a person from cups of tea consumed per day. When one cup of tea is taken per day, the total utility derived by the person is 12 utils. With the rise in total utility to 22 utils, marginal utility falls to 10. It will be seen from the above table that marginal utility from the additional cup goes on diminishing. At the seventh cup of tea marginal utility equal to -2 utils. This is because too many cups of tea consumed per day may cause disutility rather than positive satisfaction.

Table: 1.1. Diminishing Marginal Utility		
Cups of tea consumed per day (Q)	Total Utility (utils) TU	Marginals Utility (utils) $\frac{\Delta TU}{\Delta Q}$
1	12	12
2	22	10
3	30	8
4	36	6
5	40	4
6	41	1
7	39	-2
8	34	-5

This is also depicted with the help of Figure below.

In the Fig. 1.1, Q1, Q2, Q3 and Q4 shows the quantity by which diminishing marginal utility was derived. With an additional unit of cup of tea, MU goes on decreasing. At quantity Q4 the slope of the TU is zero at this point. Beyond the Q4 the TU declines and MU become negative. Thus, quantity Q4 of the commodity represents the satiation quantity.

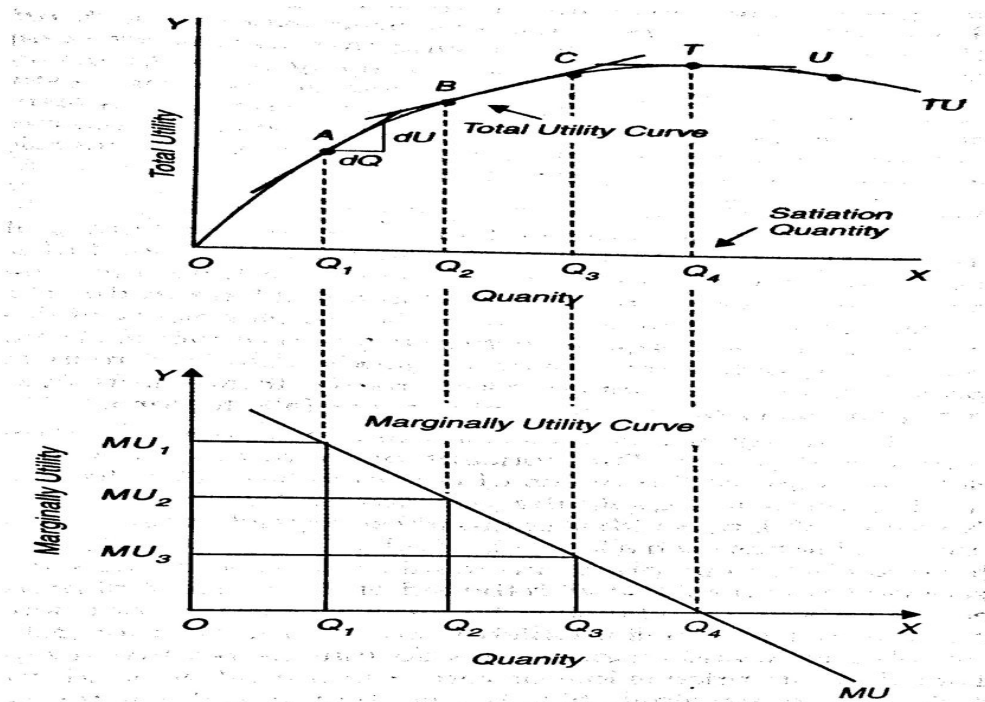


Fig. 1.1 Total utility and Marginal utility

1.3 Consumer Equilibrium through Utility Analysis

Consumer Equilibrium is a situation wherein a consumer gets maximum satisfaction out of his limited income and has no tendency to change his existing expenditure pattern. A consumer is considered to be extremely satisfied when he allocates his income in such a way that the last rupee spent on each commodity yields the same level of utility. The concept of consumer equilibrium can be examined under a one-commodity model and a multicommodity model. Consumer equilibrium through utility analysis is based on the following set of assumptions:

- 1) Consumer is rational, i.e. the consumer chooses the best option in order to maximise his utility.
- 2) Utility can be measured in quantifiable terms.
- 3) It is assumed that utility is measured in terms of money, and the utility of money does not change.
- 4) It is assumed that the income of the consumer and prices of goods remain constant.
- 5) It is assumed that the taste and preferences of the consumer remain the same.

1.3.1 Conditions of Consumer's Equilibrium

There are two fundamental conditions of a consumer's equilibrium through the Indifference curve approach:

1. The price line should be tangent to the Indifference curve. It means that at the point of equilibrium, the slope of the indifference curve and of the price line should be the same. The slope of Indifference curve indicates MRS_{xy} i.e. $-\Delta Y/\Delta X$. The slope of the price line indicates the ratio between price of two goods X and Y i.e. P_x/P_y .

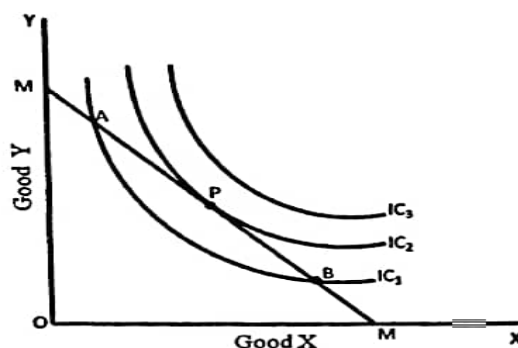


Fig. 1.2 Consumer equilibrium through indifference curve.

2. Indifference curve should be convex to the point of origin: Marginal rate of substitution of X for Y (MRS_{xy} i.e. $\Delta y/\Delta x$) is equal to the slope of the price line that indicates the ratio between prices of two goods.

In Fig. 1.2, IC1, IC2 and IC3 are the three indifference curves, and MM is the budget line. With the constraint of the budget line, the highest indifference curve, which a consumer can reach, is IC2. The budget line is tangent to the indifference curve IC2 at point 'P'. This

is the point of consumer equilibrium. All other points on the budget line to the left or right of point 'P' will lie on lower indifference curves and thus indicate a lower level of satisfaction. As the budget line can be tangent to one and only one indifference curve, the consumer maximises his satisfaction at point P, when both the conditions of consumer's equilibrium are satisfied.

1.4 Duality

The duality Concept related to consumer behaviour is based on the fact that preferences can be represented in two forms of function: the expenditure function and the indirect function. The usefulness of the dual approach results from two facts: Firstly, the Marshallian demand function can be computed from the indirect utility function by differentiation. Secondly, the Hicksian demand function can be computed from the expenditure function by differentiation. Both the Marshallian and Hicksian demand functions are obtained only as implicit functions when one derives demand directly from the utility function by the conventional Lagrange method.

Our starting point is the class of utility functions U :

$R^+ \rightarrow R^+$ + satisfying the following conditions:

- I. (U1) V is non-decreasing
- II. (U2) V is upper semi-continuous) is closed, (U3) $V(0) = 0$,
- III. (U4) V is unbounded. and
- IV. (U5) V is quasi-concave. That is, for each $u \in R^+$, the set $C(u) = \{x \in R^+ \mid V(x) \geq u\}$ is convex. The class of utility functions satisfying these conditions is denoted by U . The power of our strong duality theorems derives in part from the fact that U admits essentially all preference relations that are considered in the neoclassical demand theory.
- V. The following theorem lists properties of expenditure functions that are generated by a utility function:

THEOREM 1: Let $U: R^+ \rightarrow R^+$ satisfy (U1) to (U4). The expenditure function $e: R^+ \times R^+ \rightarrow R^+$ generated by U satisfies the following properties:

- I. (e1) $e(p, \cdot)$ is non-decreasing,
- II. (e2) $e(p, \cdot)$ is lower semi-continuous.
- III. (e3) $e(\cdot, u)$ is non-decreasing.
- IV. (e4) $e(p, u) = 0$ if and only if $u = 0$,
- V. (e5) $e(p, \cdot)$ is unbounded.
- VI. (e6) $e(\cdot, u)$ is concave. and
- VII. (e7) $e(\cdot, u)$ is positive homogenous of degree one.

1.5 HICKSIAN DEMAND FUNCTION

A compensated demand function, also known as the Hicksian demand function, describes how the quantity demanded of a good changes as its price changes while holding the consumer's utility (or overall economic well-being) constant through appropriate adjustments in income. The primary purpose of the compensated demand function is to isolate the substitution effect of a price change by removing the income effect. This approach is useful for understanding consumer behaviour when utility is prioritized over actual changes in income. For a clearer understanding, one may refer to the concepts of:

I. The Income Effect

II. The Substitution Effect

The ordinary (Marshallian) demand function incorporates both substitution and income effects, whereas the compensated demand function reflects only the substitution effect.

1.5.1 Example of Hicksian Demand

Suppose the price of good increases. Under ordinary demand conditions, consumers will purchase less of the good due to two reasons: first, the good becomes relatively more expensive (substitution effect), and second, there is a reduction in the consumer's purchasing power (income effect), given a fixed income. Graphically, the budget line (BL) represents all possible combinations of goods X and Y that a consumer can purchase with a given income. When the price of good X decreases, the budget line shifts outward to BL', allowing the consumer to move from an initial consumption bundle (X, Y) to a higher bundle (X', Y'), thereby increasing utility from U to U'.

However, in the case of Hicksian demand, income is adjusted downward to offset the increase in utility resulting from the price decrease. This adjustment ensures that the consumer remains on the original indifference curve (U). The new compensated budget line (represented by a dashed line) is tangent to the original indifference curve, indicating the highest level of utility attainable given the adjusted income.

At this point of tangency, the change in quantity demanded reflects only the substitution effect, as the income effect has been completely neutralized. Thus, under compensated demand, income is adjusted to maintain constant utility, allowing for a clear observation of the substitution effect alone.

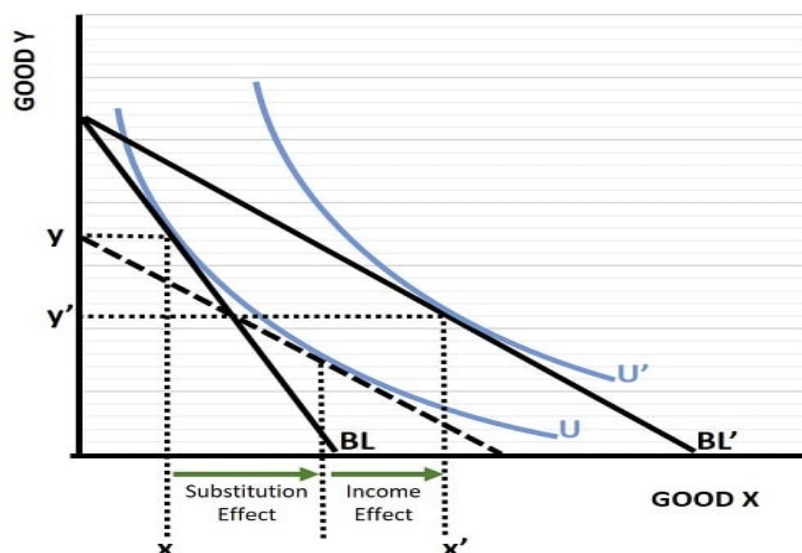


Fig 1.3 Hicksian Demand Function

1.6 ENGEL AGGREGATION

Engel Aggregation defines how changes in a consumer's income affect their total spending across all goods. It states that the sum of the income elasticity's of all goods, weighted by their respective budget shares, must equal **1**.

Mathematically, if a consumer purchases n goods, the relationship is:

$$\sum_{i=1}^n w_i \cdot \eta_i = 1$$

- I. $w_i = \frac{P_i x_i}{I}$ is the budget share of good i .
- II. $\eta_i = \frac{dx}{dI} \cdot \frac{I}{x_i}$ is the income elasticity of demand for good i .

For example, if an income increases by 1%, your total expenditure must also increase by 1% (assuming you spend all your income). Therefore, the weighted average of how your demand for individual goods reacts to that income change must account for the total 1% increase.

Engel Aggregation provides critical insights into the nature of goods in a consumer's basket:

- **Necessities vs. Luxuries:** If one good is a luxury ($\eta_i > 1$), there must be at least one other good in the basket that is a necessity or an inferior good ($\eta_i < 1$) to balance the equation to 1.
- **Inferior Goods:** It is impossible for *all* goods in a consumer's budget to be inferior. If every η_i were negative, the sum could never equal 1.
- **Budget Shares:** The more income you spend on a particular good (higher w_i), the more its income elasticity pulls the total sum toward its own value.

1.7 COURNOT AGGREGATION

Engel Aggregation deals with income changes, Cournot Aggregation deals with price changes. It states that the weighted sum of price elasticities (including the cross-price effect) must equal the negative of the budget share for that good:

Cournot Aggregation ensures that the consumer's total expenditure remains exactly equal to their income after a price change. It includes two main points:

- I. **Total Budget Impact:** When the price of good i rises, the consumer's "real" budget is squeezed by exactly the amount they were already spending on that good (w_i).
- II. **Interdependence:** The response of *every* good in the basket (through cross-price elasticities) must collectively offset or absorb that price change to keep the budget balanced.

Cournot Aggregation is closely linked to the Slutsky Equation, which decomposes these price elasticities into the substitution effect (movement along an indifference curve) and the income effect (movement to a different indifference curve due to changed purchasing power).

1.8 HOMOGENEITY

Homogeneity is a fundamental property of Marshallian demand functions. The Linear Expenditure System (LES) play as a vital empirical application of consumer theory, fundamentally anchored by the property of homogeneity of degree zero. A fundamental property of the LES is its homogeneity of degree zero in prices and income. This ensures the model is free from "money illusion"; if all prices and total income increase by the same proportion, the consumer's real purchasing power and relative price ratios remain constant, leaving the quantity demanded unchanged. Mathematically, the scaling factor cancels out within the demand equation, satisfying Euler's Theorem.

1.9 SUMMARY

This principle reveals that utility maximization (Primal) and expenditure minimization (Dual) are two sides of the same coin. Whether a consumer maximizes utility for a fixed budget or minimizes the cost to reach a specific utility level, the resulting optimal consumption point remains identical. This relationship is bridged by the Expenditure Function and the Indirect Utility Function.

1.10 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Economists show an interest in the theory of choice since it provides a stage for empirical demand analysis.
2. In economics, utility function is an important concept that measures preferences over a set of goods and services.
3. An important attribute of the absolute concept of utility is that it is ethically neutral because a commodity may satisfy a frivolous or socially immoral need, e.g., alcohol, drugs or a profession like prostitution.
4. The central theme of the consumption theory is the analysis of utility maximizing behaviour of the consumer.
5. Assuming that utility is measurable and additive, total utility may be defined as the sum of the utilities derived by a consumer from the various units of goods and services he consumes.
6. A utility-maximizing consumer reaches his equilibrium position when allocation of his consumption expenditure is such that the last penny spent on each commodity yields the same utility.
7.
 - (i) Shephard's Lemma
 - (ii) Marshallian demand curve
8. An indifference curve may be defined as the locus of points, each representing a different combination of two substitute goods, which yield the same utility or level of satisfaction to the consumer.
9. The marginal rate of substitution is the rate at which one commodity can be substituted for another, the level of satisfaction remaining the same.
10. The convexity of the indifference curves implies two properties:

- The two commodities are imperfect substitutes for one another.
- The marginal rate of substitution (MRS) between the two goods decreases as a consumer moves along an indifference curve.

11. Indifference curve shows the satisfaction of the consumers where a higher indifference curve proves to have a higher level of consumer satisfaction. A consumer, thus, in order to reach his highest indifference curve would try to maximize his satisfaction.

12. The budget line demonstrates all those combinations of two goods which the consumer can purchase by spending his given money income on the two goods at their given prices.

13. Engel aggregation and Cournot aggregation are the properties of Marshallian demand curve. They both are restrictions that are imposed by theory on the systems of demand functions.

14. The linear expenditure system is the most commonly used in CGE (computable general equilibrium) analysis due to convention and because it allows representation of subsistence consumption, in addition to satisfying the above restrictions.

15. A function is a symbolic statement of a relationship between the dependent and the independent variables.

16. The long-run demand for a product depends on the composite impact of all its determinants operating simultaneously.

1.11 QUESTIONS AND EXERCISES

1.11.1 Short-Answer Questions

1. What is preference? What is preference ordering?
2. What is utility? What are the two angles from which utility can be viewed?
3. State the law of diminishing marginal utility. What are the assumptions of the law of diminishing marginal utility?
4. When does a consumer reach his equilibrium?
5. Illustrate and derive the individual demand curve for a commodity.
6. What is the Shephard's Lemma?
7. How can the Slutsky equation be derived?
8. What is an indifference map? Illustrate with the help of a diagram.
9. What is a budget line? Why is the budget line also referred to as real income line?
10. What is the linear expenditure system? Who developed this system?
11. What is a demand function?
12. Write a note on linear demand function.

1.11.2 Long-Answer Questions

1. Discuss the concept of preference ordering and utility function.
2. Describe the meaning of utility and the Marshallian approach to consumer demand.
3. What is total and marginal utility? Discuss the law of diminishing marginal utility in detail.
4. Assess the analysis of consumer's equilibrium.
5. Discuss the indirect utility function and the connection between utility maximization problem (UMP) and expenditure minimization problem (EMP).
6. With regard to Hicksian demand function, discuss the nature and properties of indifference curves.
7. Discuss the properties of budget line and Engel and Cournot aggregation.
8. Give an overview of the linear expenditure system and its adaptation to the CGE (Computable General Equilibrium).
9. Give an overview of estimation of demand functions.

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UNIT 2 UNCERTAINTY, RISK AND IMPERFECT INFORMATION

Structure

2.0 Introduction

2.2 Decision-Making Under Different Conditions (Under Different Atmosphere)

2.1.1 Decision Making Under Certainty

2.1.2.1.2 Decision Making Under Risk

2.1.3 Decision Making Under Uncertainty

2.2 Decision Making Under Risk

2.2.1 Expected Monetary Value (EMV) Criterion

2.2.1.1 The Core Elements Of EMV

2.2.1.2 Given Below Are The Steps For The Calculations Of This Criterion

2.2.2 Expected Opportunity Loss (EOL) Criterion

2.2.2.1 Steps To Calculate EOL Are Explained Below

2.3 Expected Profit And Value With Perfect Information

2.3.1 Expected Profit With Perfect Information (EPPI)

2.3.1.1 The Steps For Calculating Expected Profit With Perfect Information (EPPI)

2.3.2 Expected Value Of Perfect Information (EVPI)

2.3.2.1 There Are Several Characteristics Of EVPI That Always Hold

2.4 Decision Making Under Uncertainty

2.4.1 Probabilities And Expected Value

2.4.1.1 Benefits Of Using Expected Value In Decision Making

2.5 Decision Making Under Uncertainty Attitude Towards Risk

2.6 Expected Utility Theory

2.6.1 Utility Functions And Decision Behaviour

2.6.1.1 Risk Preferences In Expected Utility Theory

2.6.1.2 Limits Of Expected Value And Expected Utility

2.7 Asymmetric Information;

2.7.1 Adverse Selection

2.7.2 Problems Caused by Adverse Selection

2.7.3 Moral Hazard

2.7.4 Lemon Problems

2.7.5 The Lemons Principle

2.8 ANSWERS TO 'CHECK YOUR PROGRESS'

2.9 QUESTIONS AND EXERCISES

2.9.1 Short-Answer Questions

2.9.2 Long Answer Questions

2.10 REFERENCE AND CREDITS

2.0 Introduction

Decision making is an integral part of management planning, organizing, controlling processes. The decision maker selects one strategy (course of action) over others depending on some criteria, like utility, sales, cost or rate of return.

For making effective decisions, as well as recognizing when a bad decision has been made and quickly responding to the mistakes, is a key ingredient in organizational effectiveness.

- Risk involves choices involving multiple possible outcomes in which the probability of each outcome is known or may be estimated.
- Uncertainty also involves multiple-outcomes situations. What distinguishes risk from uncertainty, however, is that with uncertainty the probability of each outcome is unknown and cannot be estimated. In many cases, these probabilities cannot be estimated because of the absence of historical evidence about the event. Nevertheless, there is a fine line between decision making under conditions of risk and of uncertainty.

2.3 Decision-Making under different Conditions (under different atmosphere);

2.1.1 Decision Making Under Certainty:

A state of certainty exists when a decision maker knows, with reasonable certainty, what the alternatives are and what conditions are associated with each alternative. Very few organizational decisions, however, are made under these conditions. The complex and turbulent environment in which businesses exist rarely allows for such decisions

2.1.3 Decision Making Under Risk:

A state of risk exists when a decision maker makes decisions under a condition in which the availability of each alternative and its potential payoffs and costs are all associated with probability estimate. Decisions such as these are based on past experiences, relevant information, the advice of others and one's own judgment. Decision is 'calculated' on the basis of which alternative has the highest probability of working effectively.

2.1.3 Decision Making Under Uncertainty:

A state of uncertainty exists when a decision maker does not know all of the alternatives, the risks associated with each, or the consequences each alternative is likely to have. Most of the major decision making in today's organizations is done under these conditions. To make effective decisions under these conditions, managers must secure as much relevant information as possible and approach the situation from a logical and rational view. Intuition, judgment and experience always play major roles in the decision-making process under these conditions.

2.2 DECISION MAKING UNDER RISK:

Decision under risk occurs when decision-makers have knowledge about the probabilities associated with different outcomes. It involves considering the potential gains, losses, and probabilities of each outcome to select the course of action that maximizes expected utility or minimizes potential losses. We know either:

- The directly available probabilities of occurrence of different states of nature or
- The frequency data for different states of nature which can be converted into probabilities using the relative frequency approach of probability or
- Subjective probabilities on the basis of experience of individuals

In all cases, we have with us the probabilities of occurrence of different states of nature in the environment of decision making under risk.

The following criteria are used to select an optimum course of action in this environment:

- (i) Expected Monetary Value (EMV) Criterion,
- (ii) Expected Opportunity Loss (EOL) Criterion.

2.2.1 EXPECTED MONETARY VALUE (EMV) CRITERION

In modern risk management and decision-making processes, Expected Monetary value (EMV) stands a one of the fundamental tools.

This statistical method helps organizations evaluate potential outcomes of business decisions by combining probability calculations with financial impacts.

2.2.1.1 The Core Elements of EMV

The expected monetary value formula consists of two main components: probability and impact. Probability measures the likelihood of an event occurring, expressed as a percentage between 0% and 100%.

Impact represents the financial consequence of that event, which can be either positive (gain) or negative (loss). When these components combine, they create a clear financial picture of potential outcomes.

For example, if a project has a 30% chance of generating \$100,000 in revenue, the expected monetary value would be \$30,000 ($0.30 \times \$100,000$).

This calculation provides decision-makers with a realistic view of potential financial outcomes.

In this criterion, we first form the payoff table or payoff matrix if it is not already given. Then for each course of action, we find the expected value by multiplying the payoff value for each course of action one at a time with the probabilities of the corresponding state of nature. The resulting values are called the expected monetary values (EMVs).

Next, we select the maximum of the EMVs in the case of profit or gain, and the minimum of the EMVs in the case of loss or cost. In the case of profit or gain the course of action corresponding to the maximum expected monetary value is the optimum course of action according to this criterion. And in the case of loss or cost, the course of action corresponding to the minimum expected monetary value is the optimum course of action according to this criterion.

2.2.1.2 Given below are the steps for the calculations of this criterion:

Step 1: If the payoff table or payoff matrix is already given, Step 1 is not needed. Otherwise, we first define the courses of action and states of nature and then obtain the payoff table or payoff matrix for the given situation. We also add one more column to the table indicating the probabilities of different states of nature.

Step 2: To obtain the expected monetary value (EMV) for each course of action, we multiply the payoff value of each course of action with the probability of the corresponding state of nature and then add the results. For example, let $x_{ij}, x_{2j}, \dots, x_{mj}$ be the payoff values for the j^{th} course of action corresponding to m states of nature N_1, N_2, \dots, N_m and let P_1, p_2, \dots, P_m and let be the corresponding probabilities of these m states nature respectively. Then the expected monetary value (EMV) for the j^{th} course of action is given

$$\text{EMV for the } J^{\text{th}} \text{ course of action} = p_1x_{1j} + p_2x_{2j} + \dots + p_mx_{mj} = \sum_{i=1}^m p_ix_{ij}$$

Step 3: We select the maximum expected monetary value from among the expected monetary values obtained in Step 2 if payoff values represent profit or gain. We select the minimum EMV if the values represent loss or cost.

Step 4: Under this criterion, the course of action corresponding to the maximum (or minimum) EMV selected in Step 3 will be the optimum course of action.

2.2.2 EXPECTED OPPORTUNITY LOSS (EOL) CRITERION:

EOL is another decision-making criterion that focuses on minimizing the potential regret or loss from not choosing the best alternative. It is also known as the Expected Regret.

This criterion suggests the course of action which minimizes our expected opportunity loss. The steps involved in the procedure of this criterion are the same as in the expected monetary value (EMV) criterion except that instead of dealing with payoff values, here we deal with opportunity loss values.

2.2.2.1 Steps to calculate EOL are explained below:

Step 1: If the payoff table or payoff matrix is already given, then Step 1 is not needed. Otherwise, we first define the courses of action, states of nature and then obtain the payoff table. We also add one more column indicating the probabilities of different states of nature.

Step 2: We obtain the opportunity loss values or regret values or conditional opportunity loss values for each state of nature by subtracting all payoff values corresponding to each state of nature from their respective maximum payoff values in case of profit or gain or the minimum payoff value corresponding to each state of nature from all other payoff values of the states of nature in case of cost or loss.

Step 3: Next, we obtain the expected opportunity loss values for each course of action by finding the sum of the products of the opportunity loss values of the course of action with the probabilities of the corresponding states of nature.

Step 4: Finally, we select the minimum from among the expected opportunity loss values calculated in Step 3. The course of action corresponding to the minimum expected opportunity loss value will be the optimum course of action.

2.3 EXPECTED PROFIT AND VALUE WITH PERFECT INFORMATION;

2.3.1 Expected Profit with Perfect Information (EPPI): Expected profit with perfect information (EPPI) is the expected profit that we could make if we had perfect information about the occurrence of a particular state of nature. That is, it represents the expected profit under the environment of certainty and is defined as:

$$EPPI = \sum_i P(N_i) \times \left(\begin{array}{l} \text{payoff value of optimum course} \\ \text{of action for the state of nature } N_i \end{array} \right)$$

2.3.1.1 The steps for calculating Expected Profit with Perfect Information (EPPI):

Step 1: Identify the states of nature

These are the possible future scenarios (e.g., *High demand*, *Low demand*). Each state has an associated probability.

Step 2: Construct the payoff table

List the profits (or payoffs) for each decision alternative under each state of nature. Example: Two strategies (A and B) with profits under High and Low demand.

Step 3: Find the best payoff for each state. For each state of nature, select the maximum profit among all alternatives. This represents what you would earn if you had perfect foresight.

Step 4: Weight by probabilities, multiply each **best payoff** by the **probability** of that state occurring.

$$\text{Weighted payoff} = P_i \cdot \text{Best payoff under state } i$$

Step 5: Sum the weighted payoffs. Add all weighted payoffs together:

$$EPPI = \sum_i P_i \cdot \text{Best payoff under state } i$$

This gives the Expected Profit with Perfect Information. Thus, EPPI is the maximum attainable value of EMV under perfect information about the occurrence of the states of nature.

2.3.2 EXPECTED VALUE OF PERFECT INFORMATION (EVPI):

The expected value of perfect information (EVPI) represents the excess of the amount earned under the environment of certainty over the expected monetary value (EMV) under the environment of risk. In other words, it represents the value of the maximum amount to be paid to get perfect information. If EMV* represents the expected monetary value under the environment of risk (i.e., probabilities are associated with states of nature) then EVPI is defined as

$$EVPI = EPPI - EMV$$

EVPI provides a criterion by which to judge ordinary imperfectly informed forecasters. EVPI can be used to reject costly proposals: if one is offered knowledge for a price larger than EVPI, it would be better to refuse the offer. However, it is less helpful when deciding whether to accept a forecasting offer, because one needs to know the quality of the information one is acquiring.

2.3.2.1 There are several characteristics of EVPI that always hold:

The value of information can never be less than zero since the decision-maker can always ignore the additional information and make a decision as if such information is not available.

No other information gathering/sharing activities can be more valuable than that quantified by EVPI.

In a decision problem with two choices, and two possible outcomes for the random variable, EVPI cannot exceed half the maximum difference in the reward under each outcome

2.4 DECISION MAKING UNDER UNCERTAINTY

Decision-making under uncertainty involves choosing actions when outcomes are unpredictable, using probabilistic models, optimization, and adaptive strategies to manage risk and improve decision quality.

Decision-making under uncertainty occurs when the outcomes of choices cannot be predicted with certainty, often due to incomplete information, stochastic events, or complex interdependencies between variables.

2.4.1 Probabilities and Expected Value

Expected value (EV) is the simplest formal method for evaluating uncertain outcomes. It represents the weighted average of all possible outcomes, where each outcome is multiplied by its probability of

occurrence. In mathematical terms, it converts a probability distribution over outcomes into a single summary quantity.

The appeal of expected value lies in its clarity. If probabilities are known and outcomes can be expressed in a common unit, the option with the highest expected value can be identified as the best choice for a risk-neutral decision-maker. This makes expected value especially useful in gambling, finance, engineering reliability, insurance, and other domains where repeated exposure or portfolio logic can make average outcomes meaningful.

However, expected value treats outcomes only in terms of their numerical magnitude. It does not ask whether a gain of 100 means the same thing to a poor decision-maker as to a wealthy one, or whether a large downside risk is psychologically or practically tolerable even when the average payoff is attractive. That limitation is one reason expected utility became so important.

Probabilities provide a structured way to handle risk, while expected value offers a rational benchmark for decision-making. Together, they form the foundation of managerial economics tools like decision trees and sensitivity analysis, enabling managers to evaluate alternatives systematically under uncertain conditions.

This concept is particularly useful in situations where decisions involve risk and uncertainty.

The formula for expected value (EV) is given by:

$$EV = \sum_{i=1}^n P_i \times O_i$$

Where, P_i is the probability of the i^{th} outcome, and O_i is the value of the i^{th} outcome.

2.4.1.1 Benefits of Using Expected Value in Decision Making

The use of expected value in decision making offers several benefits:

- 1) **Clarity and Objectivity:** Expected value provides a clear, quantifiable measure that is based on the probabilities and outcomes of different scenarios, reducing the influence of personal biases.
- 2) **Simplification of Complex Decisions:** By condensing multiple outcomes and their probabilities into a single number, expected value simplifies the comparison of different decision options.
- 3) **Improved Decision Making Under Uncertainty:** Expected value is particularly useful in situations involving uncertainty, as it helps decision makers understand the potential average outcome of their choices.

2.5 Decision Making Under Uncertainty Attitude Towards Risk:

Decision-making under uncertainty means the act of choosing among options wherein the outcomes are unknown, common across various fields, from financial investment, health, and business strategy. This

is heavily influenced by the attitude of the individual or organization towards risk, which thus impresses a distinct character in the different choices made. It is attitudes toward risk that ultimately determine decision making under uncertainty and form choices and strategies in uncertain environments. Hence, on identifying such attitudes, individuals and organizations will be able to come up with better ways of managing risk and optimizing outcomes from decisions. Risk attitudes towards uncertainty are;

- 1) **Risk Aversion:** Risk-averse individuals prefer certainty, which makes them opt for choices with lower potential returns in case they involve less risk. They try to shun gambles or investments that will involve losses, even with the chances of getting a higher reward.
- 2) **Neutrality to Risk:** Risk-neutral decision-makers are primarily concerned with the expected outcome of their choices; all that matters to them is the expected outcome, as they are indifferent to the level of risk involved. To them, options are considered for their probable returns rather than the risks connected.
- 3) **Risk Seeking:** The risk-seeking type will go for options with higher risks, hoping for larger gains. They are inclined to take gambles or investments associated with high uncertainty if there is a good possibility of large gains.
- 4) **Deviation for Decision Making:** Knowing one's attitude toward risk is cardinal in making decisions under uncertainty. For example, the risk-averse may prefer diversified investment portfolios that minimize potential loss, while risk-loving individuals may undertake high-volatility stocks seeking high returns.

Comparison of Risk Attitudes in Economics;

Risk Attitude	Meaning	Example
Risk Aversion	Individuals prefer safe outcomes and avoid uncertainty	Buying insurance instead of investing in risky stocks
Risk Neutrality	Individuals focus only on expected returns and ignore risk	Choosing investments based only on average returns
Risk Seeking	Individuals prefer risky options for higher possible gains	Investing in high-volatility cryptocurrencies

Real World Examples of Decision Making under Uncertainty. Decision making under uncertainty appears in many real-life situations:

1. **Investment decisions:** Investors face the challenge of choosing between safe bonds and risky stocks because they lack knowledge about future market performance.
2. **Insurance purchase:** Risk-averse people purchase insurance policies to safeguard themselves against unpredictable financial damages.

3. **Business strategy:** Companies launching new products face uncertainty about consumer demand and market competition.

2.6 EXPECTED UTILITY THEORY

Expected utility (EU) extends expected value by introducing the idea that outcomes are not evaluated purely as objective quantities. Instead, they are transformed through a utility function that reflects the decision-maker's subjective valuation of those outcomes.

Expected utility theory is founded on Bernoulli's famous paper, "Exposition of a New Theory on the Measurement of Risk", which was published in 1738. It was an attempt to resolve the Petersburg paradox. Bernoulli argued that people do not respond to money linearly and that the value of an increment of wealth depends on the level of wealth already possessed. Further development in expected utility theory was done in the mid-20th century by economist John Von Neumann and mathematician Oskar Morgenstern. They introduced the concept of expected utility theory in their book, "Theory of Games and Economic Behaviour", which was published in 1944. It assesses the probability-weighted value of different outcomes, helping individuals make informed decisions under uncertainty.

2.6.1 Utility functions and decision behaviour

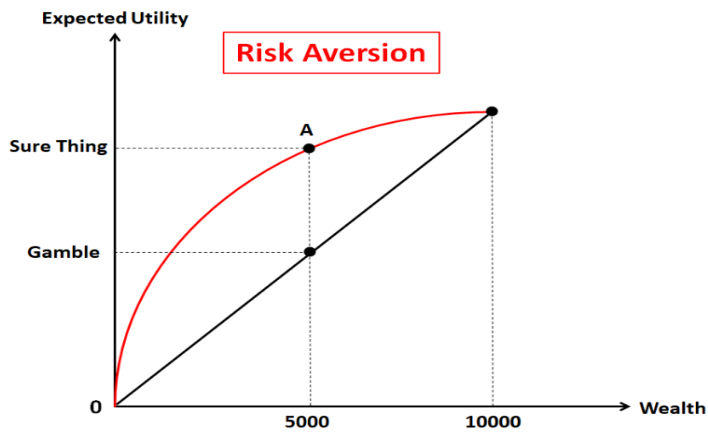
The shape of the utility function determines how uncertainty is valued. A concave utility function implies diminishing marginal utility and therefore risk aversion. A linear function implies risk neutrality. A convex function implies risk-seeking behaviour over the relevant range.

In principle, utility functions allow highly nuanced decision modelling. In practice, however, they are not always easy to elicit or justify. Preferences may vary across individuals, domains, time horizons, and institutional settings. A person may be risk-averse about health outcomes, risk-neutral in routine budgeting, and risk-seeking in entrepreneurial strategy.

2.6.1.1 Risk Preferences in Expected Utility Theory

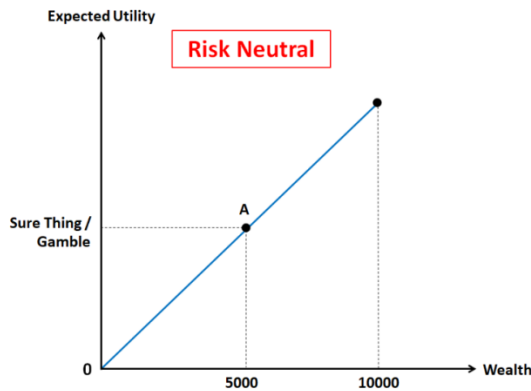
Expected utility therefore allows decision-makers to model different attitudes toward risk. Risk preferences can be understood by considering an example of a hypothetical situation of lottery tickets, which can be represented by a risk-aversion graph, a risk-neutral graph, or a risk-seeking graph.

Risk Aversion



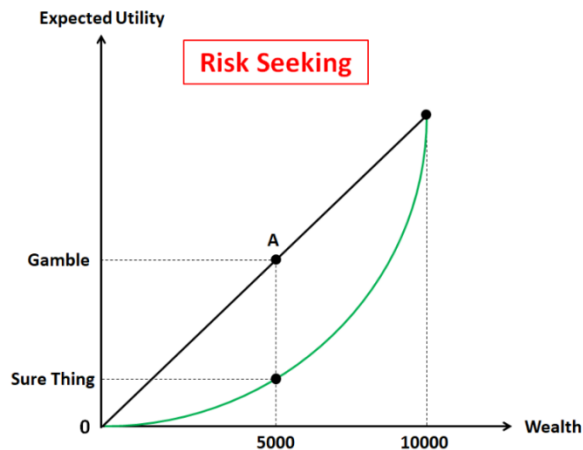
In the above graph, we have taken wealth on the horizontal axis (x-axis) and utility on the vertical axis (y-axis). The red upward curve shows the value of expected utility with respect to wealth. The person who is playing the simple lottery goes with the sure thing because he is risk-averse and less tolerant of risk. This person doesn't prefer to gamble, as the utility value of gambling is low and consists of low returns.

Risk Neutral



In the above graph, the blue curve shows risk-neutral behaviour. The person is risk-neutral in this situation because the utility-wealth curve is a straight line.

Risk Seeking



In the above graph the green downward curve shows risk-seeking behaviour, and the person is more likely to take a risk because the value of utility to wealth is less shown as a sure thing in the graph. This person prefers to gamble instead of choosing a sure thing.

2.6.1.2 Limits of expected value and expected utility

Expected value and expected utility are powerful, but both have important limitations.

First, they require probabilities. In many real-world situations, probabilities are uncertain, disputed, unstable, or impossible to estimate with confidence. When the probability model itself is fragile, both EV and EU become harder to apply cleanly.

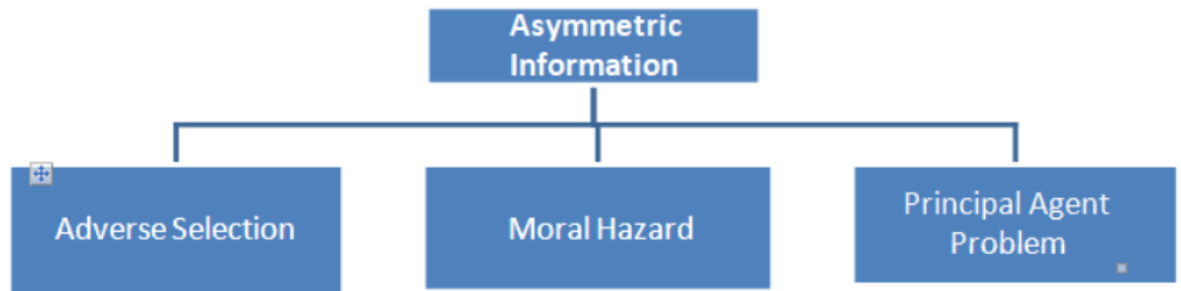
Second, expected utility assumes that preferences can be represented coherently and with enough stability to support formal analysis. Yet, behavioural research shows that preferences are often context-dependent, influenced by framing, loss aversion, reference points, and cognitive bias.

Third, these models typically evaluate outcomes in a relatively contained way. In complex systems, outcomes may depend on feedback loops, interdependence, dynamic adaptation, and path dependence. In those environments, the decision problem may not be adequately represented by a fixed menu of states and payoffs alone.

2.7 ASYMMETRIC INFORMATION;

According to Macmillan dictionary of modern Economics, Asymmetric information implies differences in the information processed by the parties to a market transaction. Buyers and sellers have unequal knowledge of the relevant information. This absence of perfect (or equal) information on the part of buyers and sellers precludes perfect competition

Presence of asymmetric information can give rise to a number of outcomes such as adverse selection, Moral hazard or Principal-agent problem



2.7.1 ADVERSE SELECTION

First major outcome of asymmetric information can be a phenomenon called as adverse selection as sellers may have access to information that buyers do not have or vice-versa, often resulting in transactions that can negatively affect the less-informed party.

The relationship between adverse selection and information asymmetry is inherently symbiotic; they do not exist independently of each other but are the two sides of the same coin in financial markets. The existence of adverse selection is often a direct result of information asymmetry in the market. They represent the complexity and potential challenges that arise from imperfect or unevenly distributed information in financial markets. The role of information asymmetry, therefore, is to act as a breeding ground from which adverse selection can occur and persist.

The phenomenon of adverse selection was mainly explained by Akerlof (1970) in case of second hand car market. If the potential buyers are not able to distinguish between a high-quality car and a low quality car (which in America is known as “lemon”), they will only willing to pay a fixed price for a car that averages the value of a good car and “lemon” together. But sellers know whether they hold a good car or a bad car. Given the fixed price at which buyers will buy, sellers will sell only when they hold “lemons” and they will leave the market when they hold a high-quality car. Eventually, as enough sellers of high-quality second-hand cars leave the market, the average willingness-to-pay of buyers will decrease (since the average quality of cars on the market decreased), leading to even more sellers of high-quality cars to leave the market through a positive. Therefore, Adverse selection is the market mechanism that leads to a market collapse.

2.7.2 Problems caused by adverse selection

1. Market Failure: When uninformed participants face unfavourable terms, they may exit the market and over time, this imbalance may collapse the market entirely.
2. Premium Escalation (Insurance “Death Spiral”): High-risk individuals are more likely to buy insurance, while low-risk individuals opt out. Insurers raise premiums to cover higher claims, which drives even more low-risk customers away, worsening the imbalance.

3. Inefficient Market Operations (Lemons Problem): Good quality products or low-risk customers are driven out because prices don't reflect true quality or risk and bad quality products (lemons) dominate, reducing efficiency and trust in the market.
4. Corporate Sustainability Risks: Firms may allocate resources poorly due to incomplete information. They may take on risky projects without fully understanding the risks, undermining long-term growth.
5. Financial Crisis Amplification: In the 2007–2008 crises, lenders approved risky borrowers (subprime/NINJA loans) without adequate information. This adverse selection contributed to widespread defaults and systemic collapse.

Adverse selection can be mitigated through information disclosure, contractual safeguards, regulatory oversight, and risk screening mechanisms. Together, these strategies reduce information asymmetry, enhance market efficiency, and protect both buyers and sellers.

2.7.3 MORAL HAZARD

Moral hazard is a situation in which one party gets involved in a risky event knowing that it is protected against the risk and the other party will incur the cost. It arises when both the parties have incomplete information about each other. The phrase “moral hazard” originally comes from the insurance world and is based largely on the fact that each party has different information regarding a situation – specifically, differing information on the actual level of risk.

In a financial market, there is a risk that the borrower might engage in activities that are undesirable from the lender's point of view because they make him less likely to pay back a loan. It occurs when the borrower knows that someone else will pay for the mistake he makes. This in turn gives him the incentive to act in a riskier way. This economic concept is known as moral hazard.

2.7.4 LEMON PROBLEMS

The lemons problem refers to issues that arise regarding the value of an investment or product due to asymmetric information possessed by the buyer and the seller. The lemons problem was put forward in a research paper, "The Market for 'Lemons': Quality Uncertainty and the Market Mechanism," written in the late 1960s by George A. Akerlof, an economist and professor at the University of California, Berkeley. The tag phrase identifying the problem came from the example of used cars Akerlof used to illustrate the concept of asymmetric information, as defective used cars are commonly referred to as “lemons.” Akerlof used the example of the used car market, where sellers know more about the quality of the car than buyers. Because buyers cannot easily distinguish between good-quality cars and defective ones (lemons), they are only willing to pay an average price. This creates a problem: sellers of high-quality cars withdraw from the market because the price is too low, leaving mostly low quality cars behind. Over time, this process leads to adverse selection, where bad-quality goods drive out good-quality goods.

Asymmetric information is at the core of this issue. Sellers have private knowledge about the product's true condition, while buyers must rely on limited or imperfect information. This imbalance reduces trust in the market. Buyers become cautious and lower their willingness to pay, which in turn discourages sellers of high-quality goods from participating. The result is a decline in overall market efficiency and, in extreme cases, complete market collapse. This problem is not limited to used cars. It appears in many real-world markets. For example, in insurance markets, individuals know more about their health or risk levels than insurers. High-risk individuals are more likely to buy insurance, leading to higher premiums and driving out low-risk individuals. Similarly, in labor markets, employers may struggle to assess the true productivity of workers, especially before hiring.

To address the lemons problem, several solutions have been developed. One approach is signaling, where informed parties provide credible information about quality. For instance, warranties, certifications, and brand reputation help assure buyers about product quality. Another solution is **screening**, where the less-informed party (such as buyers or employers) designs mechanisms to reveal information, like inspections, tests, or interviews. Government regulations, quality standards, and consumer protection laws also help reduce information asymmetry. In conclusion, the lemons problem highlights how asymmetric information can distort markets and lead to inefficient outcomes. Without proper mechanisms to ensure transparency and trust, markets may fail to function effectively, reducing welfare for both buyers and sellers.

2.7.5 The lemons principle: The basic tenet of the lemon's principle is that low-value cars force high-value cars out of the market because of the asymmetrical information available to the buyer and seller of a used car. This is primarily due to the fact that a seller does not know what the true value of a used car is and, therefore, is not willing to pay a premium on the chance that the car might be a lemon. Premium-car sellers are not willing to sell below the premium price so this results in only lemons being sold.

2.8 ANSWERS TO 'CHECK YOUR PROGRESS'

1. The concept of risk and uncertainty can be better explained and understood in contrast to the concept of certainty.
2. Risk refers to a situation in which a business decision is expected to yield more than one outcome and the probability of each outcome is known to the decision makers or it can be reliably estimated.
3. The probability of outcomes of a decision can be estimated statistically by way of standard deviation' and 'coefficient of variation'.
4. Classical economists, like, Jeremy Bentham, Leon Walrus and Carl Menger and the neo-classical economist, notably Alfred Marshall, believed that utility is cardinally or quantitatively measurable.
5. When an individual's utility of the gamble's expected value is higher than the expected utility from the gamble itself, the individual is considered to be risk averse.

6. When an individual's utility of the gamble's expected value is exactly equal to the expected utility from the gamble itself, they are categorised as being risk neutral.
7. People have different attitude towards risk based on whether the marginal utility of money increases, diminishes or remains constant.
8. It is argued by Friedman and Savage that an individual can be at the same time risk averse and risk loving for different choices and for different segments of wealth.
9. Uncertainty is a case when there is more than one possible outcome to a decision and where the probability of each specific outcome occurring is not known.
10. The condition of certainty refers to a state of perfect knowledge. It implies that investors have complete knowledge about the market conditions, especially the investment opportunities, cost of capital and the expected returns on the investment.
11. This method is 'a crude rule of thumb' and can hardly be defended except on the ground of avoiding risk associated with long pay-back projects. Besides, this method assumes that cash inflows are known with a high degree of certainty.
12. The decision index is, in fact, a weighted average of maximum possible and minimum possible pay-offs, weight being their subjective probability such that sum of probabilities of maximum (Max) and minimum (Min) pay-offs equals one.
13. Asymmetric information is a situation where some people have more information about a thing than others. Asymmetric information is characteristic of many business situations.
14. Market failure arises because there are owners of high-quality cars who value their cars less than potential buyers of high-quality cars. As a result, both parties can enjoy gains from trade.
15. The implications of asymmetric information about product quality were first analysed by George Akerlof.
16. Moral hazard occurs when an insured party whose actions are unobserved can affect the probability or magnitude of a payment associated with an event.

2.9 QUESTIONS AND EXERCISES

2.9.1 Short-Answer Questions

1. What is certainty? What are the two approaches to estimate probabilities of outcomes of a business decision?
2. What is uncertainty? How can it be classified?
3. What is subjective probability distribution?
4. What led to the idea of cardinal utility and ordinal utility? Why have the modern economists discarded the concept of cardinal utility?
5. Who is a risk-averse person? How can his behaviour be captured?
6. Illustrate graphically the attitude of a risk averter towards risk.
7. What is decision analysis?
8. Distinguish between certainty and uncertainty.

9. Write a note on the concept of present value.
10. Hurwicz has suggested a criterion for investment decisions under uncertainty.'
11. What is this criterion?
12. Why do automobile companies offer warranties on parts and service for new cars?
13. How does the market for used cars describe the idea of asymmetric information?
14. What is the lemon's problem?
15. Write a note on adverse selection and signalling.
16. What is a moral hazard?

2.9.2 Long Answer Questions

- Differentiate between uncertainty and risk in decision making.
- Discuss the ordinal and cardinal measures of utility.
- Based on the behaviour that people project towards risk, it is possible to place them under one of the three distinct categories.' What are these categories?
- Evaluate the elasticity of marginal utility and risk aversion.
- Describe absolute and relative risk aversion.
- Discuss the concept of risk, certainty and uncertainty. Also, discuss choices taken under uncertainty.
- Describe investment decisions under the condition of certainty.
- Evaluate investment decisions under the condition of uncertainty.
- Assess the concept of asymmetric information. Also, discuss the implications of asymmetric information using the example of market for used cars.
- Critically evaluate the term 'adverse selection' and 'signalling'.
- What is moral hazard? Discuss.
- Discuss the applications of moral hazards on insurance.

2.10 REFERENCE AND CREDITS

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UNIT 3 THEORY OF FIRMS

3.0 Introduction

3.1 The Traditional Theory of Firm And Its Evaluation:

3.1.1 Criticisms of The Traditional Theory of The Firm Include

3.2 Baumol's Sales Revenue Maximization Model: (Static And Dynamic)

3.2.3 Static Model : Without Advertisement

3.2.1.1 Arguments In Support of The Theory

3.2.1.1.1 Criticism:

3.2.4 Dynamic Model:

3.2.2.1 Assumptions

3.2.2.1 The Multi-Period Model

3.3 Bain's Limit Pricing Theory

3.3.1 Assumptions of Bain's Model of Limit Pricing:

3.3.2 Diagrammatic Representation of The Limit Pricing Model

3.4 Marris's Model of Managerial Enterprise

3.4.1 Equilibrium of The Firm

3.5 Williamson Model of Managerial Discretion

3.5.1 Simplification of the Model:

3.5.1.1 Graphical Presentation of Williamson's Model of Managerial Discretion

3.5.1.2 Criticism

3.6 ANSWERS TO 'CHECK YOUR PROGRESS'

3.7 QUESTIONS AND EXERCISES

3.7.1 Short-Answer Questions

3.7.2 Long-Answer Questions

3.8 REFERENCE AND CREDITS

3.0 INTRODUCTION

The theory of the firm is a part of microeconomics that studies how firms make decisions about production, pricing, and resource use. A firm combines factors like land, labour, capital, and entrepreneurship to produce goods and services, mainly to earn profit. This theory explains how firms

decide what to produce, how much to produce, and at what price to sell. It also helps in understanding how firms respond to changes in demand, costs, and technology. By studying firm behaviour under different market structures, the theory provides insight into how businesses operate and contribute to the overall economy

The following theory of firms are explained below:

- 1) The traditional theory of firm and its evaluation
- 2) Baumol's sales revenue maximization model
- 3) Bian's limit pricing theory
- 4) Marris 's model of managerial enterprise
- 5) Williamson model of managerial discretion

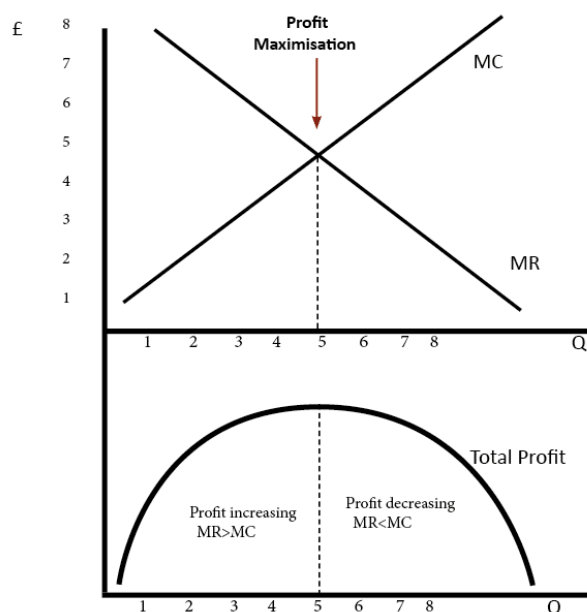
3.1 THE TRADITIONAL THEORY OF FIRM AND ITS EVALUATION:

The traditional theory of the firm is based on classical economics and the work of early economists, such as David Ricardo and Leon Walras. This theory focuses on profit maximization as the sole objective of firms. it dominated economic thought for much of the 19th and early 20th centuries.

The basic assumptions of the traditional theory of the firm are

1. Firms seek to maximise profits.
2. Information symmetry. Owners and workers of the firm have access to good information which enables them to maximise profits.
3. Firms act as a homogenous unit with owners wishing to maximise profits and these aims being achieved by managers and workers.
4. To maximise profits a firm makes use of marginal analysis. In particular profit maximisation occurs at an output where marginal revenue = marginal cost.
5. Firms and managers are rational. With their rational objectives being to maximise profits.

Profit maximisation is assumed that firms wish to maximise profits because this will enable the owners and managers to maximise their own salary, bonus and dividends. To maximise profits, they will seek to cut costs and set the profit maximising price and level of output.



This is a model to show that a firm will maximise profits by setting the output at five and setting price where $MR=MC$ (£5)

Whilst the traditional theory of the firm remains a useful starting point for investigating the behaviour of firms and is still taught as a foundation in economics, the traditional theory of the firm is increasingly questioned by modern economists.

3.1.1 Criticisms of the traditional theory of the firm include

- Firms are not a homogenous unit. Owners may want profit maximisation, but managers and workers may have different objectives.
- Other objectives to profit maximisation. Profit maximisation is not the only goal of a firm, it could include maximising sales, maximising market share, social responsibility (e.g. looking after the environment) and co-operatives which seek to improve the welfare of all society.
- Marginal approach to firms is not replicated in the real world. businessmen do not have time or the ability to work out the marginal cost and marginal revenues. They tend to use a rough 'rule of thumbs' such as average cost + profit margin. Prices may also be sticky (not change) even if marginal cost and marginal revenue changes.
- Imperfect information. Firms have imperfect information about prices, costs and competitors. Also, workers are not like a typical factor of production. They may become demotivated or discouraged if work appears boring or lacking in interest. This can affect the objectives of firms.
- Behavioural economics. Recent behavioural economists, Thaler and Aversky state the importance of human psychology in determining the behaviour of firms – a much more complex set of circumstances than simple profit maximisation

3.2 BAUMOL'S SALES REVENUE MAXIMIZATION MODEL: (Static and Dynamic)

Prof. Baumol in his book *Business Behaviour, Value and Growth* (1967) has presented a managerial theory of the firm based on sales maximisation. This model, like other managerial theories, is an alternative to the profit maximization model.

According to him, the sales maximization model is one of the managerial theories of the firm. In this model, more emphasis was given to the manager's role and their interest in deciding price, output and advertising policies.

The objective of this model is not to maximize the physical volumes of sales but to maximize the total revenue from sales. Thus, this theory is also known as the revenue maximization model.

He discusses two models of sales maximisation: a static model and a dynamic model.

3.2.5 Static Model : Without Advertisement

The model is based on the following assumptions:

1. There is a single period time horizon of the firm.
2. The firm aims at maximising its total sales revenue in the long run subject to a profit constraint.
3. The firm's minimum profit constraint is set competitively in terms of the current market value of its shares.

4. The firm is oligopolistic whose cost curves are U-shaped and the demand curve is downward sloping. Its total cost and revenue curves are also of the conventional type.

Baumol's findings of oligopoly firms in America reveal that they follow the sales maximisation objective. According to Baumol, with the separation of ownership and control in modern corporations, managers seek prestige and higher salaries by trying to expand company sales even at the expense of profits.

Baumol cites evidence to suggest that short-run revenue maximisation may be consistent with long-run profit maximisation. But sales maximisation is regarded as the short-run and long-run goal of the management. Sales maximisation is not only a means but an end in itself.

3.2.1.1 Arguments in support of the theory

1. A firm attaches great importance to the magnitude of sales and is much concerned about declining.
2. If the sales of a firm are declining, banks, creditors and the capital market are not prepared to provide finance to it.
3. Its own distributors and dealers might stop taking interest in it.
4. Consumers might not buy its product because of its unpopularity.
5. Firm reduces its managerial and other staff with fall in sales.
6. But if firm's sales are large, there are economies of scale and the firm expands and earns large profits.
7. Salaries of workers and management also depend to a large extent on more sales and the firm gives them bonus and other facilities.

By sales maximisation, Baumol means maximisation of total revenue. It does not imply the sale of large quantities of output, but refers to the increase in money sales (in rupee, dollar, etc.). Sales can increase up to the point of profit maximization where the marginal cost equals marginal revenue.

If sales are increased beyond this point money sales may increase at the expense of profits. But the oligopolistic firm wants its money sales to grow even though it earns minimum profits. Minimum profits refer to the amount which is less Quantity than maximum profits. The minimum profits are determined on the basis of firm's need to maximize sales and also to sustain growth of sales.

Minimum profits are required either in the form of retained earnings or new capital from the market. The firm also needs minimum profits to finance future sales. Further, they are essential for a firm for paying dividends on share capital and for meeting other financial requirements.

Thus minimum profits serve as a constraint on the maximisation of a firm's revenue. "Maximum revenue will be obtained only" according to Baumol, "at an output at which the elasticity of demand is unity, i.e. at which marginal revenue is zero."

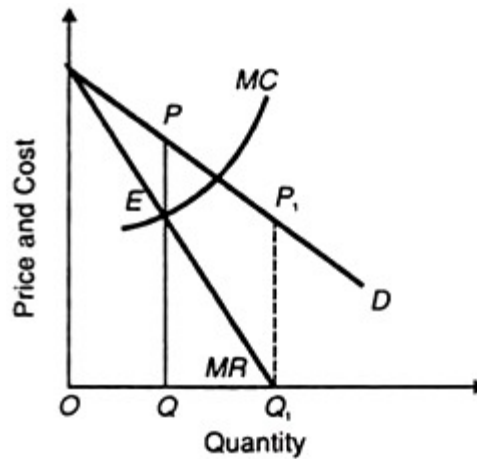


Fig. 5

This is the condition which replaces the “marginal cost equals marginal revenue profit maximisation rule.” This is shown in Figure 5 where the profit maximisation firm produces OQ output where $MC = MR$ at point E. But the sales maximisation firm will produce OQ₁ output where MR is zero.

Baumol’s model is illustrated in Figure 6 where TC is the total cost curve, TR the total revenue curve, TP the total profit curve and MP the minimum profit or profit constraint line. The firm maximises its profits at OQ level of output corresponding to the highest point B on the TP curve.

But the aim of the firm is to maximise its sales rather than profits. Its sales maximisation output is OK where the total revenue KL is the maximum at the highest point of TR.

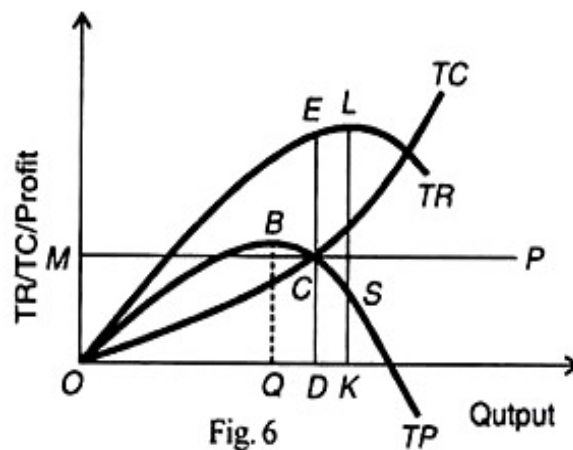


Fig. 6

This sales maximisation output OK is higher than the profit maximisation output OQ. But sales maximisation is subject to minimum profit constraint. Suppose the minimum profit level of the firm is represented by the line MP.

The output OK will not maximise sales as the minimum profits OM are not being covered by total profits KS. For sales maximisation the firm should produce that level of output which not only covers the minimum profits but also gives the highest total revenue consistent with it.

This level is represented by OD level of output where the minimum profits DC (=OM) are consistent with DE amount of total revenue at the price DE/OD, (i.e., total revenue/total output). Baumol’s model of sales maximisation points out that the profit maximisation output OQ will be smaller than the sales maximisation output OD, and price higher than under sales maximisation.

The reason for a lower price under sales maximisation is that both total revenue and total output are equally higher while under profit maximisation total output is much less as compared to total revenue. Imagine if QB is joined to TR in Figure 6. “If at the point of maximum profit”, writes Baumol, “the firm earns more profit than the required minimum, it will pay the sales maximiser to lower his price and increase his physical output.”

3.2.1.1.1 Criticism:

Baumol’s sales maximisation model is not free from certain weaknesses.

1. Rosenberg challenges Baumol’s sales maximisation model by questioning the practicality of the profit constraint. He argues that firms cannot easily determine a precise minimum profit level, since choices always involve trade-offs between profit and sales. If two options fall below the constraint, the firm will prefer the one with higher profit; if two options yield the same profit, the one with greater sales will be chosen. Even on the profit constraint line itself, firms still favour the option with higher sales. This shows that the model’s reliance on a fixed profit constraint is problematic, making Baumol’s framework less workable in real-world decision-making.
2. According to Shepherd, under oligopoly a firm faces a kinked demand curve and if the kink is large enough, total revenue and profits would be the maximum at the same level of output. So both the sales maximiser and the profit maximiser would not be producing different levels of output.
3. Hawkins has shown that if the firm is engaged in any form of non-price competition such as good packaging, free service, advertising, etc., Shepherd’s conclusions become invalid. When the sales maximiser spends more on advertising, his output will be more than that of the profit maximiser. This is because the kink of the former’s demand curve will occur to the right of the kink of the profit maximiser.
4. Hawkins has also shown that Baumol’s conclusion that a sales maximiser will in general produce and advertise more than a profit maximiser, is invalid. According to Hawkins, a sales maximiser “may choose a higher, lower or identical output, and a higher, lower or identical advertising budget. It depends on the responsiveness of demand to advertising rather than price cuts.”
5. In the case of multiproduct, Baumol has argued that revenue and profit maximisation yield the same results. But Williamson has shown that sale maximisation yields different results from profit maximisation.
6. Another weakness of this model is that it ignores the interdependence of the prices of oligopolistic firms.
7. The model fails to explain “observed market situations in which price are kept for considerable time periods in the range of inelastic demand.”
8. The model ignores not only actual competition, but also the threat of potential competition from rival oligopolistic firms.
9. The model does not show how equilibrium in an industry, in which all firms are sales maximisers, will be attained. Baumol does not establish the relationship between the firm and industry.

3.2.6 Dynamic model:

The dynamic model is an improvement over the static single-period model. The most serious weakness of the static model is the short time-horizon of the firm and the treatment of the profit constraint as an exogenously determined variable. These problems have been solved in the dynamic model by incorporating an extended time-horizon and endogenising the profit constraint.

The dynamic model assumes that firms evaluate present and future revenues using discounted values, ensuring that current decisions contribute to sustained growth. As a result, firms may adopt strategies such as lowering prices or increasing output to capture larger market share, thereby securing stronger sales growth trajectories. This approach highlights the importance of long-term expansion, competitive positioning, and stability, contrasting with the static model's focus on immediate outcomes.

3.2.2.1 Assumptions

- 1) The firm maximises the rate of growth of sales over its lifetime.
- 2) Profit is the main source of finance for growth of sales. It is an instrumental variable whose value is endogenously determined.
- 3) Demand is downward sloping and costs curves are U-shaped.

3.2.2.1 The Multi-period Model

Let us assume that the sales revenue (R) grows at a rate of g percent. Over its lifetime, the stream of revenues would be, R, R (1+ g), R (1+ g)²....., R (1+g)ⁿ.

Suppose i is the subjective rate of discount of the firm. It is exogenously given by the expectations and risk-preferences of the firm. The discount rate is higher than any form of market interest rate because it includes subjective assessment of risk. The present value of the stream of future revenues is estimated by using 'i' in the discount factor as follows:

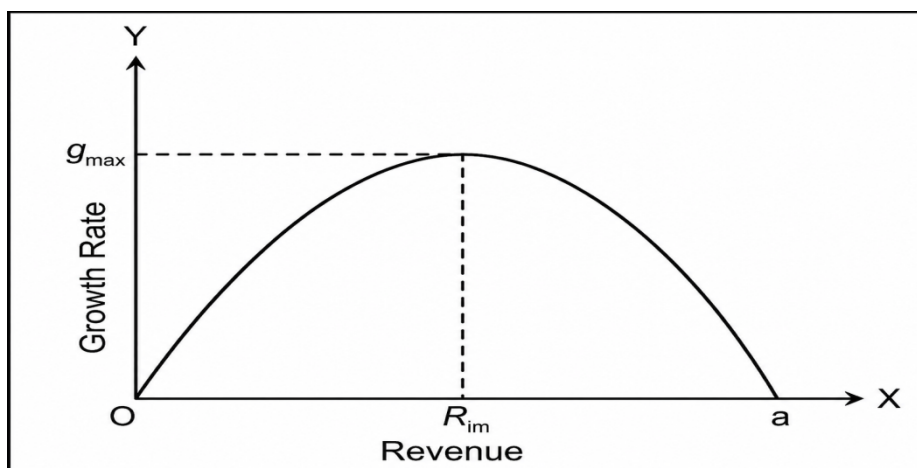
$$R, R\left(\frac{1+g}{1+i}\right), R\left(\frac{1+g}{1+i}\right)^2, \dots, R\left(\frac{1+g}{1+i}\right)^n$$

The total present (discounted) value of all f

$$S = \sum_{t=0}^n R \left(\frac{1+g}{1+i}\right)^t \quad (t = 0, 1, \dots, n)$$

S = future stream of sale

The growth function is derived from profit function, as growth of firm is mainly financed by retained profits. The highest attainable growth rate is achieved when profit is maximised



Expansion of the firm depends on the current level of profit because the retained portion of π is the primary source of growth. Consequently, the highest attainable growth rate (g) will be at the point of maximum profit. Beyond the level of sales revenue where profits are maximised, say, R_M , the growth rate g will decline as π declines. Beyond that point, however, current sales revenue continues to increase but the rate of growth declines. This feature is represented in the above figure.

To arrive at the equilibrium, we will consider an iso-present value curve, which shows all combinations of g and R , which yield the same S .

$$S = a_1 g + a_2 R$$

$$g = \frac{1}{a_1} S - \frac{a_2}{a_1} R$$

$$R = \frac{1}{a_2} S - \frac{a_1}{a_2} g$$

Plotting this in the $g - R$ plane would give us a downward sloping straight line. The further away an iso-present value curve is from the origin, the higher is the value of S . This is depicted as follows:

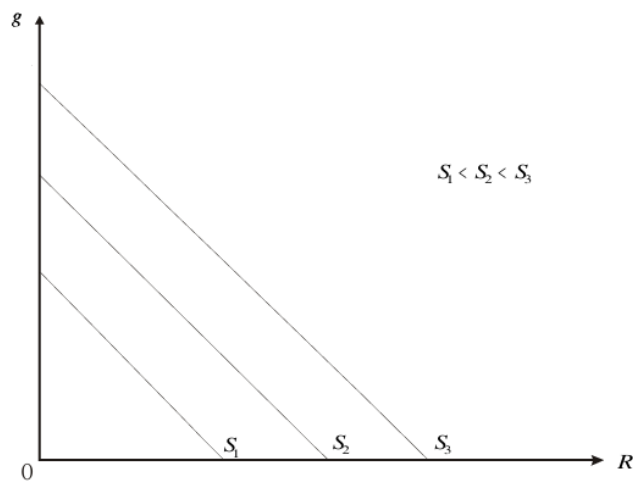


Fig. 12.8: Iso - Present Value Curve

Superimposing the growth curve of the above on Figure 12.8, we arrive at the equilibrium level of g^* , R^* in Figure 12.9, where the growth-curve is tangent to the highest iso-present value curve to get the highest possible level of S subject to the growth constraint.

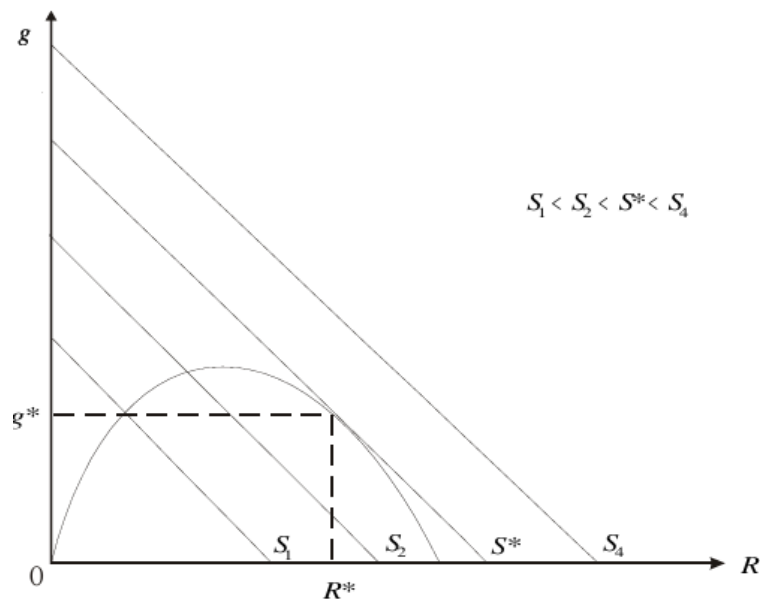


Fig. 12.9: Equilibrium in Growth -Curve

The equilibrium output, price and profit can be determined as shown in Figure 12.10.

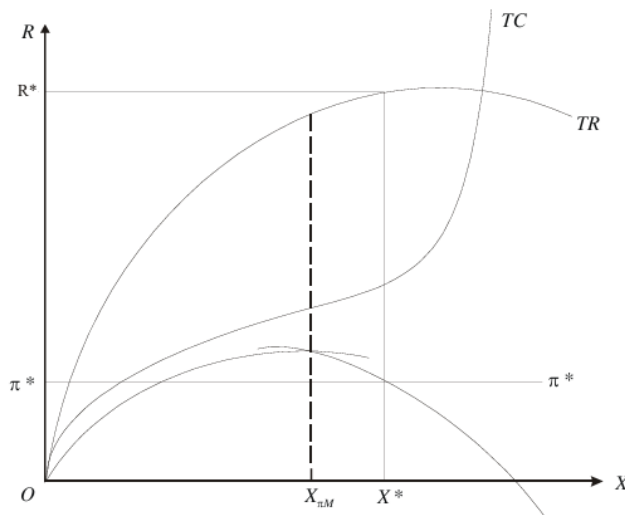


Fig. 12.10: Equilibrium Output, Price and Profit Under Revenue Maximising Curve

Given R^* , the equilibrium output X^* is obtained from the TR curve. The equilibrium price P^* is given by OR^*/OX^* . From the total profit curve, the amount of profit that accrues to the firm in equilibrium is given by π^* .

3.3 BAIN'S LIMIT PRICING THEORY

J. S. Bain, in his pioneering work 'A Note on Pricing in Oligopoly and Monopoly' (1949), followed by his book 'Barriers to New Competition', developed the theory of limit pricing. According to him, the limit theory implies that firms do not maximize profit in the short run because of the fear of excessive profit, which induces the entry of new firms and thus reduces the profits in the long run.

According to Bain, the price is not set at the minimum point of the long-run average cost curve. He explained that the firms deliberately set a price above the minimum of the long-run average cost in order to restrict the potential entry of new firms.

Thus, the 'limit price' was the highest price, which the established firms believed they could charge without inducing further entry. This price may be lower than the price set by the profit-maximizing firm. This theory is basically related to the case of a collusive oligopoly firm.

According to Bain, the limit price is determined by the following:

- The cost of the potential entrants,
- Market size where firms are operating
- The number of established firms in the industry
- Price elasticity of demand for the industry product and
- The shape of the long-run average cost Curve.

3.3.1 Assumptions of Bain's Model of Limit Pricing:

1. There are some established firms in the industry.
2. The market demand curve for the product is not affected by price adjustment by the existing firms or by the entry of new firms in the industry.
3. There is effective collusion among the firm which is based upon the dominant leader firm.
4. There are long-run price and output adjustments.
5. The leader firm fixes the limit price below which entry will not take place.
6. The other firms in the group follow a unified price policy.
7. The established firms seek the maximization of their own long-run growth.

Under Bain's Model, he defined the limit price model as the condition for entry. The condition for entry is defined as a percentage by which an established firm can increase the price above the competitive price without attracting the entry of new firms into the industry. The conditions for entry can be expressed mathematically as follows:

$$C = P_L - P_c / P_c$$

$$\text{Or } P_L = P_c (1 + C)$$

Where,

P_L is the limit price

P_c is the perfectly competitive price

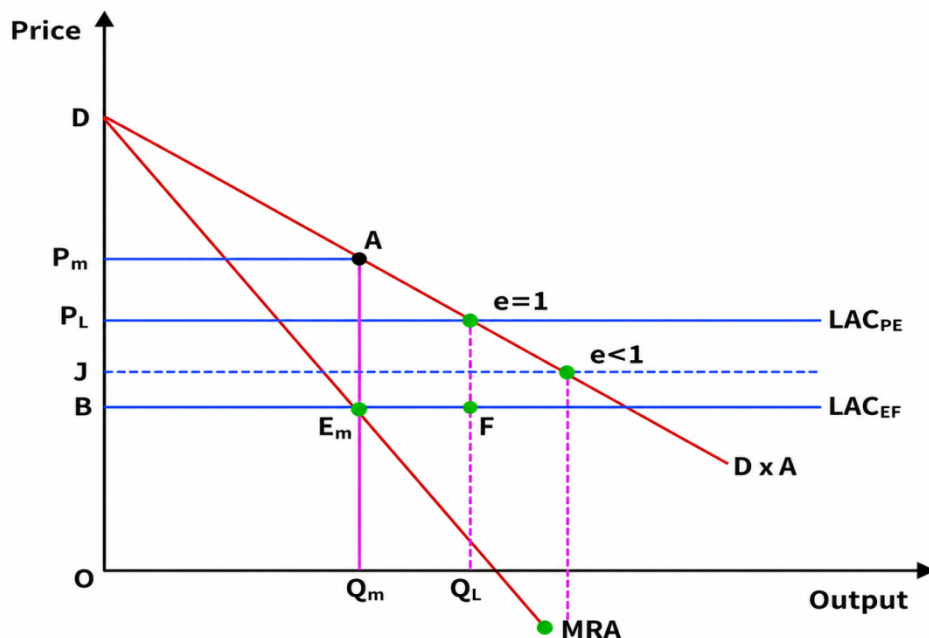
C is the percentage which the established firms may get.

Suppose when firms set a limit price (P_L) above the competitive price (P_c), they earn supernormal profits since price exceeds average cost. If price equals average cost, only normal profits are earned. The difference between P_L and P_c represents a premium (C) that existing firms gain by fixing a higher price. Bain argued that entry of new firms depends on a time period long enough for demand and input conditions to change. The longer it takes for a new firm to establish itself, the weaker the threat of entry.

Thus, the gap between the competitive price and the limit price is called the entry barrier or entry gap, which protects existing firms from new competition.

3.3.2 Diagrammatic Representation of the Limit Pricing Model

Given, there is determinate demand curve for the industry. The market demand curve for the product is not affected by price adjustment by the existing firms or by the entry of new firms in the industry. It remains unaltered and stable. Corresponding to this demand curve there is a marginal revenue curve which shows the addition to revenue attributable to sale of one more unit of product.



In the figure, price is measured on the x-axis and output on the y-axis.

- DD is the market demand curve faced by the collusive oligopoly firms.
- MR is the marginal revenue curve.
- LAC_{EF} is the long run average cost curve of the existing established collusive oligopolists. It is constant and parallel to horizontal axis.

As long run average cost of the established firms are constant, long run marginal cost is equal to long run average cost of the established firm i.e. $LAC_{EF} = LMC_{EF}$.

- If the collusive oligopolistic firm wants to maximize short run profits, it would produce the level of output where the marginal revenue is equal to marginal cost.
- It is shown as point E where the long run marginal cost LMC_{EF} is equal to marginal revenue.
- The short run profit maximizing price is P_m and oligopolistic firms are selling OQ_m units of output. This OP_m price is the monopoly price because this price is charged by collusive oligopolistic firms. This price (OP_m) will induce entry of new firms in the industry as this price is more than the long run average cost of the potential entrants by $P_m P_L AC$. With the entry of new firms in the industry, the established firm would lose a part of the market demand. This reduction in the market demand curve would cause a shift in the market demand curve to left. This results in uncertainty among firms about the price level of demand for their product as a result of new entry of firms

If, the firms set the price P_L equal to the long-run average cost of potential entrants i.e. LAC_{PF} then firms are ready to sell OQ_L units of output. At this price, existing firms still earn profits since P_L is above their own average cost, but new firms would only earn normal profits. If entrants join, the increased supply would push the post-entry price below their average cost, causing losses. Thus, P_L acts as the entry-preventing price, discouraging rivals from entering. Although profits at P_L are lower than monopoly profits (P_m) i.e. $P_m A E_m B > P_m A C P_L$, firms accept this trade-off to secure long-run stability and deter competition.

The important aspect of the Bain's limit pricing theory is that Bain tried to explain the phenomenon of oligopolistic firms in some industries keeping their price at a level of demand where price elasticity of demand is less than unity. It can be seen from the figure that if the average cost of the potential entrants is OJ on the given market demand curve DD , the price elasticity of demand is less than unity. This corresponds to a point below the mid-point of the linear demand curve DD and at this price, marginal revenue curve becomes negative. According to Bain, the established oligopoly could set price OJ as the limit price as this price is still more than their long run average cost curve. At this price, established firms are earning profit as price is more than long run average cost.

Another important feature of Bain's limit pricing theory is that if the market demand and the cost conditions allow the monopoly price to be less than the limit price then the oligopolistic firms would charge the monopoly price to maximize their short run profits. This price not only maximizes the short run profits but also serves to prevent potential entrants and maximizes the long run profits. We have seen that Bain was able to explain why collusive oligopolistic firms charge price below the short run profit maximizing price. This is because of threat of potential entry of new firms. These firms want to prevent the new entry to ensure long run maximum profits.

3.4 MARRIS 'S MODEL OF MANAGERIAL ENTERPRISE

The Marris model of managerial enterprise was developed by Robin Marris in 1964. It stated that the goal of the firm is to maximise the balanced growth rate of the firm (g) through the maximisation of growth rate of the demand for the firm's products (g_D) and the growth of firm's capital supply (g_C), that is, $g = g_D = g_C$, where, g is the balanced growth rate, g_D is the growth of demand for the products of the firm and g_C is the growth of the supply of capital. However, in pursuing this maximum balanced growth rate, the firm has two constraints:

1. **Managerial constraint:** Marris adopts Penrose's notion of the existence of a certain limit on the rate of efficient managerial expansion. At any one time period, the capacity of the top management is given. There is a ceiling to the growth of the firm set by the capacity of its managerial team (skills, capability, productivity, and authenticity). The managerial capacity can be increased by hiring new managers, but there is a definite limit to the rate at which

management can expand and remain competent (efficient). A new manager requires time before he is fully ready to join the teamwork necessary for the efficient functioning of the organisation. Similarly, the 'research and development' (R & D) department sets a limit to the growth rate of the firm. This department is the source of new ideas and new products, which affect the growth of demand for the products of the firm. The work in the R & D department is 'teamwork' and as such, it cannot be expanded quickly, simply by hiring more employees. New scientists and designers require time before they can efficiently contribute to the teamwork of the R & D department. Thus, the managerial constraint and the R & D capacity of the firm set limits both to the rate of growth of demand (g_D) and the rate of growth of capital supply (g_C).

2. **Financial/Job Security constraint:** Managers want job security. They attach certain disutility to the risk of being dismissed. The risk of dismissal of managers arises if their policies lead the firm towards financial failure (bankruptcy) or render the firm attractive to take-over raiders. The risk of dismissal is mainly avoided by:
 - non-involvement with risky investments. The managers choose projects which guarantee a steady performance, rather than risky ventures which may be highly profitable, but will endanger the managers' position, if they fail. Thus, the managers become risk-avoiders.
 - Choosing a 'prudent financial policy'.

Marris suggests that job security is attained by adopting a practical financial policy which consists of determining optimal levels for three crucial financial ratios:

1. **The leverage/debt ratio:** It is defined as the ratio of debt to the gross value of total assets of the firm, that is, $Value\ of\ debts/Total\ assets = D/A$. It is a financial tool to understand the degree to which a company's operations are funded by debt. The managers will not want excessive borrowing because the firm may become broke and be declared bankrupt, due to the demands for interest payments and repayment of loans. So, the managers try to maintain a low debt ratio to avoid bankruptcy and thereby, secure their job.
2. **The liquidity ratio:** It is defined as the ratio of liquid assets to the total gross assets of the firm, that is, $Liquid\ assets/Total\ assets = L/A$. It is used to determine a borrower's ability to pay-off its current debt, without raising any external capital. If the liquidity ratio is too low, it increases the risk of bankruptcy. If the liquidity ratio is very high, it makes the firm attractive to take-over raids, because the raiders think that they can utilise the excessive liquid assets to promote the operations of their enterprises. Thus, the managers have to choose an optimal liquidity ratio, that is, neither too high nor dangerously low.
3. **The Retention ratio:** It is defined as the ratio of retained profits (net of interest on debt) to total profits, that is, $Retained\ profits/Total\ profits = \Pi_R/\Pi$. According to Marris, retained/reported profits are the most significant source of finance for the growth of capital. However, the firm cannot retain as much profits as they wish because the minimum/distributed profits must be sufficient to satisfy the shareholders and avoid a fall in the share prices else, it would render the firm attractive to take-over raiders. If the distributed profits are low, the existing shareholders may decide to replace the top management. If the low profits lead to a fall in the price of shares, a take-over raid may be successful and the position of managers is thus, endangered.

Hence, the justification of the goal of a balanced growth is that by jointly maximising the growth rate of demand for firms' product and the capital, the utility of the managers and that of the owners are maximised. Hence, these two growth rates are transformed into two utility functions.

The manager's utility function (U_M) can be written as,

$$U_M = f(\text{salaries, power, status, job security})$$

The owner's utility function (U_O) can be written as,

$$U_O = f(\text{profits, capital, output, market share, public image})$$

There are various measures (indicators) of size: capital, output, revenue, market share, and there is no agreement on which of these measures is the best to measure the firms' size. However, Marris limits his model to situations of *steady rate of growth* over time, during which, most of the relevant economic variables change simultaneously, so that 'maximising the long-run growth rate of any indicator can reasonably be assumed equivalent to maximising the long-run rate of most other indicators'.

Marris implicitly assumes that salaries, status and power of managers are strongly correlated with the growth of demand for the products of the firm (g_D). Managers will enjoy higher salaries and will have more prestige with faster growth rate of demand for its products. Hence, the utility functions of the managers and the owners can be re-written as,

$$U_M = f(g_D, s) \text{ and } U_O = f(g_C)$$

Where, g_D is the growth of demand for the products of the firm, g_C is the growth of the supply of capital and s is a measure of job security, measured by a weighted average of three crucial ratios: the liquidity ratio, the leverage/debt ratio and the profit-retention ratio. These ratios reflect the financial policy of the firm. Marris treats 's' as an exogenously determined constraint by assuming that there is a saturation level for job security: above the saturation level the marginal utility from an increase in 's' (job security) is zero, while below the saturation level the marginal utility from an increase in 's' is infinite. Thus, the managerial utility function can be written as,

$$U_M = f(g_D)\bar{s}$$

where \bar{s} is the security constraint.

The three financial ratios are combined, subjectively by the managers, into a single parameter \bar{a} , which is called the 'financial security constraint', which is exogenously determined by the risk attitude of the top management. Though Marris does not explain the process by which \bar{a} is determined, it is stated that it is a weighted average of the three ratios, the weights depending on the subjective decisions of managers. Let,

$$a_1 = \frac{L}{A} = \text{Liquidity ratio}, a_2 = \frac{D}{A} = \text{Leverage ratio} \text{ and } a_3 = \frac{\Pi_R}{\Pi} = \text{Retention ratio}.$$

3.4.1 Equilibrium of the Firm

The equilibrium condition of the firm to attain the maximum balanced-growth rate is $g = g_D = g_C$. Marris establishes that the factors that determine g_D and g_C can be expressed in terms of two variables, the

diversification rate (product differentiation), defined as the number of new products introduced per time period, denoted by d , and the average profit margin, defined as the measure of firm's profitability in the long-run, denoted by m . It is the percentage of revenue the firm keeps as profits over the long-term.

- **Growth Rate of Demand for Firm's Products (g_D)**

It is assumed that the firm grows by diversification. The growth rate of demand for the products of the firm depends on the diversification rate, d , and the percentage of successful new products, k , that is, $g_D = f(d, k)$.

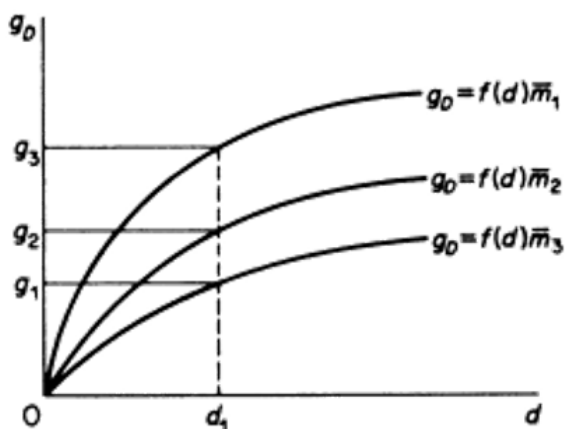
Diversification takes two forms:

1. Differentiated diversification: Introducing a completely new product with no close substitutes, creating new demand. This is considered the most important form of diversification in which the firm seeks to grow, since there is no danger of invading on the market of competing firms.
2. Imitative diversification: Introducing a completely new product with close substitutes, definitely inducing competitors' reactions.

The greater the d , the higher the rate of growth of demand g_D . The proportion of successful new products, k , depends on the rate of diversification d , on their price, the advertising expenses (A), the R & D expenditure, as well as on the intrinsic value of the products, that is,

$$k = f(d, P, A, R\&D, \text{intrinsic value})$$

The higher advertising expenses and/or R & D, the higher the proportion of successful new products and vice versa. Marris uses m , the average profit margin, as a proxy for the two policy variables, A and R & D. However, higher advertising expenses and/or R & D will lead to lower average profit margin (m) and higher proportion of successful new products (k). Hence, with a given rate of diversification d (as in d_1), the lower the m , the larger the A and/or the R & D expenses, and hence, the larger the proportion of successful products (k) and the higher the growth of demand g_D . The average profit margin (m) is constant along any g_D curve. The g_D curve shifts downwards as m increases due to the negative relationship between g_D and m .



k also depends on d , the rate of new products introduced in each period: if too many new products are introduced too fast, the proportion of failed products increases. If the research team is pressed to speed up the development process of new products, there will be not enough time to 'research' the product and/or its marketability adequately. Furthermore, top management becomes overworked when the rate of introduction of new products is high, and the proportion of unsuccessful products is bound to increase. Thus, when d increases, g_D also increases but at a decreasing rate due to the rate of

introduction of new products outrunning the capacity of the workers involved in the development and the marketing of the products. In short, $g_D = f(d, m)$ and there is a positive relation between g_D and d .

- **Growth Rate of Capital Supply (g_c)**

According to Marris, the rate of growth of capital supply is proportional to the level of profits.

$$g_c = a \cdot P$$

Where,

g_c is the growth rate of corporate capital

P is the net rate of profits, after depreciation and tax, earned on productive assets.

a is the financial security coefficient

The level of total profits, P , depends on the average rate of profit, m , and on the capital-output ratio, O , which is the efficiency of the performance of the firm. So, P is a function of the average profit rate and overall capital-output ratio.

$$P = (m, O), \text{ where } \partial P / \partial m > 0$$

The overall capital output \ ratio is not a simple arithmetic average of the capital/output ratios of the individual products of the firm, but is a function of the diversification rate d . It can be written as $O = O(d)$. For a given capital, the relationship between capital output ratio and diversification is up to a certain level of d positive, reaches a maximum, and then starts falling as the number of new products increases the overall output. Output is at maximum when the d is at its optimum level allowing the optimal use of the managerial team and the Research and Development personnel. Beyond the optimal point, the total output decreases with further increases in d . Hence the success rate for new products falls and efficiency declines. Substituting for capital output function in the profit function we obtain

$$P = (m, d)$$

Now substitute the profit function P in the g_c function we obtain $g_c = a \cdot (m, d) = a \cdot P$

The rate of growth of capital is determined by three factors the financial policies of the managers, the average rate of profit and the diversification rate. If all the security constraints on leverage, liquidity and retention ratio are operative, the value of 'a' becomes unique. This unique value of a then becomes a constraint in the model. This can be written as $a \leq a^*$

And $g_c \leq a^*$, where a^* is the value of a associated with financial policies in which all the security constraints are effective.

the complete form of Marris Model: The complete summarization of the above equations is as follows

$$g_D = (m, d) \text{ (Demand Growth Equation)}$$

$$P = (m, d) \text{ (Profit Rate Equation)}$$

$$g_c = a \cdot (m, d) = a \cdot P \text{ (Supply of Capital Equation)}$$

$$a \leq a^* \text{ (Security constraint)}$$

$$g_c = g_D \text{ (Balanced Growth Equation)}$$

The firm is in equilibrium where $[g_c = a \cdot f(m, d) = a \cdot P]$. Here the equilibrium equation depends upon two unknown variables, m and d . The model cannot be solved unless one of the variables, m or d , is subjectively determined by the managers. Once the managers define 'a' and one of the other two policy variables, the equilibrium rate of growth can be determined.

3.5 WILLIAMSON MODEL OF MANAGERIAL DISCRETION

The model of the managerial theory of the firm was presented by Oliver. E Williamson is known as Williamson's model of the Managerial Discretion. It was developed in 1963. According to him, managers have the discretion of following policies which further their utility maximization objective, rather than that of owners. But discretion of managers is limited by the desire of owners to earn a minimum level of profits. This acts as a constraint on the profit maximizing behaviour of the managers

Managers utility function comprises the variables as salary, job security, power, status, position etc. The profits that satisfy the owners have been conceptualized as follows:

(a) Actual profit Π : Actual profit is sales revenue less total costs including staff expenditure $\pi = R - C - S$

(b) Reported Profit Π_R : This actual profit is reported to the tax authority after deducting managerial emoluments. In other words, it is the difference between actual profit and management slack (nonessential managerial expenditure) $\Pi_R = \pi - M = R - C - S - M$

(c) Minimum Profit Π_0 : This is indeed the minimum amount of profit (after tax) needed to pay satisfactory dividends to the shareholders, without which the 'job security' of the manager may be at stake. This is because if shareholders do not get reasonable dividends, then either there will be a possibility of takeover or the top management may be dismissed. $\Pi_R \geq \pi_0 + T$ Thus reported profits should be sufficient enough cover minimum profit plus the taxation.

(d) Discretionary profit Π_D : This is also a residue, i.e., the amount of profit left after subtracting the minimum profits and the tax $\pi_D = \pi - \pi_0 - T$

(e) Discretionary investment, ID: This is a residue of the amount left from the reported profit after setting aside minimum profit and meeting the tax obligations. Thus $ID = \pi_R - \pi_0 - T$ The difference between discretionary profits and investment arises due to M(management slack) which is incorporated in the former but not in the latter. Thus $\pi_D = ID + M$ if $M=0$; then $\pi_D = ID$ as $\pi_R = \pi$

The objective of a firm/manager is to maximize its own utility function with profit constraints as the job security of managers endanger if managers fail to earn a minimum profit to pay in the form of dividends to the owners. Manager's utility can be increased by additional values of expenditure on staff(S), managerial emoluments(M), and discretionary investment (ID). It is also argued that these provide additional utility, and is utility "U" that managers aim to maximize. The manager's utility function is being presented as ;Maximize $U=f(S, M, ID)$

Where, S= staff expenditure; it includes salaries and other monetary benefits to managers and staff.

M=managerial emolument; it includes benefits to managers like expensive and luxury offices, cars, personal secretary, status, prestige and satisfaction

ID= Discretionary investment/profit. It is called discretionary investment because it can be independently spent by the management in their desired projects. Such spending allows managers to pursue their pet projects, personal investment preferences and to exercise their power and thus it increases their utility.

3.5.1 Simplification of the model:

Maximize Utility $(U)=f(S,M,ID)$

Subject to $\pi_R \geq \pi_0 + T$

Where, π_R is the reported profit (reported to the tax office) which is the difference between actual profit (π) and managerial emolument i.e. $\pi_R = \pi - M$,

Π_0 is the minimum profit that satisfies the shareholders/required by the shareholders. The actual profit (π) is the current profit of the firm which is the difference between total revenue (R) and total cost including staff expenditure i.e. $\pi = R - C - S$.

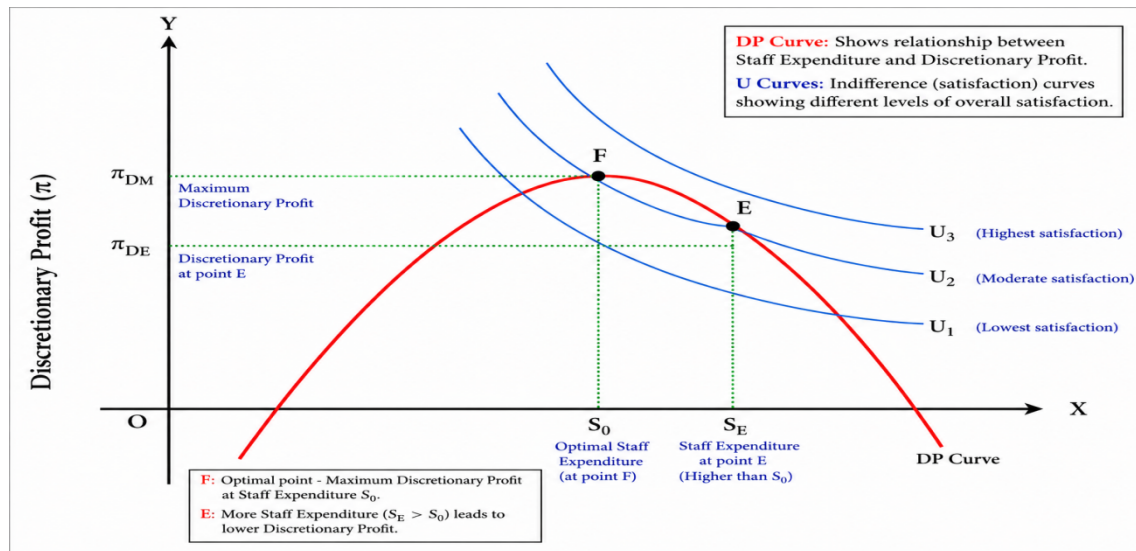
When $M=0$ then the utility function can be expressed as

Maximize $(U)=f(S, DP)$

Where S is staff expenditure and DP is discretionary profit. So, the manger's utility is based on staff expenditure and discretionary profit. The higher the level of staff expenditure and discretionary profit, the higher will be the level of the manager's utility. This model can be further explained with the help of the following diagram.

3.5.1.1 Graphical presentation of Williamson's model of managerial Discretion:

The following graph helps to explain the model;



In the above diagram, the managerial utility curve U_3 is tangent to the discretionary profit (DP) curve at point E. so, point 'E' is the equilibrium point where managers get maximum utility with π_{DE} level of discretionary profit and S_E level of staff expenditure.

At maximum profit point 'F', the staff expenditure is S_0 which is less than S_E and π_{DM} level of discretionary profit which is higher than π_{DE} but the lower level of managerial utility.

From the above discussion, we can infer that managers do prefer higher staff expenditure than that of profit maximizes and managers also would like to sell at a lower price than that of profit maximizes. Thus, this model primarily highlights the manger's utility while taking business decisions rather than the interest of other stakeholders. However, the profit can not be entirely ignored in this model too. The minimum level of profit that managers need to fulfil is fixed and most importantly there is the place for manger's discretion in the investment decision that motivates managers and thus they act for the overall betterment of the business firm.

3.5.1.2 Criticism;

Some conceptual weaknesses of this model are

1. This model or theory does not explain the problems of the interdependence of firms under oligopolistic competition.
2. This model applies only when rivalry among the firms is not so strong.
3. This model has underestimated the concept of profit maximization because this theory says that managerial utility is impossible to maximize if economic profit is maximized by the firm.
4. There is no adequate evidence to evaluate this theory.

3.6 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Although the conventional theory of firm still holds its ground firmly, several alternative theories of firm were proposed during the early 1960s by economists, notably by Simon, Baumol, Marris, Williamson, Berle and Means, Galbraith, and Cyert and March.
2. The alternative theories of the business firms are sometimes classified under the following categories:
 - (i) Managerial theories of firm
 - (ii) Growth maximization theories of firm
 - (iii) Maximization of managerial utility theories
 - (iv) Behavioural theories of firm
3. The basic premise of Baumol's theory is that sales maximization, rather than profit maximization, is the plausible goal of the business firms.
4. To formulate his theory of sales maximization, Baumol has developed two basic models: (i) static model and ii) dynamic model each with and without advertising.
5. Baumol's theory does not distinguish between firm's equilibrium and industry equilibrium. Nor does it establish industry's equilibrium when all the firms are sales maximizers.
6. A. A. Berle and G. C. Means were the first business economists to point out, in 1932, that management is separated from ownership in the large multi-product business corporations and this influences the role of business managers in setting the goals of the large corporations.
7. Williamson's model does not deal satisfactorily with the problem of interdependence of firms under oligopolistic competition. Williamson's model is said to hold only where rivalry is not strong. In the case of strong rivalry, profit maximization hypothesis has been found to be more appropriate.
8. There are many differences between a manager and an entrepreneur: while a manager is appointed by a higher authority, an entrepreneur emerges out of the people. While managers have colleagues, entrepreneurs have helpers to assist them.
9. The National Business Incubation Association (NBIA) has identified the following characteristics of a successful entrepreneurial firm:
 - An effective management team that works cooperatively and consists of members selected to provide a range of knowledge and skills
 - Sound financing, the earlier the better; funding is directly related to a firm's success, and in some cases can be the deciding factor between a business venture's success and failure
10. In maximizing firm's growth rate, managers are faced with two constraints:
 - (i) managerial constraints and (ii) financial constraints.
11. In their effort to strike a balance between their own and the owner's utility functions, managers adopt a prudent financial policy.
12. Limit price can be defined as the maximum price that existing firms charge with the objective of limiting the number of firms and preventing the entry of new firms to the industry.
13. Bain has attempted, in his model, to explain why oligopoly firms maintain their prices over a long period of time at a level which is lower than the price that would maximize their profits.

3.7 QUESTIONS AND EXERCISES

3.7.1 Short-Answer Questions

1. What lies at the foundation of the alternative theories of business firms? Do the alternative theories really offer an alternative explanation to firms' behaviour?
2. What was the conventional theory of firm based on?
3. According to Baumol, why do business managers pursue the goal of sales maximization?
4. In what way is Baumol's theory superior to the conventional theory based on profit maximization hypothesis?
5. Does Baumol's model offer a more appropriate explanation to price and output determination than the conventional theory?
6. How does Williamson's model of managerial utility maximization explain the equilibrium of the firm?
7. How does Marris define the balanced growth of the firm? How do managers arrive at the balanced growth? What kind of financial policy do the managers adopt to secure their stake in the firm?
8. Write a short note on limit pricing theory.

3.7.2 Long-Answer Questions

1. Discuss the traditional theory of firm.
2. Explain Baumol's theory of sales revenue maximization.
3. Assess Baumol's model of price and output determination with and without advertisement.
4. Evaluate Williamson's model of managerial utility maximization.
5. Critically analyse the differences between managerial and entrepreneurial firm.
6. Explain Marris' model of managerial enterprise.
7. Describe the limit pricing theory with special reference to Bain's model of limit pricing.

3.8 REFERENCE AND CREDITS

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UNIT 4 WELFARE ECONOMICS AND GENERAL EQUILIBRIUM

4.0 Introduction

4.1 Pareto Optimality: Its Conditions- Consumption, Production and Exchange

4.1.1 The Optimum Distribution of Products among the Consumers: Efficiency In Exchange

4.1.2 Efficiency In Production

4.1.3 Product-Mix Efficiency

4.1.4 Critical Evaluation of Pareto Optimality

4.2 Kaldor-Hicks Welfare Criterion

4.2.1 Compensation Principle

4.2.1.1 Assumptions

4.2.1.2 Scitovsky's Double Criterion of Welfare

4.3 Bergson's Social Welfare Function

4.4 Brouwer's Fixed-Point Theorem

4.4.1 The Three Mandatory Requirements

4.5 General Equilibrium

4.5.1 Principles of General Equilibrium

4.5.2 Existence, Uniqueness And Stability

4.5.2.1 Existence

4.5.2.2 Uniqueness

4.5.2.3 Stability

4.6 Summary

4.7 ANSWERS TO 'CHECK YOUR PROGRESS'

4.8 QUESTIONS AND EXERCISES

4.8.1 Short-Answer Questions

4.8.2 Long-Answer Questions

4.9 REFERENCE AND CREDITS

UNIT 4 WELFARE ECONOMICS AND GENERAL EQUILIBRIUM

4.0 Introduction

Welfare economics studies how economic activities affect the well-being of individuals and society. It focuses on the efficient allocation of resources and the distribution of income to achieve maximum social welfare. Concepts such as efficiency, equity, and optimal resource use are central to this field. General equilibrium, on the other hand, examines how different markets in an economy interact and reach a state of balance simultaneously. It explains how prices and quantities are determined across all markets together. Both concepts help in understanding how economies function and how policies can improve overall welfare and economic efficiency.

The following theories will be discussed under this unit:

- 1) Pareto Efficiency (Pareto Optimality)
- 2) Social Welfare Function
- 3) Kaldor–Hicks Compensation Principle
- 4) Bergson–Samuelson Social Welfare Function
- 5) Walrasian General Equilibrium Theory
- 6) Existence, Uniqueness, and Stability of Equilibrium
- 7) Brouwer’s fixed-point theorem

4.1 PARETO OPTIMALITY: ITS CONDITIONS- CONSUMPTION, PRODUCTION AND EXCHANGE

An allocation is Pareto optimal if it is not possible to reallocate resources without making at least one person worse off. The conditions of Pareto optimality relate to efficiency in exchange (or consumption), efficiency in production and overall Pareto efficiency (or efficiency in both consumption and production), which is discussed below:-

4.1.1 The Optimum Distribution of Products among the Consumers: Efficiency in Exchange

Exchange efficiency means the distribution of a given output of goods between individuals in a society should be such that it is not possible to make someone better off without making anyone else worse off. The required condition is that “the marginal rate of substitution between any two products must be the same for every individual who consumes both.”

$$MRS_{xy}^A = MRS_{xy}^B$$

This condition can be explained with the help of the Edgeworth Box diagram. In Fig. 4.1.1 O_A and O_B are the origins for the utilities of two persons A and B respectively. I_{a1} , I_{a2} , I_{a3} , I_{a4} and I_{b1} , I_{b2} , I_{b3} , and I_{b4} are their successively higher indifference curve. CC is the contract curve passing through various tangency points Q , R , and S of the indifference curves of A and B. The marginal rates of substitution (MRS) between the two goods for individuals A and B are equal on the various points of the contract curve CC' . Any point outside the contract curve does not represent the equality of MRS between the two goods for two individuals

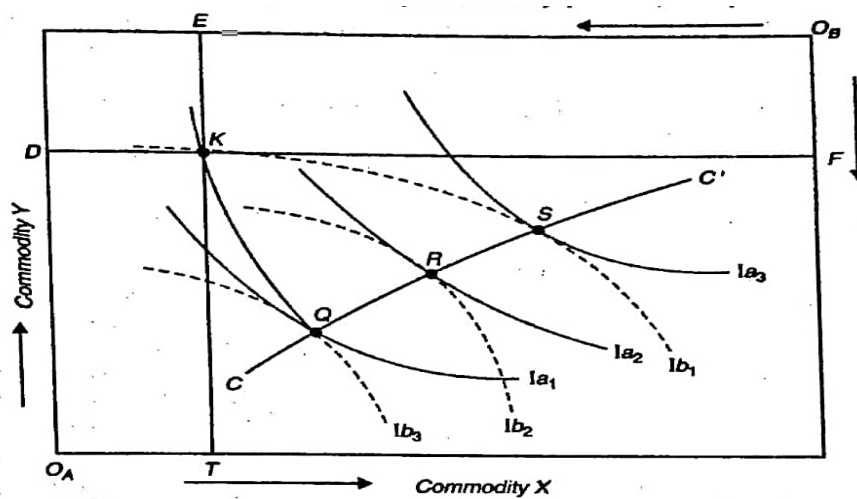


Figure 4.1.1: Efficiency in exchange

A and B of the society. Let us consider point K where indifference curves I_{a1} and I_{b1} of individuals A and B respectively intersect each other instead of being tangential. Therefore, at point K marginal rate of substitution between two goods X and Y (MRS_{XY}) of individual A is not equal to that of B. With the initial distribution of goods as represented by point K , it is possible to increase the satisfaction of one individual without any decrease in that of the other or to increase the satisfaction of both by redistribution of the two goods X and Y between them. A movement from K to S increases the satisfaction of A without any decrease in B's satisfaction. Similarly, a movement from K to Q increases B's satisfaction without any decrease in A's satisfaction. The movement from K to R increases the satisfaction of both because both move to their higher indifference curves. Thus, movements from K to Q or S or any other point on the segment SQ of the contract curve will, according to the Pareto criterion, increase the level of social welfare. From the above, it follows that movement from any point away from the contract curve to a point on the relevant segment of the contract curve will mean an increase in social welfare. At any point away from the contract curve in the Edgeworth box, the

indifference curves of the two individuals will intersect which will mean that the MRS_{xy} of two individuals is not the same. And, as explained above, this indicates that through an exchange of some units of goods between them, they can move to some point on the contract curve where the social welfare (that is, the welfare of two individuals taken together) will be higher. Since the slope of an indifference curve represents the marginal rate of substitution (MRS_{XY}) at any point of the contract curve, which represents tangency points of the indifference curves, the MRS_{XY} of the two individuals is equal.

4.1.2 Efficiency in Production

Production is Pareto-efficient when it is not possible to reallocate resources to produce more of some goods without producing less of some other goods. Here, the conditions require is that the marginal rate of technical substitution (MRTS) between any two factors must be the same for any two firms using these factors to produce the same products. In other words, this occurs when the **Marginal Rate of Technical Substitution (MRTS)** between any two inputs is equal across all industries.

$$MRTS_{LK}^X = MRTS_{LK}^Y$$

Let us assume two firms A and B produce the same product by using two factors labour and capital. The available quantities of labour and capital are represented on the vertical and horizontal axis respectively. OA and OB are the origins of firms A and B respectively. Isoquants Ia1, Ia2, Ia3 and Ib1, Ib2, Ib3 of firms A and B respectively represent successively higher and higher quantities of output which they can produce by different combinations of labour and capital. The slope of the isoquants, which are convex to the origin, represents the marginal rate of technical substitution (MRTS) between two factors. MRTS of one factor for another is the amount of one factor necessary to compensate for the loss of the marginal unit of another so that the level of output remains the same. So long as the MRTS between two factors for two firms is not equal, the total output of a product can be increased by the transfer of factors from one firm to another. In terms of the above diagram, any movement from K to S or Q raises the output of one firm without any decrease in the output of the other. The total output of the two firms increases when through the redistribution of factors between the two firms, a movement is made from the point K to the point Q or S on the contract curve.

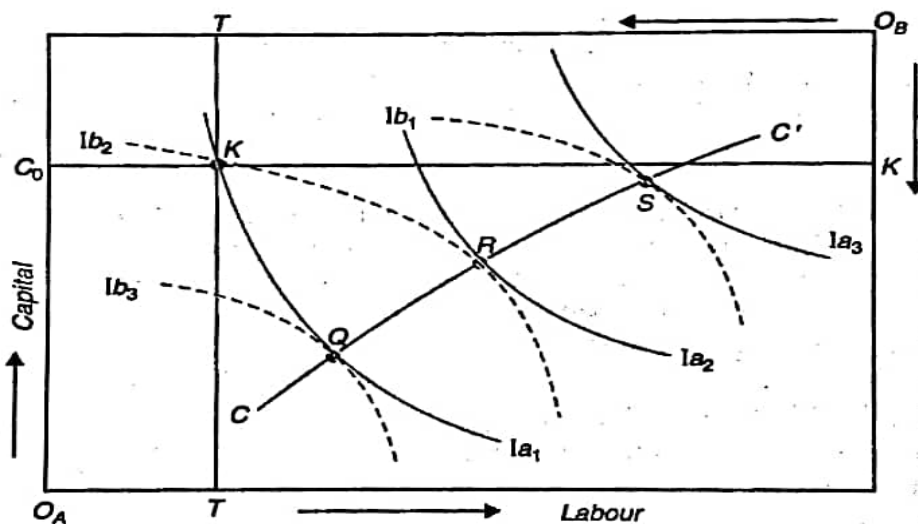


Figure 4.1.2: Efficiency in production

A glance at Figure 4.1.2 will show that movement from point K outside the contract curve to point R on the contract curve will raise the output of both the firms individually as well as collectively. Therefore, it follows that corresponding to a point outside the contract curve there will be some points on the contract curve production which will ensure greater total output of the two firms. As the contract curve is the locus of the tangency points of the isoquants of two firms, the marginal rate of substitution of the two firms is the same at every point of the contract curve CC . It is, therefore, follows that on the contract curve at every point of which MRTS between the two factors of two firms is the same, the allocation of factors between the two firms is optimum. When the allocation of factors between the two firms is such that they are producing at a point on the contract curve, then no reallocation of factors will increase the total output of the two firms taken together. But it is worth mentioning that there are several points on the contract curve and each of them represents the optimum allocation of labour and capital between the two firms. But which one of them is best cannot be said based on the Pareto criterion because movement along the contract curve in either direction represents such factor reallocation which increases the output of one and reduces the output of another firm. The slope of the isoquants, which are convex to the origin, represents the marginal rate of technical substitution (MRTS) between two factors. MRTS of one factor for another is the amount of one factor necessary to compensate for the loss of the marginal unit of another so that the level of output remains the same. So long as the MRTS between two factors for two firms is not equal, the total output of a product can be increased by the transfer of factors from one firm to another.

4.1.3 Product-Mix Efficiency

The product-mix efficiency means that allocation of resources among the production of various goods and services is in accordance with the preferences of the people. The required condition is that the marginal rate of substitution (MRS) between two products must equal the marginal rate of transformation (MRT) between them.

$$MRS_{xy} = MRT_{xy}$$

Commodities X and Y have been represented on the X and Y axes respectively (figure 4.1.3).

AB is a community's transformation curve between any pair of goods X and Y. This curve represents the maximum amount of X that can be produced for any quantity of Y, given the

amounts of other goods that are produced and

fixed supplies of available resources. IC1 and

IC2 are the indifference curves of a consumer the slope of which at a point represents the

marginal rate of substitution between the two goods of the consumer. The MRT' of the

community and MRS of the consumer are equal to each other at point R at which the

community's transformation curve is tangential to the indifference curve IC2 of a representative

consumer, Point R represents an optimum composition of production in which commodities X

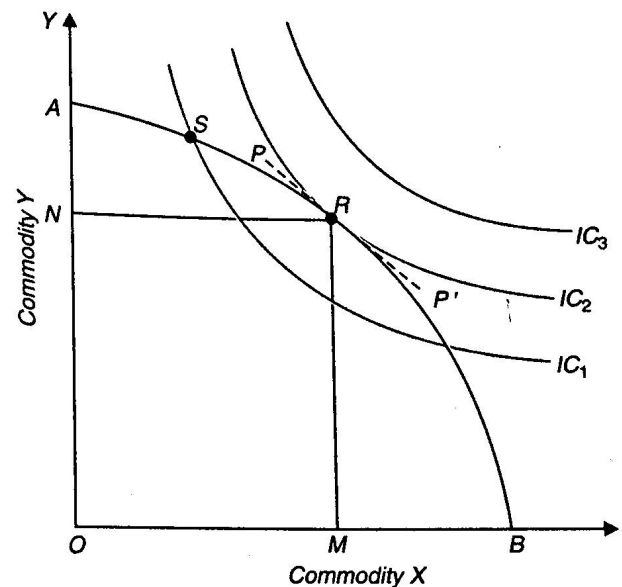
and Y are being produced and consumed in OM and ON quantities. This is because of all the

points on the community's transformation curve, point R lies at the highest possible

indifference curve IC2 of the consumer. For instance, if a combination of goods X and Y

represented by S is being produced and consumed, the consumer would be at a lower level of

welfare because S lies on his lower indifference curve IC1 which intersects the community's



production of Y.

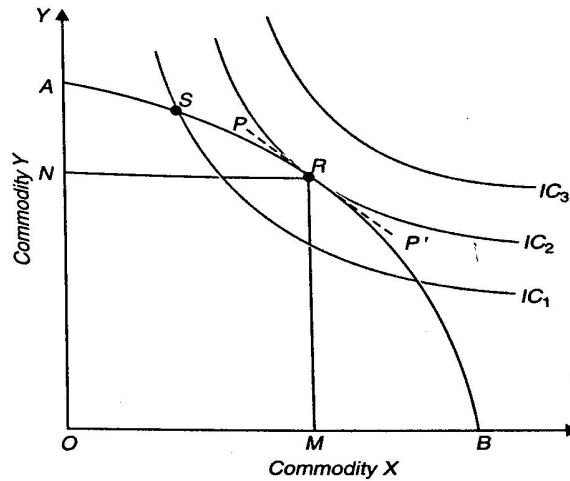


Figure 4.1.3: Product-Mix-Efficiency

Thus, the optimum direction of production is established at point R where community's transformation curve is tangent to the indifference curve of a consumer in the society. Commodities X and Y have been represented on the X and Y axes respectively. AB is a community's transformation curve between any pair of goods X and Y. This curve represents the maximum amount of X that can be produced for any quantity of Y, given the amounts of other goods that are produced and fixed supplies of available resources. IC1 and IC2 are the indifference curves of a consumer the slope of which at a point represents the marginal rate of substitution between the two goods of the consumer. The MRT' of the community and MRS of the consumer are equal to each other at point R at which the community's transformation curve is tangent to the indifference curve IC2 of a representative consumer, Point R represents an optimum composition of production in which commodities X and Y are being produced and consumed in OM and ON quantities. This is because of all the points on the community's transformation curve, point R lies at the highest possible indifference curve IC2 of the consumer. For instance, if a combination of goods X and Y represented by S is being produced and consumed, the consumer would be at a lower level of welfare because S lies on his lower indifference curve IC1 which intersects the community's transformation curve instead of being tangential to it. As a result, at point S, the MRS_{XY} of the consumer is not equal to the MRT_{XY} of the community. With the situation at S, there is a possibility of moving the consumers to a higher indifference curve by changing the direction (i.e. composition) of production i.e. by increasing the production of X and reducing the production of Y. Thus, the optimum direction of production is established at point R where community's transformation curve is tangent to the indifference curve of a consumer in the society.

4.1.4 Critical Evaluation of Pareto Optimality

1. One of the most influential technical critiques was put forward by Lipsey and Lancaster. They argued that if even one of the necessary conditions for Pareto optimality cannot be satisfied—such as in the presence of a monopoly or a tax—then attempting to fulfil the remaining Pareto conditions may actually reduce overall economic efficiency. This idea, known as the theory of the second best, highlights that in a world with unavoidable distortions, pursuing partial efficiency improvements does not necessarily lead to a more optimal outcome.

The standard Pareto model assumes all parties have perfect information. However, Greenwald and Stiglitz demonstrated that whenever information is imperfect or markets are incomplete (which is always), the market is **not** even "constrained" Pareto optimal.

2. **Information Asymmetry:** The standard Pareto model assumes all parties have perfect information. However, Greenwald and Stiglitz demonstrated that whenever information is imperfect or markets are incomplete (which is always), the market is not even "constrained" Pareto optimal.

This reveals that the Pareto criterion is topologically inconsistent when the redistribution of income significantly alters relative prices and demand.

3. **The Paretian Liberal Paradox:** Amartya Sen (1970) demonstrated a fundamental conflict between Pareto efficiency and individual rights.

4.2 KALDOR-HICKS WELFARE CRITERION

4.2.1 Compensation Principle: Economists like Kaldor, Hicks and Scitovsky have made efforts to evaluate the changes in social welfare resulting from any economic reorganisation which harms somebody and benefits the others. These economists have sought to remove indeterminacy in the analysis of Pareto optimality. They have put forward a criterion known as the 'compensation principle' based on which they claim to evaluate those changes in economic policy or organisation which make some individuals better off and others worse off. The 'compensation principle' is based on the following assumptions.

4.2.1.1 Assumptions:

1. The satisfaction of an individual is independent of the others and he is the best judge of his welfare.
2. There exist no externalities of consumption and production.
3. The tastes of the individuals remain constant.

4. The problems of production and exchange can be separated from the problems of distribution. The compensation principle accepts the level of social welfare to be a function of the level of production. Thus, it ignores the effects of a change in distribution on social welfare.

5. Utility can be measured ordinally and interpersonal comparisons of utilities are not possible.

Given the above assumptions, a criterion of compensation principle can be discussed. Kaldor, Hicks and Scitovsky have claimed to formulate a value-free objective criterion for measuring the changes in social welfare with the help of the concept of 'compensating payments.

Nicholas Kaldor was the first economist to give a welfare criterion based on compensating payments. Kaldor's criterion helps us to measure the welfare implications of a movement in either direction on the contract curve in terms of the Edgeworth box diagram. According to Kaldor's welfare criterion, if a certain change in economic organisation or policy makes some people better off and others worse off, then a change will increase social welfare if those who gain from the change could compensate the losers and still be better off than before. In the words of Prof. Baumol, "Kaldor's criterion states that a change is an improvement if those who gain evaluate their gains at a higher figure than the value which the losers set upon their losses." Thus, if any policy change benefits any one section of the society (gainers) to such an extent that it is better off even after the payment of compensation to the other sections of the society (losers) out of the benefits received, then that change leads to increasing in social welfare. In Kaldor's own words, "In all cases, where a certain policy leads to an increase in physical productivity and thus of aggregate real income. It is possible to make everybody better off without making anybody worse off. It is quite sufficient to show that even 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." Prof. J.R. Hicks supported Kaldor for employing the compensation principle to evaluate the change in social welfare resulting from any economic reorganisation that benefits some people and harms others. This criterion states, "If A is made so much better by the change that he could compensate B for his loss and still have something left over, and then the reorganisation is an unequivocal improvement." In other words, a change is an improvement if the losers in the changed situation cannot profitably bribe the gainers not to change from the original situation. Hicks have given his criterion from the losers' point of view, while Kaldor had formulated his criterion from the gainers' point of view. Thus, the two criteria are the same though they are clothed in different words. That is why they are generally

called by a single name 'Kaldor-Hicks criterion. Kaldor-Hicks criterion can be explained with the help of the utility possibility curve.

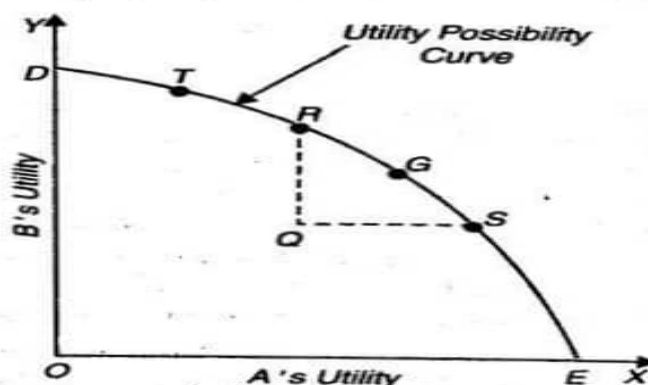


Figure 4.3.1: Kaldor Hicks Criterion

In Fig. 4.3.1 ordinal utility of two individuals A and B is shown on X and Y axis respectively. DE is the utility possibility curve which represents the various combinations of utilities obtained by individuals A and B. As we move downward on the curve DE, the utility of A increases while that of B falls. On the other hand, if we move up on the utility curve ED, the utility of B increases while that of A falls. Suppose the utilities obtained by A and B from the distribution of income or output between them are represented by point Q inside the utility possibility curve DE. Let us assume that as a result of some change in economic policy, the two individuals move from point Q to point T on the utility possibility curve DE. As a result of this movement, the utility of individual B has increased while the utility of A has declined, that is, B has become better off and A has become worse off than before. Therefore, this movement from point Q to point T cannot be evaluated through the Pareto criterion. Of course, points such as R, G, S or any other point on the segment RS of the utility-possibility curve DE are socially preferable to point Q based on the Pareto criterion. However, the compensation principle propounded by Kaldor-Hicks enables us to say whether or not social welfare has increased as a result of movement from Q to T. According to the Kaldor-Hicks criterion, we have to see whether the individual A, who gains with the movement from position Q to position T could compensate the individual A who is a loser and still be better off than before. Now, it will be seen from Figure 4.3.1 that the utility possibility curve DE passes through points R, G and S. This means that by mere redistribution of income between the two individuals, that is, if individual B gives some compensation to individual A for the loss suffered, they can move from position T to the position R. It is evident from the figure that at position R individual A is as well off as at the position Q but individual B is still better off as compared to the position Q. It means due to a policy change and consequent movement from position Q to position T,

the gainer (individual B) could compensate the loser (individual A) and is still better off than at Q. Therefore, according to Kaldor-Hicks criterion, social welfare increases with the movement from position Q to position T, because from T they could move to the position R through mere redistribution of income (i.e. compensation). It is noteworthy that, according to Kaldor-Hicks criterion, compensation may not be actually paid to judge whether or not social welfare has increased. It is enough to know whether the gainer could compensate the loser for the loss of welfare and still be better off. Whether redistribution of income (that is, payment of compensation) should be made following the policy change is left for the Government to decide. If the gainer can compensate the loser and still be better off, the economists can say that social welfare has increased. It may be noted that the gainer can compensate the losers and still be better off only when the change in economic policy leads to an increase in output or real income. That is why Kaldor and Hicks claim that they have been able to distinguish between changes in output from a change in distribution. When their criterion is satisfied by a change in the situation, it means that the economy has moved to a potentially more efficient position and as a result, social welfare can be said to have increased. Now, whether redistribution of income is made through payment of compensation by the gainers to the losers, according to them, is a different matter. Now, the implications of the Kaldor-Hicks criterion become clearer if through redistribution the position of the two individuals changes from T to G (see Fig. 4.3.1). It is quite manifest that at position G both the individual's A and B are better off than at the position Q. Thus, the position T to which the two individuals moved as a result of a certain change in economic policy is superior to the initial position Q from the viewpoint of social welfare since from position T movement can be made merely through redistribution of income to position G where both are better off as compared to the position Q. It may be noted that in the situation depicted in Figure 4.3.1, the change in economic policy brings about a movement from a position inside the utility possibility curve to a point on it. Now let us see what happens to social welfare if as a result of the adoption of a certain economic policy the utility possibility curve moves outward and the two individuals move from a point on a lower utility possibility curve to a point on a higher utility possibility curve. It can be shown that, according to the Kaldor Hicks criterion, such a movement causes an improvement in social welfare.

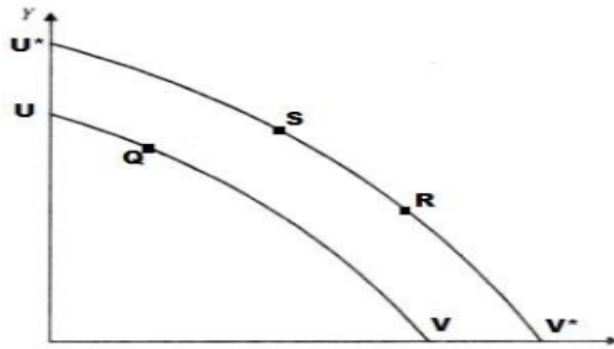


Fig: 4.3.2 Kaldor-Hicks Welfare Criterion

Consider Figure 4.3.2. UV is the original utility possibility curve and Q represents the position at which the two individuals are initially placed. Now, suppose the utility possibility curve shifts outward to the new position, U^*V^* , and the two individuals are placed at point R on it. In the movement from Q on the utility possibility curve UV to point R on the utility possibility curve U^*V^* the utility of A has increased and that of B has declined. But position R denotes greater social welfare on the basis-of Kaldor's criterion when compared to the position Q on the original utility possibility curve UV because with UV as the utility possibility curve it is possible to move through mere redistribution of income from position R to position S where the individual B has been fully compensated for his loss of utility, the individual A is still better off as compared to position Q. To conclude, any change in the economy that moves the individuals from a position on a lower utility possibility curve to a position on a higher utility possibility curve increases social welfare.

Scitovsky Paradox Scitovsky pointed out an important limitation of the Kaldor-Hicks criterion that it might lead to contradictory results. He showed that, if in some situations, position B is shown to be an improvement over position A on the Kaldor-Hicks criterion, it may be possible that position A is also shown to be an improvement over B based on the same criterion. For getting consistent results when position B has been revealed to be preferred to position A based on a welfare criterion, then position A must not be preferred to position B on the same criterion. According to Scitovsky, Kaldor- Hicks criterion involves contradictory and inconsistent results. Since Scitovsky was the first to point out this paradoxical result in the Kaldor-Hicks criterion, it is known as the 'Scitovsky Paradox'. How the Kaldor-Hicks criterion may lead to contradictory results in some situations is depicted in Figure 4.3.3.

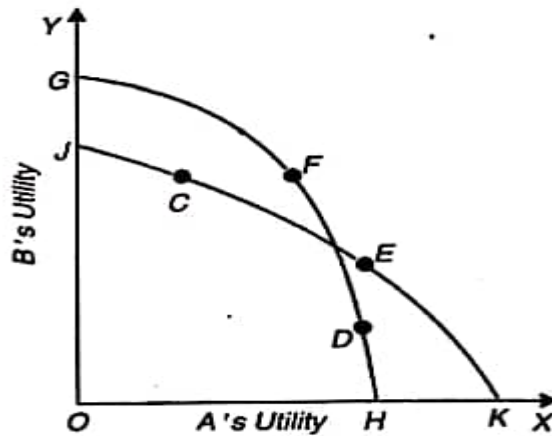


Fig 4.3.3: Scitovsky Paradox

In this figure, JK and GH are the two utility possibility curves which intersect each other. Now suppose that the initial position is at point C on JK. Further suppose that due to a certain policy change, the utility possibility curve changes and takes the position GH and the two individuals find themselves at position D. Position D is superior to position C based on Kaldor-Hicks criterion because from position D movement can be made through mere redistribution to position F at which individual B has been fully compensated but individual A is still better off as compared to the original position C. Thus movement from position C to position D satisfies Kaldor-Hicks criterion. But, as has been pointed out by Scitovsky, reverse movement from position D on the new utility possibility curve GH to the position C on the old utility possibility curve JK also represents an improvement on Kaldor-Hicks criterion, that is, C is socially better than D based on Kaldor-Hicks criterion. This is because from position C movement can be made by mere redistribution of income to position E on the utility possibility curve JK on which position C lies and which also passes through the position E. And, as will be observed from Fig. 4.3.3, that at position E while A is as well off as at position D, the individual B is still better off than at D. Thus see that the movement from position C to position D due to a policy change is passed by the Kaldor-Hicks criterion and also the movement back from position D to position C is also passed by the Kaldor-Hicks criterion. This implies that D is socially better than C on this criterion and C is also socially better than D on the same criterion. So Kaldor-Hicks criterion leads us to contradictory and inconsistent results. It is mentioned that these contradictory results are obtained by Kaldor-Hicks criterion when following a policy change new utility possibility curve intersects the former utility possibility curve. After bringing out the possibility of contradictory results in Kaldor-Hicks criterion Scitovsky formulated his own criterion which is generally known as Scitovsky's Double Criterion.

4.2.1.2 Scitovsky's Double Criterion Of Welfare: To rule out the possibility of contradictory results in Kaldor-Hicks criterion Scitovsky formulated a double criterion which requires the fulfilment of Kaldor-Hicks criterion and also the fulfilment of the reversal test. It means that a change is an improvement if the gainers in the changed situation can persuade the losers to accept the change and simultaneously losers are not able to persuade the gainers to remain in the original situation. Scitovsky's double criterion can also be explained with the help of the utility possibility curve.

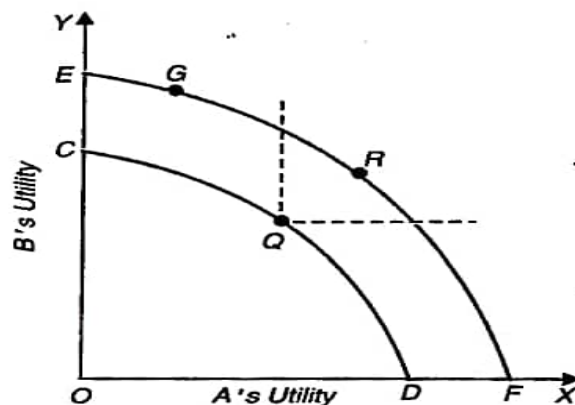


Figure 4.3.4: Scitovsky's double criterion

In Figure 4.3.4, CD and EF are the two utility possibility curves which do not intersect each other at any point. Suppose there is a change from position Q on the utility possibility curve CD to position G on the utility possibility curve EF as a result of the adoption of a new economic policy. Such a movement is an improvement on the Kaldor-Hicks criterion because G lies on the utility possibility curve EF passing through point R. From position G, movement can be made to position R simply by redistributing income between the two individuals. R is better than Q because the utility of both the individuals is greater at R as compared to the position Q. Thus, the Kaldor-Hicks criterion is satisfied and therefore change from Q to G will increase social welfare. Now, let us see, what happens to the reversal test. It must also be satisfied if the Scitovsky double test is to be fulfilled. That is, a movement from the position G back to the original position Q must not be passed by Kaldor-Hicks criterion if Scitovsky's reversal test is to be satisfied. It is evident from Figure 4.3.4 that from position R we cannot move to any position on the utility possibility curve CD merely through redistribution of income which is socially better than G (that is, which raises utility of either A or B, the utility of the other remaining constant or which raises the utility of both). Thus, while moving from position Q to G is passed by Kaldor-Hicks criterion, reverse movement from position G to position Q is not passed by Kaldor-Hicks criterion. Hence, in Figure 4.3.4 the movement from

the position Q to G satisfies Scitovsky's criterion. Thus, when the two utility possibility curves are non-intersecting and change involves movement from a position on a lower utility possibility curve to a position on a higher utility possibility curve, the change raises social welfare based on Kaldor-Hicks-Scitovsky criterion. This happens only when a change brings about an increase in aggregate output or real income.

4.3 BERGSON'S SOCIAL WELFARE FUNCTION

The concept of 'Social Welfare Function' was propounded by A. Bergson in his article 'A Reformulation of Certain Aspects of Welfare Economics' in 1938. Prior to its various concepts of social welfare had been given by different welfare theorists but they failed to provide a satisfactory solution to the problem of maximisation of social welfare and measurement. Bentham talked of welfare in terms of 'the greatest happiness of the greatest number.' Neo-Classical welfare theorists discussed the problem of social welfare based on cardinal measurability of utility and interpersonal comparison of utility. Analysis of Pareto optimality maximises social welfare by satisfying various marginal conditions of production, distribution and allocation of resources among products. But unfortunately, they are not fulfilled due to the existence of various externalities and imperfections in the market. Moreover, Pareto optimality analysis fails to measure the changes in welfare resulting from any change which benefits one section of society and harms the other. The compensation principle as given by Kaldor-Hicks-Scitovsky attempts to measure the changes in social welfare resulting from such economic changes which harm some and benefit others through hypothetical compensating payments. Compensation theorists claimed to give a value-free objective criterion based on the ordinal concept of utility but, this is based upon implicit value judgements and does not evaluate changes in social welfare satisfactorily. By providing the concept of social welfare function Bergson and Samuelson have attempted to provide a new approach to welfare economics and have succeeded in rehabilitating welfare economics. They have put forward the concept of social welfare function that considers only the ordinal preferences of individuals. They agree with Robbins' view that interpersonal comparison of utility involves value judgements but they assert that without making some value judgements, economists cannot evaluate the impact of changes in economic policy on social welfare. Thus, according to them, welfare economics cannot be separated from value judgements. According to them, welfare economics is essentially a normative study. But the approach to studying it must be scientific even though the use of value judgements in it is unavoidable. The following features of the Bergson-Samuelson Social Welfare function are worth noting:

1. The Bergson-Samuelson social welfare function is based on explicit value judgements and involves interpersonal comparisons of utility in ordinal terms.
2. Bergson-Samuelson social welfare function, the maximum social welfare position is completely determined as a result of the introduction of value judgements regarding the distribution of welfare among individuals.
3. The social welfare function is not based on any unique value judgements. Instead, any set of value judgements can be used by a welfare economist to construct a social welfare function. Thus, it is not any unique function but changes with the change in value judgements.
4. Once the social welfare function has been decided upon by value judgements, the maximisation technique is used to obtain the maximum social welfare position at which allocation of resources is Pareto optimum and also the distribution of goods and services is equitable. Thus, both efficiency and equity are achieved so that social welfare may be maximised.
5. Used along with the Pareto optimality analysis the concept of social welfare function enables us to find a unique optimum solution which combines economic efficiency with distributive justice. The social welfare function is an ordinal index of society's welfare and is a function of the utility levies of all individuals constituting the society.

Bergson-Samuelson social welfare function can be written in the following manner:

$$W = W(U_1, U_2, U_3, \dots, U_n)$$

Where W represents the social welfare $U_1, U_2, U_3, \dots, U_n$ represent the ordinal utility indices of different individuals of the society. The ordinal utility index of an individual depends upon the goods and services he consumes and the magnitude and kind of work he does. The important thing to note about the social welfare function is that in its construction explicit value judgements are introduced. Value judgements determine a form of the social welfare function; with a different set of value judgements, the form of social welfare function would be different. Value judgements are essentially ethical notions which are introduced from outside economics. The value judgements required to construct a social welfare function may be obtained through a democratic process with voting by individuals or it may have to be imposed on the society in a dictation manner. Whatever the case may be, the form of social welfare function depends upon the value judgements of those who decide about them since it expresses their views regarding the effect that the utility level of each individual has on the social welfare. In the world of Prof. Scitovsky, "The social welfare function can be

thought of as a function of each individual's welfare which in turn depends both on his personal well-being and on his appraisal of the distribution of welfare among all members of the community". Since the value judgements required for the formation of social welfare function are not of the economist himself and instead they are introduced from outside economics they are not obtained through any scientific method. It has been claimed that the social welfare function has solved the basic problem of welfare economics since it thinks unnecessary for the economists themselves to make value judgements concerning what is a desirable distribution of welfare between individuals constituting the society. In other words, an economist need not himself decide about what is the most desirable distribution of welfare. He can make value judgements regarding distribution as given from outside economics. Bergson's social welfare function is supposed to be dependent on changes in economic events that have a direct effect on individual welfare. The ordinal utility level of an individual is a function of his consumption of goods and services and not of others. Moreover, the utility level of an individual depends on his value judgments regarding the composition of different goods and services consumed which depends upon his tastes. An individual may derive more utility from the consumption of liquor whereas another individual may derive very nominal utility or no utility at all from it. We can explain the social welfare function with the help of social indifference curves or welfare frontiers. Let us assume a society of two persons. In such a case social welfare function can be represented with the help of social indifference curves.

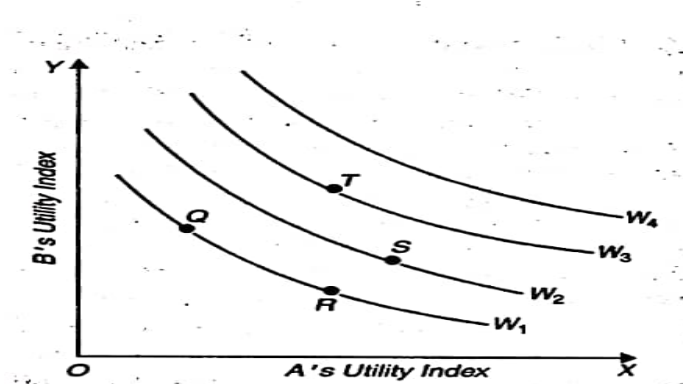


Fig 4.4.1: Social Indifference Curve depicting social welfare functions

In Fig. 4.4.1 the utilities of individuals A and B have been represented on the horizontal and vertical axes respectively. W_1 , W_2 and W_3 are the social indifference curves

representing successively higher levels of social welfare. A social indifference curve is a locus of various combinations of utilities of A and B which result in an equal level of social welfare. The properties of social indifference curves are just like that of individual consumer indifference curves. Given a family of social indifference curves, the effect of a proposed change in policy on social welfare can be evaluated. In terms of Fig. 4.4.1 any policy change that moves the economy from Q to T is an improvement. Similarly, a movement from Q to S or from R to S also represents an improvement in social welfare, and a movement from T to Q or T to S represents a decrease in social welfare. A movement along the same social indifference curve represents no change in the level of social welfare. Analysis of Pareto optimality failed to provide a 'unique optimum solution' which represents maximum social welfare. There are a large number of solutions which are optimum based on the Pareto criterion. In terms of Edgeworth-box diagram every point on the contract curve represents the optimum position. In terms of the Grand Utility Possibility Frontier, all points on it are Pareto optimal or economically efficient. But Pareto criterion does not tell us the best of them. Thus, Paretian analysis leaves us with a lot of indeterminacy in the choice of maximum social welfare point. Now, the significance of the social welfare function is that it enables us to obtain a unique optimum position regarding social welfare. This unique optimum position is the best of all the Pareto optima and therefore ensures the maximum social welfare. By including the concept of grand utility possibility frontier along with Bergson-Samuleson social welfare function we can obtain a unique optimum position or maximum social welfare position which is explained below. As shall be explained below, a 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. In other words, every point on the grand utility possibility curve represents the optimum position about the allocation of the products among the consumers, allocation of factors among different products and the direction of production. Thus every point on the grand utility possibility curve represents a Pareto optimum and as we move from one point to another on it the utility of one individual increases while that of the other falls. Now, let us superimpose the grand utility possibility curve on the social indifference curves representing the social welfare function to find a unique optimum position of social welfare.

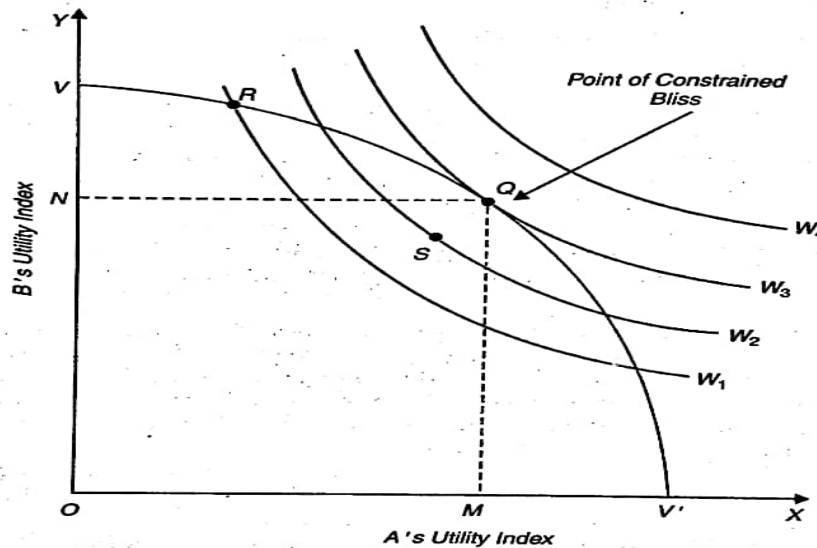


Fig 4.4.2: Social Welfare Function and position of constrained bliss

In Fig. 4.4.2 social indifference curves W_1 , W_2 , W_3 and W_4 representing the social welfare function has been drawn along with the grand utility possibility curve VV' . Social indifference curve W_3 is tangent to the grand utility possibility curve VV' at point Q . Thus, point Q represents the maximum possible social welfare given the factor endowments, state of technology and preference scales of the individuals. Point Q is known as the point of constrained bliss since, given the constraints regarding factor endowments and the state of technology. Q is the highest possible state of social welfare the society can attain. Social welfare represented by the social indifference curve W_4 is higher than social indifference curve W_3 passing through Q but it is not possible to attain it, given the technology and factor endowment. Thus, from among a large number of Pareto optimum points on the grand utility possibility curve, we have a unique optimum point Q at which the social welfare is the maximum. The point of constrained bliss represents the unique pattern of production of goods, the unique distribution of goods between the individuals and the unique combination of factors employed to produce the goods.

4.4 BROUWER'S FIXED-POINT THEOREM

This is a fundamental theorem in topology. It provides the mathematical "existence proof" for equilibrium states in systems where variables change continuously.

Definition: Any continuous function (f) mapping a compact, convex set into itself must have at least one fixed point x^* such that $f(x^*) = x^*$.

4.4.1 The Three Mandatory Requirements

1. **Continuity:** The mapping has no sudden jumps; small changes in input lead to small changes in output.
2. **Convexity:** The set has no "holes" or "indents." If you pick any two points in the set, the straight line between them is also inside the set.
3. **Compactness:** The set is closed (includes its boundaries) and bounded (does not go to infinity).

The "Price-Adjustment" Mechanism

In economics, we use this to prove that a General Equilibrium actually exists. If we assume that prices change continuously based on supply and demand:

Let P be a set of all possible prices. We define a function $f(p)$ that adjusts prices based on "Excess Demand." If there is too much demand, the function moves the price up. If there is a surplus, it moves the price down. Because the set of prices is compact and convex, Brouwer's theorem guarantees there is a price p^* where the function stops moving. At this "Fixed Point," **Supply exactly equals Demand**.

4.5 GENERAL EQUILIBRIUM

This approach recognises the interdependence of constituent parts of the economic system. It recognises the interrelations and interdependence of economic variables and seeks to answer the question how all the segments of the economy reach an equilibrium position simultaneously. General equilibrium shows, by using the tools of partial equilibrium analysis, how prices and outputs are simultaneously determined in all segments of the economy. Basically, general equilibrium is concerned with three questions: (i) Is there really any equilibrium? (ii) Does the equilibrium meet certain optimal criteria? (iii) Is the equilibrium stable? This unit discusses general equilibrium and their various approaches.

4.5.1 Principles of General Equilibrium

A fundamental feature of an economic system is the interdependence and interrelatedness of economic activities production and consumption of its various constituent's individuals, households, firms, banks and other kinds of financial institutions. The working mechanism of

economic system is unimaginably complex. It is not possible to trace the behaviour of each economic element and its interaction with the rest of the economy and trace equilibrium of each and every element of the economy. The economists, therefore, adopt two kinds of approaches to economic analysis: (i) Partial equilibrium approach, and (ii) General equilibrium approach. Partial equilibrium approach ignores the interdependence of the various segments of the economy. It isolates the segment or the phenomenon of the study from the other segments and assumes non-existence of influences of the changes occurring outside the area delimited for the study. For example, in the analysis of utility-maximization behaviour of the households, their incomes are assumed to remain constant even if incomes change due to change in factor prices in factor markets; prices of related goods (substitutes and complements) are assumed to remain constant even if they change due to change in demand and supply conditions; and the consumer's taste and performance are assumed to be given even if they are not. Similarly, in the analysis of profit maximizing behaviour of the firms, the factor prices, technology, and commodity-prices are assumed to remain constant even if these variables continue to change. The general equilibrium approach, on the other hand, recognizes the interdependence of constituent parts of the economic system. It recognizes the interrelations and interdependence of economic variables and seeks to answer the question how all the segments of the economy reach an equilibrium position simultaneously.

Thus, the task of general equilibrium theory is to find out whether there exists a general equilibrium in an economy. A general equilibrium is defined as a state in which all economic units maximize their respective objective function and all prices are simultaneously in equilibrium, and all markets are cleared. General equilibrium theory explains how this state can, if ever, be attained. If attained, whether it remains stable or not.

Leon Walras (1834–1910), a French economist, was the first to attempt to answer these questions in his book *Elements of Pure Economics* (1874). Although long before Walras, Cournot had realized that 'for a complete and precise solution of the partial problems of the economic system, it is inevitable that one must consider the system as a whole. In their opinion, the problem of general equilibrium was beyond the resources of mathematical analysis. However, Walras showed, by using a system of simultaneous equations, that all prices and quantities in all markets are simultaneously determined through their interaction with each other.

4.5.2 Existence, Uniqueness and Stability

In this section, three problems arise in connection with general equilibrium

- (i) Does a general equilibrium solution exist?
- (ii) If an equilibrium situation exists, is it unique?
- (iii) If an equilibrium situation exists is it stable?

4.5.2.1 Existence: If number of equations and the number of ‘unknowns’ are equal, it may sometimes make one think that there exists a general equilibrium solution. But, the equality of number of equations with that of unknowns is neither a sufficient nor a necessary condition for the existence of a general equilibrium solution. That it is not a sufficient condition is easy to prove. It is possible to find a system of two equations with two unknowns that has no solution in the realm of real numbers, for only real numbers have economic meaning. Market equilibrium does not always exist at a positive price-quantity combination.

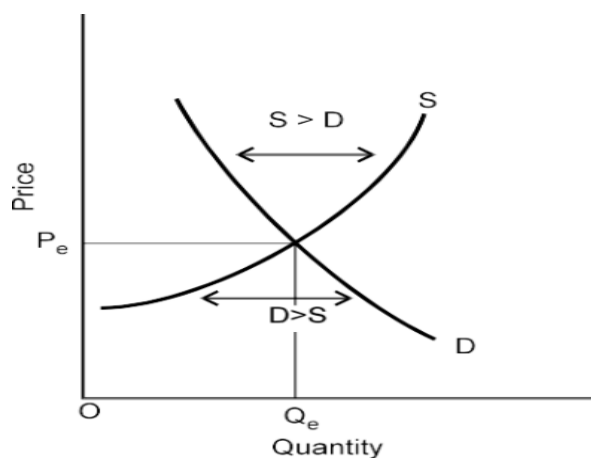


Fig. 4.5.1 Unique and Stable Equilibrium

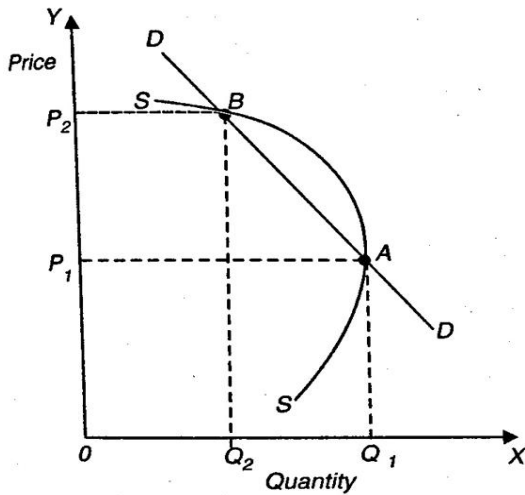


Fig 4.5.2 Backward bending supply

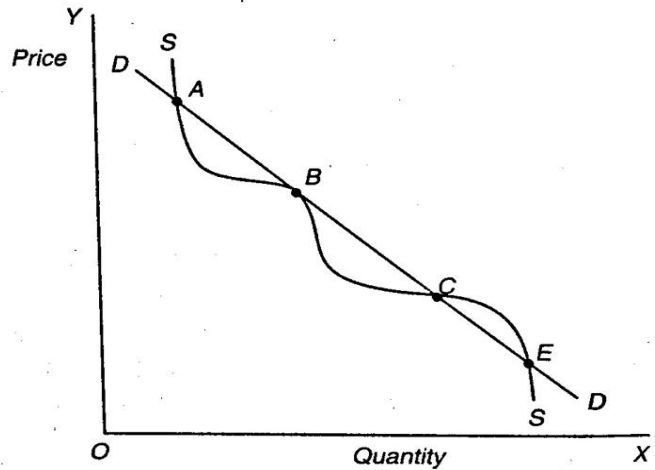


Fig. 4.5.3 Multiple Equilibria

4.5.2.2 Uniqueness: The uniqueness of general equilibrium solution requires that, at all partial equilibrium levels, demand and supply schedules intersect at only one point giving a positive price. At higher price supply curve SS bends backward in Figure 4.5.2. But in case of inferior goods, there will be no unique equilibrium. Instead there will be multiple equilibria. As shown in Figure 4.5.3, there are three equilibrium points.

However, Wald and, later, Arrow and Debreu have shown that ‘the Walrasian system does possess a unique and economically meaningful solution, provided returns to scale are constant or diminishing and there are no joint products or external effects either in production or in consumption.’ Obviously, the unique solution exists under restrictive assumptions.

4.5.2.3 Stability: Stability Walras also tried to show that general equilibrium is stable. ‘Walras’ stability analysis was based on the assumption that the rate of price changes varies directly with the amount of excess demand. Walras like Marshall, treated instability in the context of multiple equilibria; the unstable position is invariably found between two stable positions. But unstable equilibria in Walras arise from the intersection of a backward bending supply curve of a productive service with a more steeply falling demand curve. This implies the possibility but certainly not the necessity of multiple equilibria because the supply curve may never bend back again no matter how high factor price rise.’ Walras attempted to show not only stability in a single market but also a multimarket stability. Hicks have also attempted to show, in his *Value and Capital*, that the multimarket does not exist provided there are no strong income

effects. It is however difficult to establish that the general equilibrium solution is determinate and stable.

Walrasian and Marshallian Adjustment

Walrasian adjustment mechanism which considers adjustment in price over time when there is disequilibrium. On the other hand, according to Marshall it was quantity which was adjusted in case of market disequilibrium.

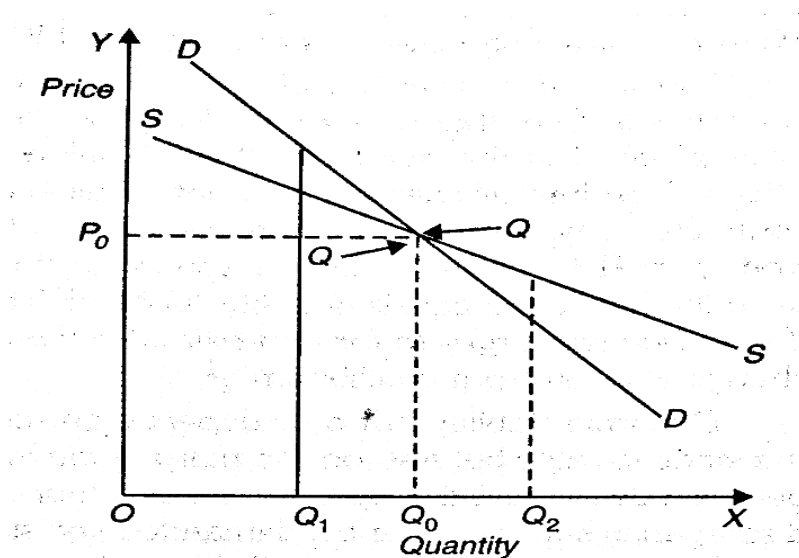


Figure 4.6.1: Walrasian and Marshallian Adjustment

However in case of both demand and supply curves sloping downward with supply curve being less steep, as shown in Figure 4.6.1, in this case according to Walrasian price adjustment, equilibrium is found to be unstable, under Marshallian, the equilibrium at Q in the Figure is stable. If current quantity is Q_1 demand price exceeds supply price at it with the result that this would tend to increase the quantity until Q_0 is reached. On the contrary, if output is Q_2 , demand price is less than supply price.

A Non-Walrasian Equilibrium (also known as Disequilibrium Economics or Fix-price Theory) describes a state where the market reaches a stable point without prices clearing. A Non-Walrasian Equilibrium occurs when prices or wages are "sticky" or fixed in the short run. Because prices cannot move to balance the market, the adjustment happens through quantities (rationing) rather than prices. It was proposed by Robert Clower, this is the foundation of Non-Walrasian theory. It distinguishes between two types of demand:

1. Notional Demand: What you *would* buy if you could sell all the labor/goods you wanted at current prices.
2. Effective Demand: What you *actually* buy based on the income you truly earned (which might be less than expected if you are unemployed).

Furthermore, he argued that during a recession, Walras' Law is not applicable. An unemployed worker might *want* to buy goods (notional demand), but they lack the cash to do so. This means their "demand" never reaches the market to signal producers to keep producing.

4.6 SUMMARY

Pareto Optimality and General Equilibrium merge into the apex of neoclassical efficiency, Brouwer's Fixed-Point Theorem gives us mathematical prove that there actually exists a price vector across all markets that clears them simultaneously. In this state of "zero waste," resources are allocated to the point where you cannot make someone better off without making someone else worse off, though the Non-Walrasian school has challenged the notion that this is ever achievable. So as Robert Clower so brilliantly showed with his Dual Decision Hypothesis, when prices are sticky "notional" desires don't convert into "effective" market signals and thus persistent disequilibrium and some form of quantity rationing is inevitable.

4.7 ANSWERS TO 'CHECK YOUR PROGRESS'

1. Welfare economics may be defined as that branch of economic science which evaluates alternative economic situations (i.e., alternative patterns of resource allocations) from the viewpoint of economic well-being of the society as a whole.
2. Welfare economics is a positive science insofar as it attempts to explain and predict the outcome of the functioning of the economic system.
3. Vilfred Pareto, an Italian economist, broke away from the cardinal utility tradition and gave a new orientation to welfare economics.
4. The basic idea behind the concept of social optimum is that while it is not possible to add up utilities of individuals to arrive at the total social welfare, it is possible to determine whether social welfare is optimum.

5. Pareto optimum is defined as a position from which it is not possible to improve welfare of any one by any reallocation of factors or of goods and services without impairing the welfare of someone else.

6. Pareto optimality in exchange is achieved when allocation of commodities among consumers is such that it is not possible to increase the satisfaction of any person without reducing the satisfaction of someone else.

7. A condition that must be satisfied for Pareto optimality of production is optimum degree of specialization of firms.

8. External economies are the gains that arise from the activities of an economic unit and accrues to other members of the society for which they cannot be charged through the market price system.

9. The standard examples of public goods are (a) radio and TV transmission;

(b) improved sanitary system of a town; (c) air-pollution control programmes;

(d) road safety-measures; (e) tree-plantation on the road sides, and green-belts of a city.

10. A minor difference between Kaldor-Hicks criteria is that Kaldor evaluates compensation from gainers' point of view while Hicks does it from losers' angle.

11. The fundamental problem in compensation criterion is that it refers to only potential rather than the actual compensation. But there is a world of difference between a potential and an actual compensation.

12. Scitovsky criterion may be stated as follows. A change in economic situation of individual would increase welfare only if (a) the change improves welfare on Kaldor-Hicks criterion; and (b) those who lose from the change are not capable of bribing those who gain for voting against the change, i.e., reversal of change does not improve the welfare.

13. A social welfare function is an indifference map which ranks different combinations of individual utilities according to a set of explicit value judgements about the distribution of income.

14. Bergson's criterion requires explicit value judgements. Value judgements of different categories of judges are bound to be different. Economists' value judgement may be different from those of the legislators, electorates or a Commission assigned with the task of policy making. Bergson does not offer a solution to resolve such differences in value judgement.

15. (i) Kenneth J. Arrow

(ii) Ordinal non-comparability

(iii) Interpersonal comparisons

16. The working mechanism of economic system is unimaginably complex. It is not possible to trace the behaviour of each economic element and its interaction with the rest of the economy and trace equilibrium of each and every element of the economy. The economists, therefore, adopt two kinds of approaches to economic analysis: i) partial equilibrium approach, and (ii) general equilibrium approach.

17. The task of general equilibrium theory is to find out whether there exists a general equilibrium in an economy.

18. The uniqueness of general equilibrium solution requires that at all partial equilibrium levels, demand and supply schedules intersect at only one point giving a positive price.

19. Walras was the first to recognize and formalize the mutual interdependence of various prices and quantities in an economic system. Although it is widely known that in economics or every-thing depends on everything else, the full implications of this generalisation were not grasped before Walras.

20. Factor market is described in Walrasian model by two sets of equations one each on demand and supply sides.

21. The original equilibrium is regained only if supply of commodity increases (decreases) and supply curve shifts forward (backward) exactly to the extent of excess (shortfall) in demand.

22. (i) Financial economics (ii) Explicit equilibrium

23. The use of the concept of 'tatonment' is a limitation of general equilibrium theory.

24. The Edgeworth's box is a way of representing various distributions of resources.

4.8 QUESTIONS AND EXERCISES

4.8.1 Short-Answer Questions

1. What is welfare economics? Is it positive or normative in character?
2. 'Pareto introduced a new concept, i.e., the concept of social optimum.' State briefly.
3. Why is Pareto's welfare economics called new welfare economics?
4. State marginal conditions of Pareto optimum in consumption and production under perfect conditions.
5. What are the conditions that must be fulfilled to achieve Pareto optimality in exchange and production under perfect conditions?
6. How are the conditions affected by the presence of: i Externalities in production and consumption, and (ii* Public goods?
7. How far can the Kaldor-Hicks-Scitovsky criteria be considered as an improvement over the Pareto criterion?
8. What is social welfare function? Does it solve the problem of Pareto's value-free criterion of social welfare?
9. What does Arrow's impossibility theorem state?
10. How and why did Amartya Sen simplify Arrow's social choice theory?
16. What are the limitations of partial equilibrium analysis?
11. Distinguish between general and partial equilibrium analysis.
12. Define general equilibrium.
13. Does general equilibrium analysis offer a unique solution of price and output determination?
14. What are the conditions, for the stable general equilibrium solution?
15. Outline the general equilibrium approach to economic studies.
16. State the conditions for the existence, stability and uniqueness of a general equilibrium in an economy with two factors, two commodities and two consumers.
17. What are the conditions for the stability of the Walrasian general equilibrium? Do such conditions exist in reality?
17. 9. What is the process of automatic adjustment?
18. 10. What are the key features of Arrow-Debreu economy?
19. 11. Briefly state the Arrow-Debreu economy.
20. 12. State some of the criticisms of general equilibrium theory.

4.8.2 Long-Answer Questions

1. Discuss the meaning and nature of welfare economics.
2. Explain the concept of Pareto optimality.
3. How has Pareto's optimality theory been criticized? Discuss.
4. Assess the Pareto optimality conditions in detail.
5. Evaluate Pareto's optimality theory under perfect competition.
6. 'Externalities in production consist of both external economies and external diseconomies.' Discuss.
7. "The Pareto criterion does not give us a sufficient basis for ordering states. The Kaldor-Hicks-Scitovsky criteria do not carry us much farther.' Examine critically.
8. Critically analyse Bergson's social welfare function.
9. Discuss Arrow's impossibility theorem. Assess the principles of general equilibrium.
10. Discuss the existence, uniqueness and stability of a general equilibrium.
11. Critically analyse the Walrasian approach to general equilibrium.
12. Discuss Walrasian approach to general equilibrium assuming a two-commodity-two-consumer-two firms-two inputs model. Illustrate graphically how economic system reaches the general equilibrium position.
13. Evaluate the process of automatic adjustment.
14. Explain the Arrow-Debreu model.
15. Discuss the impacts of Arrow-Debreu model on economics and financial economics.
16. What does the theory of general equilibrium under uncertainty state?

4.9 REFERENCE AND CREDITS

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