ARBAMINCH UNIVERSITY COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

MODULE ON

MICROECONOMICS I (Econ 2021)

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Preface

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

Regarding to the module‟s organization, there are six chapters to be covered in this course. The first chapter is an introductory chapter presenting an overview of basic concepts and principles in economics; chapter two explains the theory of demand and consumer behavior; chapter three explains choice under uncertainty; chapter four presents the details of theory of production, chapter five is about theory of cost of production, and chapter six exclusively devoted to product market structures emphasizing on perfectly competitive market.

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

Contents

CHAPTER ONE 1
1.2. Scope of Economics 2
1.3. Goals of Economic Policies 3
1.4. **Methods of Economic Analysis** 3
1.5. Basic Economic Problems and Economic Systems 4
1.6. Scarcity and the Problem of Choice 5
1.7. The PPF, Efficiency and Opportunity Cost 6
1.8. Decision–Making Units and Circular Flow of Economic Activities 11
1.10. Demand and Supply 16
1.10.1. Demand and Supply Functions, Schedules and Curves 16
1.10. 2. Market Equilibrium 24
Summary 27
Self-check Exercise 28
CHAPTER TWO 31
2. Theory of Consumer Behavior and Demand 31
2.1. Introduction 31
2.2. Budget Constraints 32
2.3. Preferences 37
2.3.1. Consumer's Preference and Preference Relation 37
2.4. Indifference Curves 38
2.5. Exceptional Cases of Indifference Curves 42
2.6. Well Behaved Preferences 44
2.6.1. Properties of Well-Behaved Preferences 44
2.7. Utility 45
2.7.1. Total and Marginal Utility 45
2.7.2. Cardinal Utility 47
2.7.3. Ordinal Utility 48
2.8. Consumer Choice 52
2.8.1 Optimum of the Consumer 52
2.8.2 Optimality Condition for Exceptional Indifference Curves 54
Derivation of Consumer Demand 55
2.9.1. Derivation of the Market Demand 56
2.10. Consumer's Surplus 58
2.11. Elasticity of Demand 59
Self-Check Exercise 65

CHAPTER THREE **68**
Choice and Uncertainty **68**
Introduction **68**
3.1. The Concept of Risk and Uncertainty; and Quantification **69**
3.2. Utility Function under Uncertainty **71**
3.4. Individual Preference toward Risk **72**
3.4.1. Risk Aversion **72**
3.4.2. Risk Loving **74**
3.4.3 Risk Neutral **75**
3.5. Reducing Risk **76**
3.5.1. Diversification **76**
3.5.2. Risk Spreading **78**
Summary **80**
Self-Check Exercise **80**
CHAPTER FOUR **81**
THE THEORY OF PRODUCTION **81**
4.1 Introduction: Definition and basic concepts **81**
4.2. Short run production: Stages of production **84**
4.3. The law of diminishing marginal returns (LDMR) **87**
4.4. Efficient Techniques of Production **88**
4.5. Long run Production: Production with two variable inputs **90**
4.5.1 Isoquant **90**
4.5.2 Properties of Isoquant **91**
4.5.3 Shape of Isoquant **94**
4.5.4 The slope of an isoquant: marginal rate of technical **97**
Substitution (MRTS) **97**
4.6. The efficient region of production: long run **98**
4.7. The long run law of production: The law of returns to scale **99**
4.8. Product Lines **101**
4.9. Graphical presentation of returns to scale for homogeneous **102**
Production function **102**
4.10 Equilibrium of the firm: Choice of optimal combination of factors of production 105
Summary **110**
Self-check Exercise **111**
CHAPTER FIVE **112**
5. Theory of Costs of Production **112**

5.1. Introduction **112**
5.2. Basic Concepts of Cost **112**
5.3. Cost Functions **114**
5.4. Traditional Theory of Cost **116**
5.4.1. Short Run Costs of the Traditional Theory **117**
5.4.2. The relationship between AVC, ATC and MC **126**
5.4.3. The Relationship between Production and Cost **128**
5.5. Traditional Theory of Long Run Costs **129**
5.5.1. Derivation of The Long- Run Average Cost Curve ***129***
5.5.2. ***The Long-Run Marginal Cost Curve*** ***133***
Summary ***135***
Self-check Exercise **136**
CHAPTER SIX **137**
6. Price And Out Put Determination Under Perfect Competition **137**
Introduction **137**
6.1 Perfect Competition **137**
Definition and Assumptions **137**
6.2. Demand and Revenue Functions under Perfect Competition **140**
6.3. Short-Run Equilibrium **142**
6.3.1. Short Run Equilibrium of the Firm **143**
6.3.2. The Short Run Supply Curve of the Firm and the Industry **153**
6.3.3. Short Run Equilibrium of the Industry **156**
6.4.1. Equilibrium of the Firm In the Long Run **157**
6.4.2. Equilibrium of the Industry in the Long-Run **158**
6.4.3. Industry's Long Run Supply Curve **161**
Summary **162**
Self-check Exercise **162**

CHAPTER ONE
1. Introduction to Basic Principles of Economics 1.1 Definition

There is no universally accepted definition for the term "Economics". Nevertheless, many scholars have penned their own definitions.

- Economics is the social science concerned with the efficient use of limited or scarce resources to achieve the maximum satisfaction of human material wants
- Economics is a study concerned with doing the best with what we have.
- Economics is the study of how best to use limited means in the pursuit of unlimited ends.

When we boil down all these definitions, we find one common theme**:** ***Economics is a social science that studies how societies use the limited resources to produce valuable goods and services that satisfy their unlimited (insatiable) wants and desires.***

NOTE: Resources are limited while human wants are unlimited. That is resources are scarce while human wants are insatiable.

There are two important ideas,

- goods are scarce and
- Society must use its scarce resources efficiently.

Indeed, economics is an important subject because of the fact of scarcity and the desire for efficiency. If human desires were fully satisfied, economics would no longer be a useful subject. But no society (whether the rich or the Poor) has reached a utopia of limitless possibilities.

Resources are limited, while wants seem limitless. Given unlimited wants, it is important that an economy makes the best use of its limited resources. This leads us to the critical notion of efficiency.

Efficiency denotes the most effective use of a society‟s resources in satisfying society‟s wants and needs.

Scarcity occurs when a society‟s wants exceed the ability of the economy to meet those needs. It is a fact of life in both developed countries like U.S. and developing countries like our country Ethiopia. In other words, it occurs when people want more than what the economy can provide at zero price. It is obvious that it is human nature for people to want

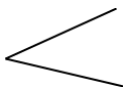
more than they have, which forces them to make choice. Hence economics is a science of choice. Scarcity and choice go together.

$\Rightarrow$ **Scarcity $\rightarrow$ choice $\rightarrow$ Economics**

Generally, the essence of economics is to acknowledge the reality of scarcity and then figure out how to organize society in a way to produce by adopting the most efficient use of resources.

1.2. Scope of Economics

In order to understand the scope of Economics it is better to explore the way it is organized. Traditionally Economics has two major divisions: namely microeconomics and macroeconomics.

Economics 

Micro economics (tree) = Price theory

Macroeconomics (forest) = Aggregate economics

Microeconomics is a branch of economics which is concerned with the behavior of individual entities such as firms, markets and households or consumers and the like at a disaggregated level.

In microeconomics we talk of an individual industry, firm or house hold

- When we study the price of a specific commodity.
- When we examine the revenue and /or expenditure pattern of a particular firm

Macroeconomics is the other branch of economics concerned with the overall performance of the economy. It studies the behavior of the economy as a whole with booms and recessions, the economy‟s total output of goods and services and the growth of output, the rate of inflation and unemployment, the balance of payment and so on. For example:

- Total agricultural production in Ethiopia for 1996 E.C
- What is the aggregate expenditure of the FDRE in 2003?

The two branches, Microeconomics and Macroeconomics, converge to form modern economics.

♥ Check your progress 1

1. **Define the subject economics.**
2. **Distinguish between macroeconomics and microeconomics.**

1.3. Goals of Economic Policies

What are the basic economic goals that any nation wants to fulfill through different economic policy instruments? Here are listed below:

a) **E***conomic Growth*: - produce more and better goods & services.

b) **F**ull *Employment*: - Provide suitable jobs for all citizens who are willing and able to work.

c) **E***conomic efficiency*: - Achieve the maximum fulfillment of wants using the available productive resources

d) **P***rice level stability*: - Avoid large up swings and down swings in the general price level that is avoid inflation and deflation.

e) **E***quity*: - Ensure that no group of citizens faces absolute poverty while others enjoy luxury in other words, guarantee fair income distribution.

f) ***B****alance of trade*: - seek a reasonable overall balance with the rest of the word in international trade and financial transactions.

NOTE: that different nations use different policy instruments in order to achieve these and other goods. These policies could be either fiscal or monetary policies.

1.4. Methods of Economic Analysis

Economics ask and attempt to answer two kinds of questions: question of fact and question of fairness (Positive and normative)

Positive economics: attempts to understand the behavior and operation of economic systems. It describes the fact of the economy, in other words, it focuses on facts and avoids value judgments i.e. it tries to describe what exists. Positive economics is a way to look at changes in economic policy or conditions to forecast the impact of changes on observable items like production, sales, prices, etc. It then tries to determine the gainers and the losers as a result of the changes in policies. That is it tries to establish statements about economic behavior that can be verified by facts. It makes statements that can be supported or rejected by empirical evidence.

Positive economics deals with questions of fact.

1. What is the economic impact of raising taxes?
2. The unemployment rate in nation A is 15%.
3. The economic growth rate in Ethiopia is very low.

Normative economics: In contrast, normative economics involves ethics and value judgments about what the economy should be or what particular policy actions should be recommended to get it to be that way. Normative statements can‟t be verified as true or false, unlike positive statements. It looks at the desirability of certain aspects of the economy.

Normative economics deals with the question of fairness.

1. Should poor people be required to work if they are to get aid? N
2. The African economy should grow at 10%. N
3. We ought to allow higher rate of unemployment in order to avoid inflation. N.

NOTE: Positive economics is concerned with "*what is*", while Normative economics is concerned with "*what ought to be*" or "*what should be*".

1.5. Basic Economic Problems and Economic Systems

The central problem that all societies face is the scarcity of resource compared to the unlimited wants of their members. Thus, economic systems try to organize and allocate these scarce resources among competing needs and withstand the imbalance between limited capacity of productive resource and unlimited human wants or desires. In order to overcome this problem every human society must confront and answer three fundamental and interdependent economic problems. These are, i) what to produce (ii) how to produce, and (iii) for whom to produce.

(i) **What to produce-** this refers to the identification of what mix of goods & services to produce and what quantity of those goods and services to produce over a period of time. In other words, a country has to decide in some way or another, what collection of goods and services will mostly satisfy the needs of its citizens and in what quantities the goods and services to be produced. The question of what to produce is a matter of deciding to produce teff or wheat or both. If the decision is to produce both, then how many quintals of each item should be produced?

(ii) **How to produce-** this problem refers to technical and organizational problem of production. An economic system chooses what techniques to use in order to produce the desired level of output. Several problems are associated with this kind of economic activity such as -

♠ **what** resources should be used in the production of goods or services, more machines or more laborers? This is the choice of production technique.

♠ **which** goods should be produced by large plants and by small scale units or cottage industries? This is the problem of size & organization of production units.

♠ **W**hat should be produced in public sector and what in private enterprises? This is the problem of ownership of productive resources.

♠ **Where** the goods and services should be produced? This is a problem of location of industries.

(iii)**For whom to produce-** this refers to the problem of who gets how much of what is produced in the economy. What should be the share of resource owners? What should be the basis of income distribution? At enterprise level as well as at national level? Such problems are resolved depending on the objective of the economic decision making unit. For example, for a commercial entrepreneur whose main objective is to maximize profit, goods & services are produced for those who are willing and able to pay high prices. For a social planner, the main objective is to guarantee fair distribution of the produced goods and services to meet the basic needs of the society at large.

1.6. Scarcity and the Problem of Choice

We have tried to define scarcity in the first chapter. Scarcity is a fact of life; and this scarcity leads to the problem of choice. Therefore, as we discussed in class, it is this science of choice that we call Economics. In this chapter we are going to see the concept of opportunity cost, efficiency and then we will develop a model known as the Production Possibility Frontier (PPF).

Next, we shall discuss about the decision making units and put them in the Circular Flow of economic activities. Finally, we will touch up the different economic systems, like the free market economy, the command economy, the mixed economy and the traditional economic systems.

♥ Check your progress 2

Dear learners have you carefully understood what we mean by scarcity and unlimited wants of human being? Suppose you are a chief economist working as a planner in your zonal planning department. How would you try to solve these economic problems confronting your society?

1.7. The PPF, Efficiency and Opportunity Cost

We have outlined the three major economic tasks of every society. To answer these questions, every society must make choices about the economy‟s inputs and outputs. Inputs (factors of productions) are commodities or services that are used by firms to produce goods and services. These are land, labor, capital and entrepreneurial ability. And these inputs are combined to produce outputs. And outputs are various useful goods or services that are either consumed or used for further production.

Since resources are scarce, the society needs to use its limited resources efficiently and produce as many goods and services as possible from the available resources, so as to maximize total satisfaction. To realize this outcome, it must achieve both full employment and full production.

Full employment: - refers to using all the available resources. No capital and land should be kept idle. No workers should be involuntarily out of work. (This sentence will not apply for the aged, children and disabled person.)

The employment of all available resources is not enough to achieve efficiency. But full production should also be realized. By full production we mean that all employed resources should be used so that they provide the maximum possible satisfaction of society‟s material wants. Furthermore, full production implies two kinds of efficiency: Productive and allocative efficiency.

1. **Productive efficiency:** is a production of any particular mix of goods and services in the least costly way. When we produce one commodity at a lowest achievable unit cost, we are expending the smallest amount of resources to produce that commodity and therefore making available the largest amount of resources to produce other desired products.

2. Allocative efficiency: refers to the production of that particular mix of goods and services most wanted by the society. This is the question of priority. It is nonsense to assign top priority to everything. In simple words, it means apportioning limited resources among firms and industries in such a way that society obtains the combination of goods and services which it wants the most.

NOTE: Productive Efficiency + Allocative Efficiency = Full Production

Opportunity Cost: - Because resources are scarce, a full employment, full production economy cannot have an unlimited output of goods and services. Therefore, people must choose which goods and services to produce and which to forgo. Suppose you have Br.10 and are deciding how to spend it. Should you buy five exercise books? A ticket for cinema? Two large fast foods?... Note, however, that once you decide to do one of these alternatives with your money (Br.10), the other alternatives are sacrificed. Therefore, opportunity cost of any decision is a sacrifice made in choosing the best alternative. It is the forgone value of the next best alternative that is not chosen.

Note that every time a choice is made, opportunity cost is incurred. **Efficiency: -**it denotes the most effective utilization of a society‟s resources in satisfying people‟s wants and needs.

The Production Possibility Frontier/Curve (PPF/PPC)

Because resources are scarce, societies cannot have everything they want. They are limited by the resources and the technology available to them. Therefore, they must choose which goods and services to produce and which to forgo. The necessity and consequences of these choices can be best understood through a production possibility model.

Assumptions

We begin our discussion with the following simplifying assumptions. (In economics, assumptions are useful to simplify economic analyses because assumptions are a simplified picture of reality.)

A) Two goods: - the economy is producing only two goods, say wheat and machinery.

B) Homogeneity of resources: - the available factors of production are homogenous in the sense that they can be employed anywhere in the production of goods and services.

C) Specialization: - some inputs are better adapted to the production of one good than to the production of the other, eg Land is more useful for the production of wheat than car. But we don‟t mean that land is not important for car producing factory‟s site.

D) Full employment and productive efficiency: -the economy is employing all of its available resources (full employment) and producing goods and services at least cost (productive efficiency).

E) Fixed technology: - technology is fixed and does not advance during the period under consideration.

F) Fixed resources: - the available supplies of factors of production are fixed in both quality and quantity. Nevertheless they can be reallocated, with in limit, among different uses (see the assumption of homogeneity).

NOTE: The assumption of fixed resources and fixed technology imply that we are looking at an economy at a very short period of time.

The production possibility frontier (PPF hereafter) is a curve that shows the different combinations of two goods or services that can be produced in a full employment, full production economy in which the available supplies of resources and technology are fixed. In simple words it is a menu of goods that can be produced by a given economy.

Given all the above listed assumptions consider the following production possibilities that list the different combinations of two products machinery and wheat.

Table 1.1- production possibility table for a hypothetical economy

Type of Products	Production alternatives				
	A	B	C	D	E
Wheat	0	1	2	3	4
Machinery	10	9	7	4	0

In the above table, we broadly classified the goods produced by the hypothetical economy in to two: wheat to represent all types of consumer goods (goods that satisfy societies want directly) and machinery to represent capital goods (that satisfy society"s wants indirectly by increasing or enhancing the future productive capacity of the economy).

At production possibility A, this hypothetical economy would be devoting all its available resources to the production of machineries while at alternative E, all resources would go to wheat production. As we can understand, these two alternatives are extreme cases since an economy typically produces both capital and consumer goods.

As we move from point A to E, we increase the production of wheat at the expense of machinery production. And the reverse is true when we move from point E to point A. In general, at any point in time, an economy that is achieving full employment and productive efficiency must sacrifice some of one good to obtain more of another good. Scarcity of recourses prohibits such an economy from having more of both goods.

The information in the above production possibility table can also be shown graphically. We use a simple two dimensional graph, arbitrarily representing the output of capital goods (machineries) on the vertical -axis and the output of consumer goods (here wheat) on the horizontal- axis as shown below.

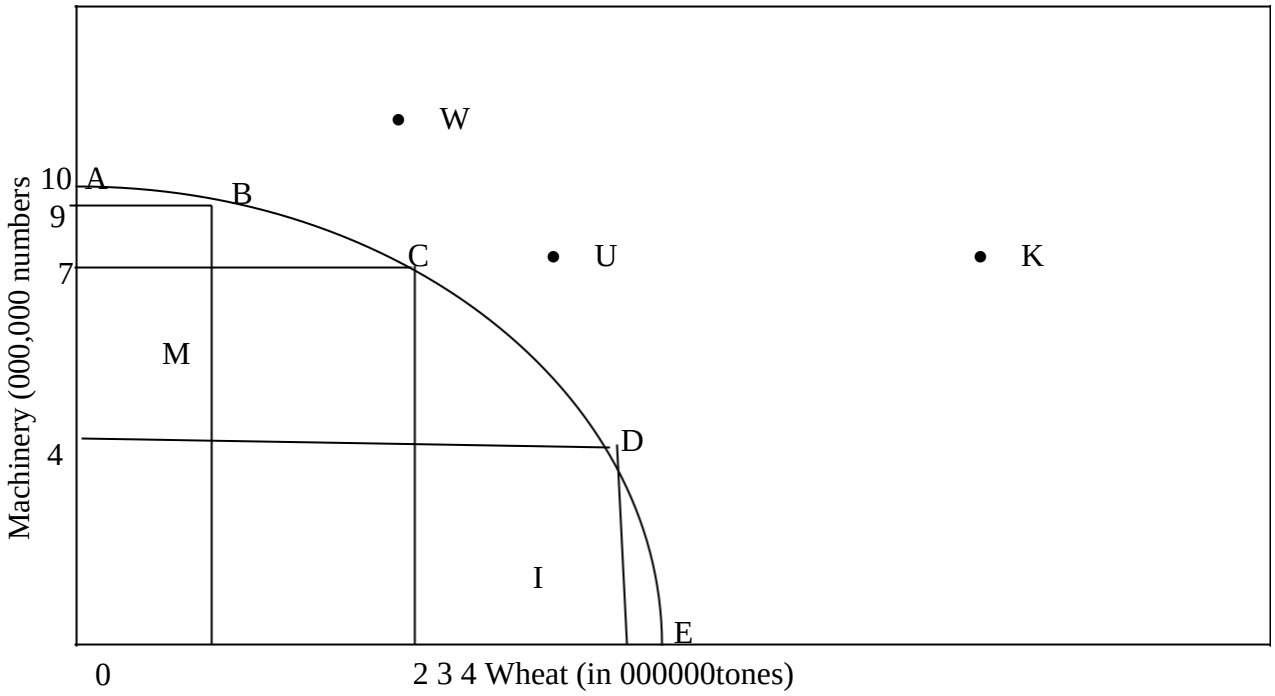


Figure 1.1: Production possibility curve

Each point on the PPF represents some maximum output of the two products. The curve is a production frontier because it shows the limit of attainable points of production. To obtain the various combinations of the two goods that fall on the PPF, the economy should achieve both full employment and productive efficiency. So, points on the PPF, like A, B, C, D, E,) are both attainable and efficient.

Points lying inside (to the left of) the curve are also attainable but not as desirable as points on the curve. Points inside the curve imply that the economy could have more of both goods if it achieved full employment and productive efficiency. So, points like I, L, M, O, etc are attainable but inefficient.

Points lying outside (to the right of) the curve would represent a greater output than that at any point on the curve. But such points cannot be attained with the current supplies of resources and technology. So, points like U, W, and K are unattainable.

Summary on PPF

- Points on the curve are both attainable and efficient

- Points inside the curve are attainable but inefficient
- Points outside the curve are unattainable.

Because resources are scarce relative to the virtually unlimited wants which they can be used to satisfy, people must choose among alternatives. More of wheat means less of machinery, and vice versa. The amount of other products which must be forgone or sacrificed to obtain more of a specific good is what we call it the opportunity cost of that good. But, the more of a product which is produced, the greater is its opportunity cost ("marginal" being implied). This is what we call the ***law of increasing opportunity cost***

The law of increasing opportunity cost states that the opportunity cost of each additional unit of output of a good over a period increases as more of that good is produced. In other words, the law states that in order to get more of something one must give up ever increasing quantities of something else. The economic rationale for this law is that economic resources are not perfectly adaptable to alternative uses. That is some economic resources are not completely adaptable to alternative employments- some economic resources are more suited than others to the production of particular goods. Because this implication has been widely supported by empirical evidence, it is called a "law". This law is reflected in the shape of the PPF. The curve is **Concave**, or bowed out, from the origin. That is, the slope of the curve gets steeper as we move down from A to E. The curve has a negative slope implying a sacrifice due to scarcity of resources. That is, negative slope of the PPF illustrates the existence of scarcity.

♥ **Check your progress 3**

What would happen to the shape of the PPF if resources were perfectly adaptable or perfectly flexible in both lines of production?
[Hint: - the law of increasing opportunity cost would be violated, and we will have constant opportunity cost.]

To sum up, PPF illustrates four basic concepts:

a) **Scarcity of resources:** - this is reflected by the negative slope of the PPF. Moreover, points outside the curve are unattainable because of the scarcity of resources.

b) **Choice: -** this is reflected in the need for the society to select among the various attainable goods on the curve. Substitution is a rule rather than exception in full employed economy and the PPF depicts the menu of society‟s choices.

c) Downward slope of the PPF: - this indicates the trade-offs that exist in the real world, i.e. opportunity cost.

d) Law of increasing opportunity cost: - this is reflected by the concavity of the PPF.

1.8. Decision–Making Units and Circular Flow of Economic Activities

Because market systems now dominate the world economy, our focus in this sub- section is on how nations use markets to respond to the economizing problem. Our goal is to identify the major groups of decision makers and the major markets in the market system. Our tool of analysis is the circular flow model.

NOTE: Market is an institution or mechanism which brings together buyers (demanders) and suppliers (sellers) of particular goods & services or resources.

The three most important decisions – making units are: Households, Business firms, and Governments

a. Households: - these are units that provide an economy with the resources they sell in the factor market and use the money paid for them to buy goods& services from the product market. They are owners of resources (land, labor, capital and entrepreneurship) and they make decisions on how to sell their resources to firms and governments. They also make decision on what and how much of the commodities they can buy from business firms.

b. Business firms: - these are production units that use resources to produce goods & services and sell them to other firms, households and governments. Business firms make economic decisions on buying resources from households in order to produce goods & services and selling their products to households and governments.

c. **Governments: -** this refers to an organization that has a legal & political power to exert control over individuals, business firms and markets. A government provides social goods & services, such as defense road, justice, education, public health, and other infrastructure facilities. The major source of government revenue to finance social goods & services comes from the collection of taxes.

***NOTE: Factor/Resource Market** is the place where resources or the services of resource suppliers are bought and sold; and **Product Market** is the place where goods & services of business times are bought and sold.*

The circular Flow Model – Two sectors Model

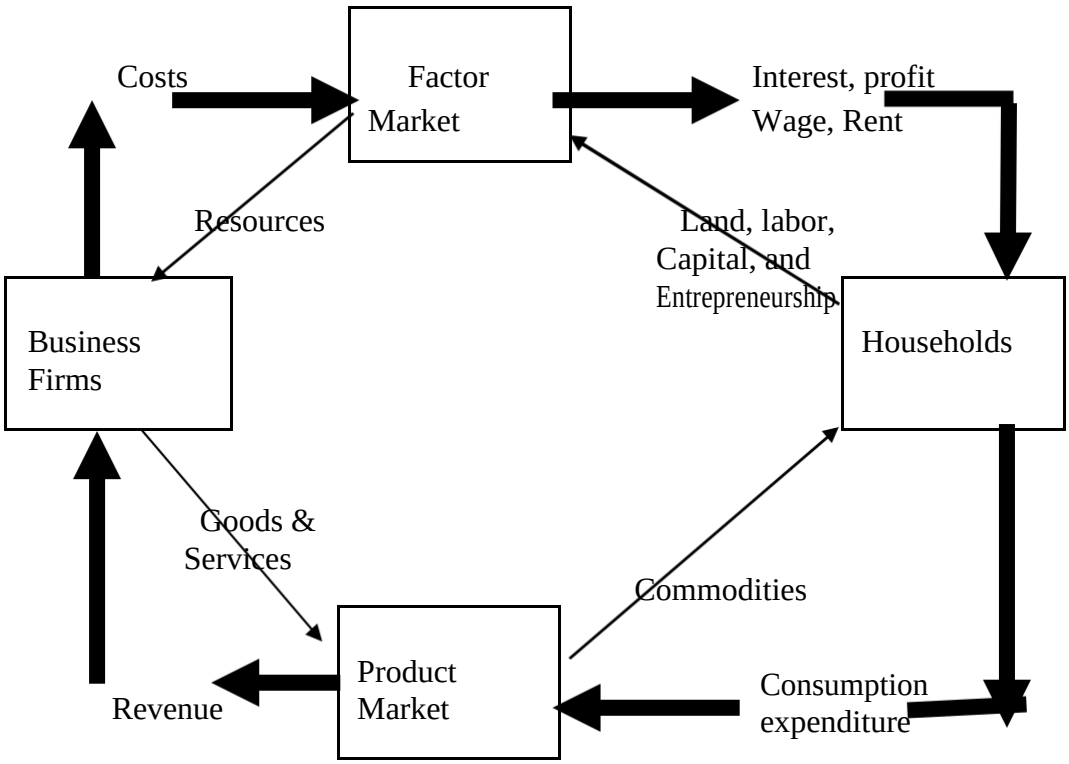


Figure 1.2: the circular flow-two sectors

In the two sector model circular flow of economic activities, we set the flow of goods & services from producers to households and the flow of resources from households to business firms. The model suggests a complex, interrelated web of decision making and economic activities. Note that households and business firms participate in both basic markets, but on different sides of each - firms are on the buying or demand side of resource markets, and households (as resource owners and suppliers) are on the selling or supply side. In the product market, on the other hand, these positions are reversed households are on the demand side, and firms on the supply side. Each group of economic units both buys and sells.

In the factor market firms purchase or hire economic resources to produce goods& services which are demanded by households. The households, in turn, use the income they earn from the sale of the resources (rent, wages, interest and profit) to purchase goods & services which are supplied by the firms and thus the circular flow of economic activities is complete.

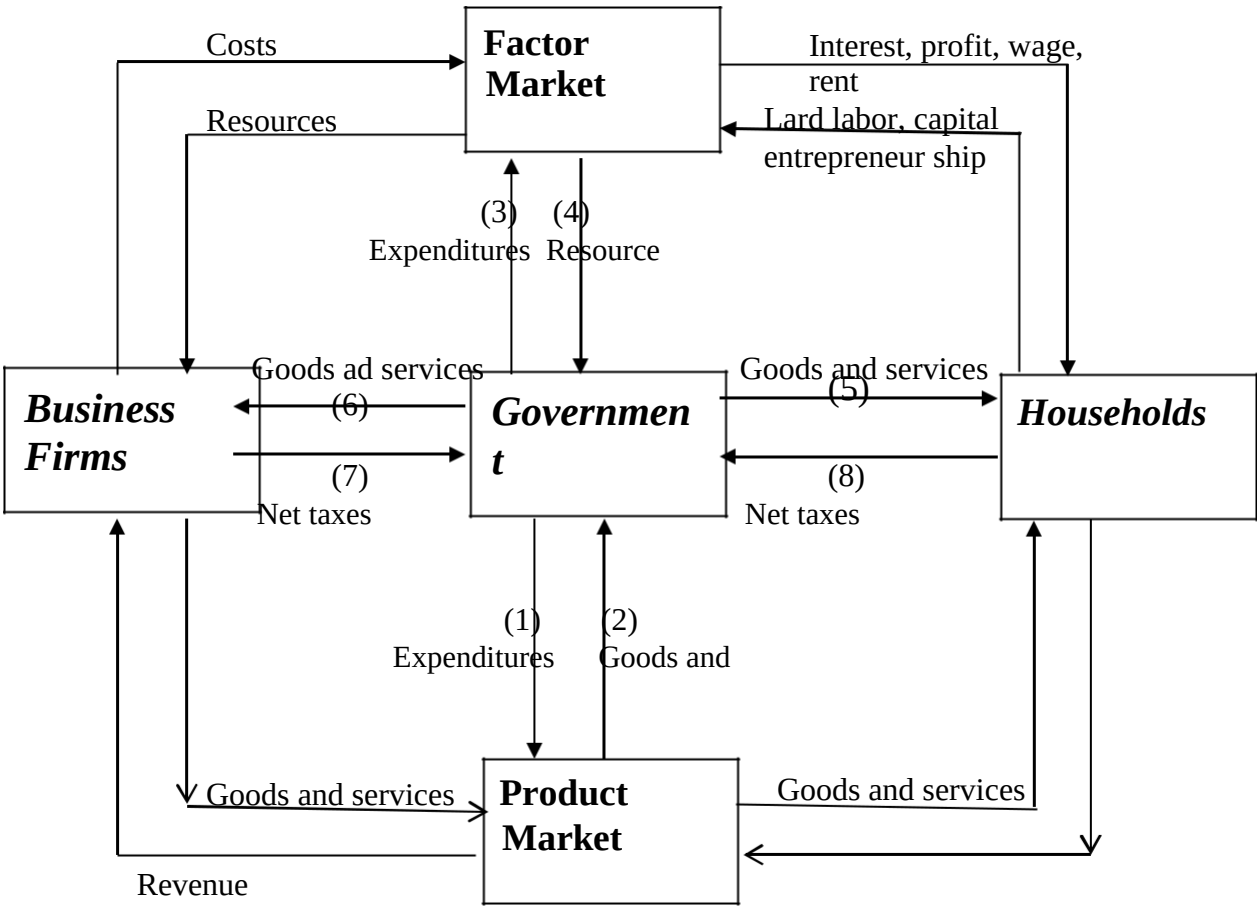
Moreover, the problem of scarcity challenges these economic activities & exchanges. Because households have only limited amounts of resources to supply to firms, consumers‟ money incomes are limited, which means that each consumer‟s income will go only so far. A

limited amount of money income clearly will not permit the purchase of all the goods & services the consumer might like to buy. Similarly, because resources are scarce, the output of finished goods and services is also necessarily limited.

To summarize: In a monetary economy, households, as resource owners, sell their resource to businesses /firms and as consumers, spend the resource income by buying goods & services. Firms must buy resources to produce goods & services, their finished products are then sold to households in exchange for consumption expenditures or, as firms see it, revenues. These revenues are used to purchase additional resources to maintain the circular flow. The net result is, in the above figure, a counter clock wise real flow of economic resources and finished goods & services, and a clock wise money flow of income and consumption expenditures. Those flows are simultaneous & repetitive.

- ***Real flow – the flow of resources and finished goods & services.***
- ***Money flow – the flow of income and consumption expenditures.***

We have also a ***three–sector model*** in which the government is involved in economic activities. Government is thoroughly integrated in to the real and monetary flows that make up the economy.



♥ Check your progress 4

Dear students consider the modifications resulting from the addition of government and suggest ways government might try to stabilize the economy.
(Explain it by your own words)

Alright! If you have tried to answer the above questions by your own understanding, it is nice. Now let‟s discuss what really happens and what government does by the virtue of its involvement. As we can see from the diagram government occupies the central place of such a three sector model.

Flows (1) through (4) tell us that government makes purchases in both product and resource markets. Specifically, flows (1) and (2) represent government purchases of such things as paper, computers, machinery, building or contracts for the construction of buildings, etc from private firms. Flows (3) and (4) reflect government purchases of resources. The Ethiopian government employs and pays salaries to civil servants, armed force, justice department, lawyers and so forth.

Government then provides public goods & services to both households and businesses as shown by flows (5) and (6). Financing public goods & services requires tax payments by firms and households as reflected in (7) and (8). Please note that most government goods & services are not sold by the private sector in markets. Instead, government avails its goods & services as public goods (like road, bridge, pension fees defense...) and, in turn, collect tax from the users.

To conclude, the modifications in the circular flow model due to the addition of government can be summarized as follows.

- The vertical arrows show how governments participate in markets: provide incomes to workers & resource owners (in the factor market) and to firms (in the product market).
- The horizontal arrows show how government charges taxes to households and firms in order to obtain the necessary funds to purchase goods & services (in the product market) and hire input services (in the factor market).
- The inputs and goods & services are used to provide public goods& services that benefit both households and firms.

1.9. Alternative Economic Systems

The existence of some kind of economic system that organizes and allocates scarce resources among the various sectors of the economy and resolves the three basic economic questions is quite essential. In this regard, economic analysis identify four types of economic systems, namely (1) free market economy, (2) command economy, (3) mixed economy, and (4) traditional economy.

Free-market economy (capitalism): This type of economy is regulated by the market prices of different commodities and services as determined by their respective markets in which demand and supply forces interact. The investment pattern or what we call as resource allocation is also done by the markets. In a free enterprise economy the basic economic problem of what, how, and for whom to produce are resolved by the market mechanism.

Command economy (socialism): This is a form of economic system in which the means of production except labor are owned by the state. The state, in fact, owns the resources on behalf of the society as a whole. Alternatively, we call it as *public ownership* or *collective ownership* of the resources. Both resource allocation and pricing decisions are undertaken by a *centralized planning commission*. Production of goods & services is undertaken for uses keeping in mind the needs of consumption rather than profit. All decisions regarding production, choice of technology, and distribution of the national income are determined by the government. Workers are employees in state enterprise and they are paid for their socially necessary labor time

.

Mixed Economy: A mixed economy will have private as well as public sectors within its scope. The shortcomings of capitalist and socialist economic systems gave rise to the evolution of a modern mixed economy which involves both market and government participation in the allocation of economic resources. The basic economic problems are resolved by a mixture of government decisions and market forces of demand and supply. However, the role of the government is *intermediate* in a mixed economy. Most of the world economies are mixed at present. The degree of the *'mixture'* of the two systems differs across counties.

Traditional Economy: In this type of economic system, the basic economic problems are resolved by traditional or long standing rules or customs of social behavior. Production,

exchange and distribution of income are sanctioned by custom. Technological change and innovations are usually constrained by tradition. In general, economic activities are treated as secondary and society mainly focuses on religious and cultural values in a traditional economy.

1.10. Demand and Supply

The tools of demand and supply can take us far in understanding not only specific economic issues but also how the entire economy works. Our circular flow model in the last chapter identified the participants in the product and resource markets. There, we asserted that prices were determined by the "interaction" between demand and supply in these markets. In this chapter we examine that interaction in detail explaining how prices and output quantities are determined.

NOTE: market is an institution or mechanism which brings together buyers ("demanders") and sellers ("suppliers") of particular goods, services, or resources. All situations which link potential buyers with potential sellers are markets. They may exist in many forms. The corner gas station, local music shop, a farmer‟s road side stand, car rent shops ... are all familiar markets. Some markets are local while others are national or international. Some are highly personal, involving face to face contact b/n demander and suppler, and others are impersonal with buyer and seller never seeing or knowing each other.

In order to simplify matters, this chapter and the next focus on markets consisting of large numbers of independently acting buyers and sellers exchanging standardized/ homogenous product- highly competitive markets. Let‟s first deal with demand and then supply; and finally we put them together to determine the equilibrium point.

1.10.1. Demand and Supply Functions, Schedules and Curves

Demand and Supply could be expressed in the form of functions, schedules, or curves. That is they are expressed in functions form [Y = f (x)] as quantities are function of prices, or these variables expressed in tabular form/ schedules, or else they can be transformed in to curves.

A) Demand: - it is a schedule or a curve showing the various amounts of a product consumers are *willing and able* to buy at each of a series of possible prices during a specified period of time. It, therefore, shows the quantities of a product which will be purchased at various possible prices, citrus paribus. In other words, demand is the inverse or negative relationship b/n the price of a commodity and the quantity demanded of an item, i.e. the

amount that buyers are willing and able to buy at a given price over a time period. Demand is simply a statement of a buyer‟s plans, or intentions, with respect to the purchase of a product.

The definition involves willingness and ability to buy because willingness alone without the necessary birr will be a nominal (not real or not actual) demand. Willingness to buy must be backed up by the ability to acquire the good. An individual may have the desire to acquire a commodity but it will not be realized in the market unless backed by the ability to pay for it. Thus, demand will be effective if and only if the buyer has both the willingness and ability to possess an item. In addition for the definition to be meaningful the quantities demanded at each price must relate to a specific period- a day, a week, a month, etc.

A fundamental characteristic of demand is this: All else equal/*cetris paribus*, as price falls, the quantity demanded rises, and as price rises, the corresponding quantity demanded falls. In short, there is a negative or inverse relationship b/n price and quantity demanded. This is called the **law of demand**.

NOTE: The law of demand states that citrus paribus, an inverse relationship exists b/n price and quantity demanded of a specific good in a given time period.

The basic determinant factors that may affect the demand for a commodity include:

The price of the commodity X (own price (P_X)),

The money income of the consumer (M),

- For normal good (+)
- For inferior good (-)

The price of other goods,

- Price of substitute goods P_S (+)
- Price of complement goods P_C (-)

Taste & preference of the consumer (T),

Number of buyers/ population served in the market (POP),

Future expectations of prices, income, and availability of the commodity

(E), Weather condition (W), Etc.

Demand for a product can be explained in functional form. A consumer‟s demand function for a commodity specifies the relationship between the quantity demanded of a commodity

(Qd) that he/she is willing and able to buy and the price level and other determinants of demand. In mathematical form, we can express it as follows:

$$Qd = f\{P_x, M, P_s, Pc, T, POP, E, W...\}$$

Note that the symbols are as explained above.

If the relationship between price and quantity demanded of a product in the short-run is to be established, the effects of other determinant factors should remain constant. That is to study the functional relationship b/n quantity demanded and price of a commodity, we keep the effect of other variables constant so that demand for the commodity becomes a function of (only) its own price, hence expressed as $Qd = f(P_x)$

E.g. $Qd_1 = 8 - 4P_1$

$Qd_2 = 80 - 25\ P_2$

$Qd_3 = 3000 - 400\ P_3$, etc

Demand can easily be shown in table form. The following table is a hypothetical demand schedule for single consumer purchasing wheat.

An individual buyer‟s demand for wheat

Table 1.2: an individual buyer's demand for wheat

Price per Quintal of Wheat (in Birr)	300	250	210	180	160
Quantity demanded per year (in quintals)	8	9	10	11	12

The above portrayal of demand reflects the relationship between the possible prices of wheat and the quantity of wheat the consumer would be willing and able to purchase at each of these prices. We say willing and able because willingness alone is not effective in the market. In the above table if the price for a quintal of wheat were Br 300, the consumer would be willing and able to buy of quintals per year; if it were Br. 250, the consumer would be willing and able to buy 9 quintals per year and so forth.

The table showing demand does not tell us which of the five possible prices will actually exist in the wheat market. This depends on the demand and supply. The data in the above demand schedule can be converted in to a demand curve. This is a simple graph that represents the inverse relationship between price and quantity demanded of a commodity, in which, by convention, we measure quantity demanded on the horizontal axis and price on the

vertical axis. What we do is we point the five price- quantity combinations in the above schedule and connect them with a smooth curve, labeled below D.

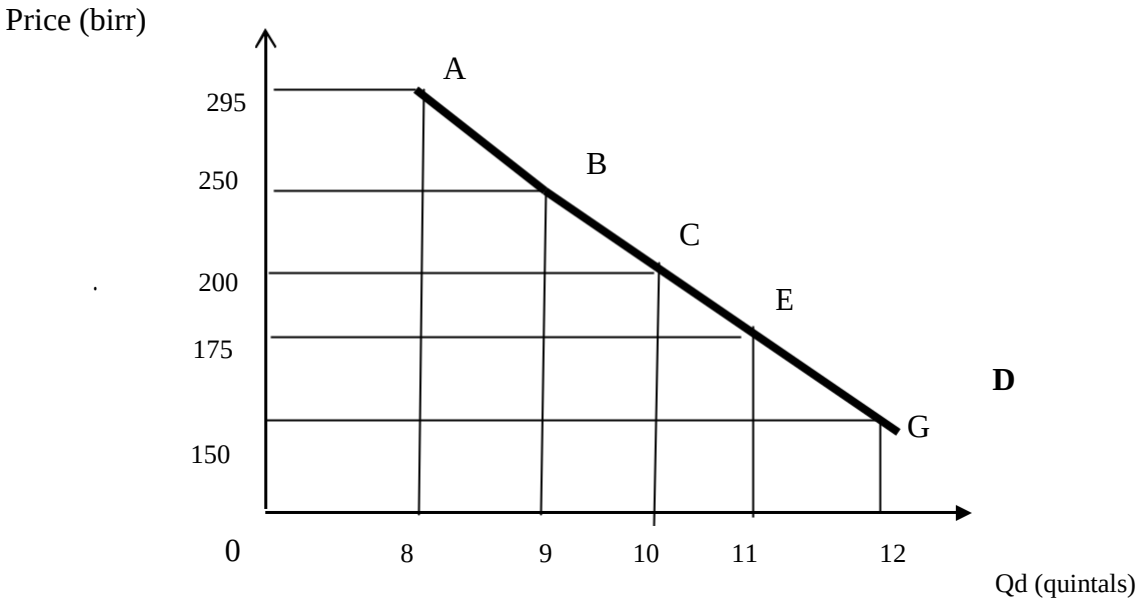
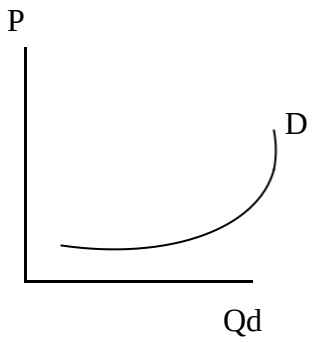


Figure 1.4 an individual's demand curve for

Note that the demand curve has a negative slope implying the law of demand. However, there are goods which may violate this law and their demand curve is positively sloped. Such goods are known as ***Giffen goods***, after the economist Giffen has discovered it. Demand curve for a commodity good



Increase in prices of such goods is considered as increase in qualities or use values of the goods and people tend to consume more of them at higher prices

Figure 1.5: Demand curve for commodity as Giffen good

Movements Vs Shift of the Demand Curve

A change in Quantity demanded: - it designates the movement form one point to another point – from one price quantity combination to another – on a fixed demand schedule or demand curve. The cause of such a change is an increase or decrease in the price of the product being considered. That is, if all the determinants of demand other than own price remain constant and only if price of the commodity changes, and then we move along the same demand curve

Change in Demand: - A change in one or more of the determinants of demand (other than own price) will change the demand data (the demand schedule). A change in the demand schedule, or graphically, a *shift* in the location of the demand curve is called a change in demand. An increase (decrease) in demand causes the demand curve to shift upward to the right (down ward to the left). In other words, while an increase in demand is explained by an outward shift of the demand curve, a decrease in demand is explained by an inward shift of the demand curve.

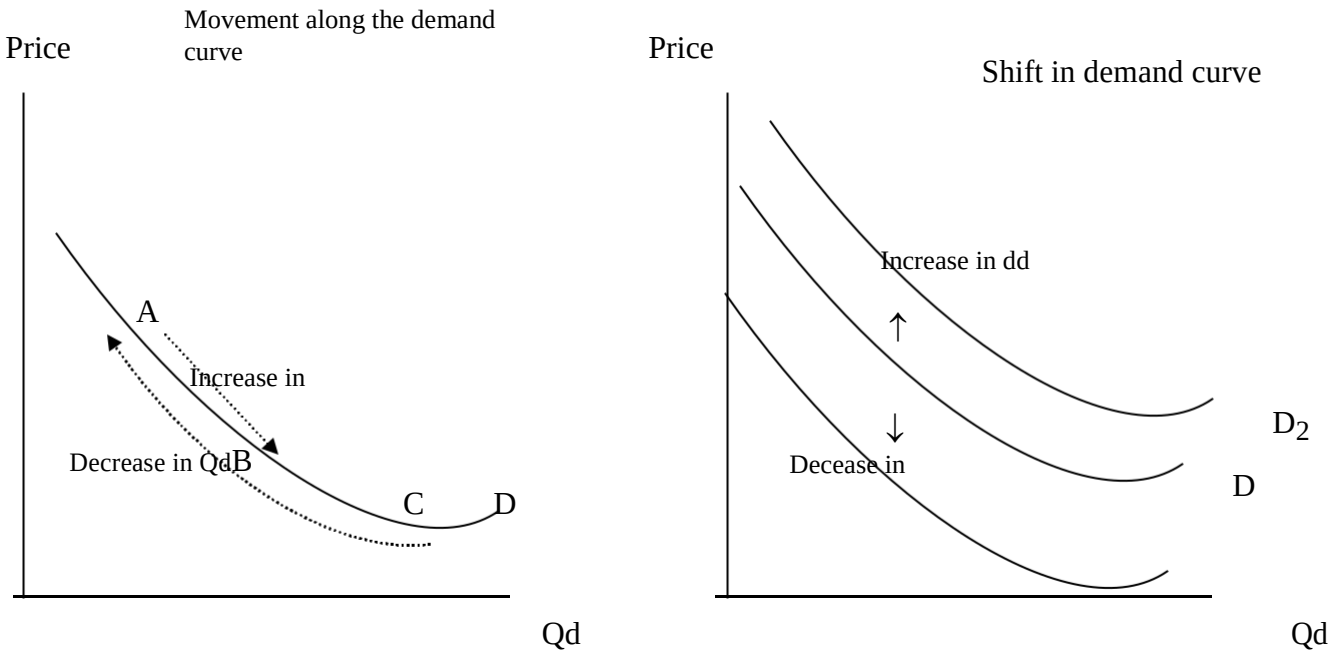


Figure 1.6: a comparison between change in quantity demanded and demand

Summary:

- Change in quantity demanded = movement along the same
  - demand curve
  - It is caused by change in price of the good
- Change in demand = shift of the demand curve and
  - Caused by changes in other factors that affect demand
- Out ward shift → increase in demand
- Inward shift → decrease in demand.

(B) **Supply**- It is a schedule or curve showing the amounts of a product a firm is *willing and able* to produce and make available for sale at each of a series of possible prices during a specific period, citrus paribus.

As the profit margin of the producer increase, the producer is willing to supply (provided he has the ability to do so) greater quantity for sales. Thus, the relationship b/n the price of the commodity and the quantity they supply is *positive* one.

The law of supply states that all other things being equal, the quantity supplied of goods & services varies directly with their prices. As price rises, the corresponding quantity supplied rises; as price falls, the quantity supplied falls. Such a direct or positive relationship b/n the price of the commodity and quantity supplied of it is reflected in the positive slope of a supply curve.

In constructing a supply curve, we assume that price is the most significant influence on the quantity supplied of any product. But other factors (the "cetris paribus") can and do affect supply. What are they?

Determinants of Supply

The basic **determinants** of supply are price of the commodity itself/own price (P_X),price of related goods (P_O),price of factor of production (P_f),state of production technology (T),number of suppliers serving the market (N),taxes and subsidies (Ts), expectations about future prices (E) ,goal of the producer (G); etc.

In symbolic functional form we can express the relationship b/n quantity of the commodity that a producer is willing (and able) to supply and its dominant factors as follows:

$Q_S = f\{P_x, P_O, P_f, T, N, T_S, E, G.....\}$; Where the symbols are as defined above.

However, if we want to formulate a relationship b/n the price of the commodity and its quantity supplied, we make the citrus paribus assumption so that the functional relationship would look $Q_S = f\{Px\}$.

Eg. $Q_{s1} = 7P_1 - 4$

$Qs_2 = -100 + 75P_2$

$Qs_3 = 500P_3 _ 4500$, etc

Therefore, the supply function refers to the functional relationship b/n the price and quantity of a commodity supplied.

Supply can also be explained by supply schedule. It is a table that shows the quantity supplied of a good related to its prices. Intuitionally, the higher the price per unit of a good, other things being equal, the greater the potential gain from supplying it. Let‟s look at the following supply schedule and then we convert it in to a supply curve.

Table 1.3 supply schedule

Price per unit (in br.)	0	1	2	3	4	5	6	7	8	9
Quantity supplied (in tons)	0	0	20	38	54	68	80	90	98	100

The above schedule illustrates that there is a positive relationship b/n the quantities supplied and its price. Moreover, we can read that the supplier requires a minimum price to start supplying its product (i.e. price =br.2) then after it increases its quantities as the unit price for its product rises, and vice versa.

From the given data, one can draw the supply curve of this particular supplier. The supply curve is a graphic representation of the supply schedule where, conventionally, the price of the product is shown on the vertical axis and its quantity supplied on the horizontal axis. The curve is, more or less, functional in accordance to the law of supply which states that, in general, the higher the price of a good, the greater the quantity of that good suppliers are willing and able to make available in the market.

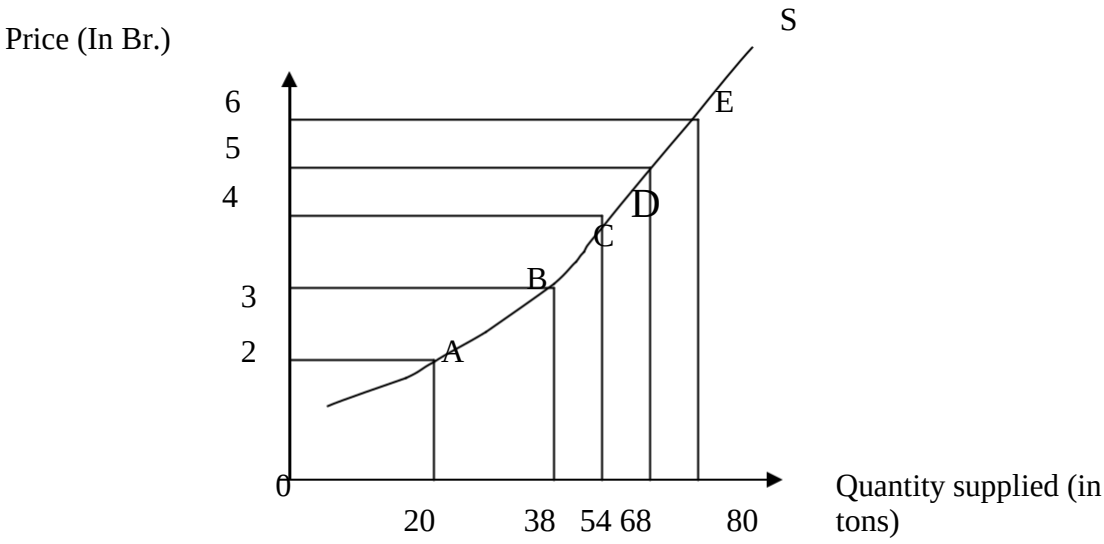


Figure 1.7: supply curve

Movement vs. Shift of the Supply Curve

A change in quantity supplied: - as we stated earlier, as price of a good increases the quantity supplied increases. We call this kind of movement along the supply curve "change in quantity supplied." This movement along the (same) supply curve is caused by a change in the price of the good, while other things being constant. For example, movement from A to B, C to B and D to A, etc.

Change in supply: -this kind of change refers to a shift in the position of the supply curve caused by a change in other factors. Note that cost of production is a major factor underlying supply curves. Hence, anything that affects these costs (other than changes in output itself) usually shifts the supply curve. The shift could be either to the right or to the left depending on the situation.

Change in any factor that contributes towards an increase in the cost of production will shift the supply curve to the left (decreasing supply), and vice versa. For example, rise in the price of the factors, increase in sales tax, decline in the number of supplies, etc. will increase the cost of production and hence shift the supply curve to the left.

On the other hand, factors that may decrease the cost of production, like increase in subsidy, decline in price of factors, advancement in production technology etc. may shift the supply curve to the right (increase supply).

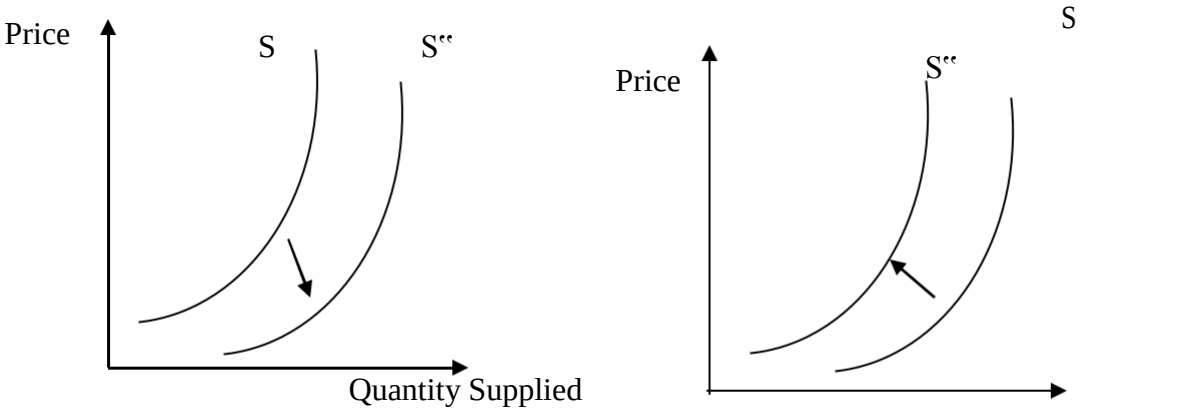


Fig 1.8: Shift of the supply curve

(A) Increase in Supply

(B) Decrease in Supply

1.10. 2. Market Equilibrium

Market equilibrium explains the balance b/n demand & supply for a commodity. That is equilibrium occurs when the quantity demanded by the buyers equals the quantity supplied by the sellers in a particular market so that the *market clears*. It is a condition which once achieved tends to persist because economic agents have no incentive to change their behavior.

The price levels at which the market reaches equilibrium is called the market clearing/ equilibrium price, and the corresponding quantity is called the equilibrium quantity. From the following figure the quantities demanded and supplied are equal only when price is at P_2, otherwise the quantities demand and supplied won‟t balance and hence there will be either shortage or surplus of that commodity in the market.

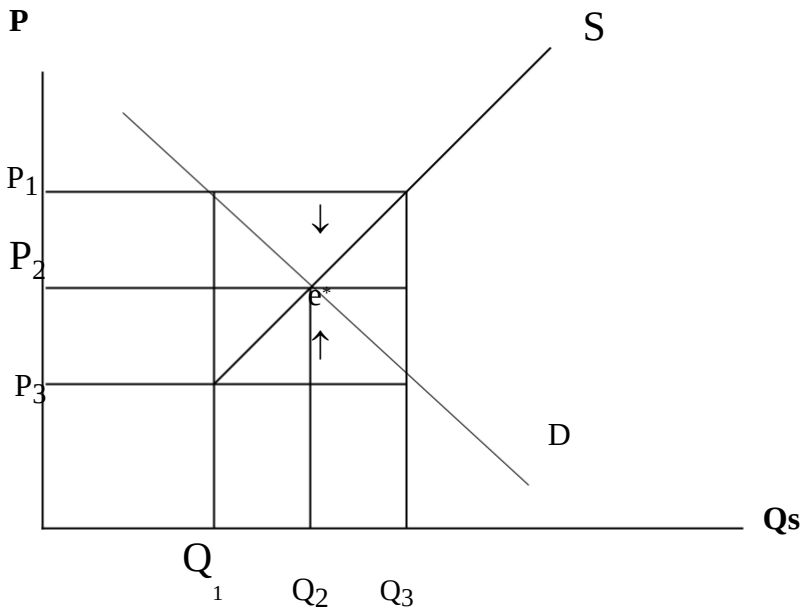


Figure 1.9 market equilibrium

When the quantity demanded in the market exceeds the quantity supplied in the same market, we say there is *shortage*, and when the opposite happens we say there is *surplus*. For instance, when price is at P_1 (see fig1.10) the quantity demanded is Q_1 and the quantity supplied is Q_3. Since $Q_3>Q_1$ (Quantity supplied exceeds quantity demanded) we say there is surplus.

NOTE: Shortage = excess demand

Surplus = excess supply

In contrast, if price of the market is at P_3 the quantities demanded and supplied in the market are Q_3 and Q_1, respectively, implying that $Q_s>Q_d$ and hence there is shortage.

Therefore, graphically, the intersection of the supply curve and demand curve for a product indicates the market equilibrium. Any price above this intersection will lead to surplus because sellers will be willing to avail more of the commodity in the market while the buyers cut their demand. On the other hand, any price below the intersection point will discourage the suppliers and reduce the quantity supplied in the market while buyers are willing to buy more, indicating that there is shortage.

However, there is always o tendency for movement towards the equilibrium point. That is when there is surplus (shortage) there is a tendency for price to move downward (upward). This ability of the competitive forces of supply and demand to establish a price at which selling and buying decisions are consistent is called the *rationing functions of prices*.

In fig 1.9, the equilibrium price of P_2 clears the market, leaving no burdensome surplus for sellers and no inconvenient shortage for potential buyers. And it is the combination of freely made individual decisions that sets this market- clearing price.

Example 1: If the market demand and supply functions are given as Qd = 80 – 3P and Qs = 9P -40 respectively. Then, what is the market clearing price and the corresponding quantity?

Soln: Equate Qd = Qs to get the equilibrium price

Qd = Qs

80 – 3p = 9p-40 substitute for Qd and Qs

120 = 12p rearrange

p* = 10 birr

To get the equilibrium quantity (Q*), substitute this price in to either of the functions. Qd = 80 – 3 (10)

Q* = 50 units

Therefore, the market clears when price is Br. 10 and both the quantity demanded and supplied are 50 units.

Example 2: If the inverse demand and supply functions for the market of ball point pen is given as follows P = 2 – 0.1 Qd and P = 1/5 Q_S – 1. Then, find the equilibrium price of a unit of ball point pen. How many ball point pens will be sold and bought at equilibrium?

Soln: First of all change the inverse functions in to direct demand and supply functions.

P = 2 - 0.1 multiply by 10

10p = 20 - Qd, rearrange

Qd = 20 - 10p

P = 1/5 Q5-1 multiply by

5 5P = Q_5 – 5 rearrange

Q_S = 5P + 5

Now, we equate the two functions and obtain the market clearing price as follows.

Qd = Q_S ; substitute

20 – 10P = 5P + 5 collect like terms

10P + 5P = 20-5

15P = 15

P* = 1 birr

Substitute this price in to cither of the functions to obtain the equilibrium quantity.

$Q_S = Qd = 20 - 10P$

$= 20 - 10\ (1)$

$Q^* = 10$ pens

♥ **Check Your Progress 6**

Suppose there are 120 identical buyers and 100 similar sellers in the market for teff. And the annual demand (for a quintal of teff) and supply functions of typical representative buyer and seller are $Qd = 45 - 0.25P$ and $Q_S = 0.1P - 6$ respectively. What is the market equilibrium price? And how many quintals of teff are transacted during a year?

Summary

- Economics is a social science which is concerned with the best use of the scarce resources to achieve the maximum satisfaction of human material want.
- Given the scarcity of economic resources. Choice is unavoidable to meet the insatiable needs of human beings optimally, and hence, it is associated with certain kind **of opportunity cost.**
- Traditionally, economics is divided into two, micro economics and macroeconomics.
- **Microeconomics** is a branch of economics that studies the behavior of individual decision making units such as firms, households and government. It is also called pricing theory because it is concerned with the working of the pricing systems. In general microeconomics is an analysis dealing with the behavior of individual elements in the economy.
- **The law of demand states** that, citrus puribus, an inverse relation exists between price and quantity demanded of specific good in a given time period.
- **The law of supply states** that all other things being equal, the quantity supplied of goods and services varies directly with their prices.
- **Market equilibrium** explains the balance between demand and supply for a commodity. That is equilibrium occurs when the quantity demanded by the buyers equals the quantity supplied by the sellers in a particular market so that the market clears.

Self-check Exercise

Part I: Discussion Items

1. What is economics?
2. What are the foundations of economics?
3. What is the central aim of economics?
4. What is micro economics?
5. What is macroeconomics?
6. Indicate each of the following sentences whether they are micro economics or macroeconomics?
    - The inflation rate in Ethiopia in 2006 was 11 %
    - The 2006 growth rate of Ethiopia was 10 %
7. What is positive economics?
8. What is normative economics?
9. Write "Normative economics" if the statement reflects Normative economics and "positive economics" if it reflects Positive economics in the following statements.
    - The rich should pay taxes
    - The inflation rate of the country has grown this year by 11%
    - The government should reduce poverty in the country
    - The salary of Government employees is increased by 17% this year.

Part II: True or False Items

Direction: Write "**True**" if the statement is true and "**False**" if it is not true on the Space provided before each question.

_____1. The best definition of Economics is the study of how societies choose to use scarce resources to produce commodities of various kinds.

_____ 2. Opportunity cost refers to the imbalance between human desires and means of satisfying them.

_____ 3. A theory is a rough representation of the actual economy.

_____ 4. Microeconomics deals with the total output level of an economy.

__ _____5.The following is an example of a positive economic statement," If there is an increase in the price of a commodity, the quantity demanded will decrease".

Part III: Multiple-choice Items

Direction: Select the correct answer from the given alternatives and write the letter of your choice.

_____1. Which of the following statement describes macroeconomics?

A) It studies the problems of aggregate production and consumption.
B) It studies the behavior of individual firms or consumers.
C) It studies inflation and unemployment of a given nation.
D) All
E) All except B

_____2. Which of the following statements is correct?

A) Macroeconomics deals with the study of individual decision making unit
B) Microeconomics is the study of aggregate economy.
C) Positive economics is concerned with statements about “what should be”.
D) Normative economics is concerned with statements about "what is".
E) None

_____3. Which concept describes the best alternative forgone?

A. Theory
B. Principles
C. Economics
D. Scarcity
E. Opportunity cost

_____4. Which of the following statements is a correct statement?

A) An opportunity cost is the allocation of scarce resources.

B) Scarcity refers to the imbalance between human wants and means of satisfying their needs.

C) Economizing refers to using resources abundantly.

D) Since society can use resources efficiently they always satisfy their desires.

E) None

CHAPTER TWO

2. Theory of Consumer Behavior and Demand

2.1. Introduction

Theory of demand seeks to establish relationship between the quantity demanded of a commodity and its price. It also explains variations in demand. The purpose of the theory of demand is to determine the various factors that affect demand. Demand is a multivariate relationship, that is, it is determined by many factors simultaneously. Some demand for a particular product are its own price, consumer‟s income, prices of other commodities, consumer‟s tastes, income distribution, total population, consumer‟s wealth, credit availability, government policy, past levels of demand and past levels of income.

Dear learners please mention the major approaches economists use to deal with the theory of demand.

Great! There are different approaches known to the economists to the theory of demand. The oldest among them is the marginal utility approach. The marginal utility analysis explains consumer‟s demand for a commodity and derives a law of demand, which shows an inverse relationship between the quantity demanded and the price of the commodities. It should be noted that the traditional theory of demand examines only the consumer‟s demand for durables and non-durables. It is partial in its approach in that it examines the demand in one market in isolation from the conditions of the demand in other markets. An important implicit assumption of the theory of demand is that firms sell their products directly to the final consumers.

All desires of a consumer are not of equal urgency or importance. Since his resources are limited and he cannot fulfill all his desires, he must pick and choose more important and more urgent desires for satisfaction. Thus, some desires take precedence of others. This is how a consumer ranks his desires and builds up a scale of preferences. Scarcity forces him to choose. Ability to arrange preferences in order of importance or urgency is inherent in human nature.

A prudent consumer exercises a lot of discrimination in his purchases. We find him substituting one commodity, partly or wholly, for another. He purchases a certain quantity of a commodity

and no more. All the time, he is aspiring to reach an equilibrium position, i.e., a position in which he derives maximum satisfaction from the use of money at his disposal. The consumer‟s scale of preferences is independent of the prices ruling in the market. He builds up his scale of preferences from the commodities he consumes. Because of this scale of preferences, he knows that one combination of the goods yields him the same satisfaction as another.

Objectives

After completing this unit, you will be able to:

- explain the concept of cardinal and ordinal utility approach;
- identify the difference between the indifference curve and indifference map;
- discuss the properties of indifference curve;
- derive the budget line
- state and explain consumer and producer surplus;
- derive the market demand;

In the following material, we shall learn in detail Consumer Preferences, Budget Constraints, Utility, Consumer Choice, Consumer surplus, Derivation of the Market Demand, and Elasticity of Demand.

2.2. Budget Constraints

Dear learner, how do you explain the idea of the budget constraint?

The budget constraints are that consumers face because of their limited incomes. People are compelled to determine their behavior in light of limited financial resources. For the theory of consumer behavior, this means that each consumer has a maximum amount that can be spent per period of time. The consumer‟s problem is to spend this amount in the way they yield maximum satisfaction.

Consider a consumer having a fixed income (M) and who has to make choice between two goods X_1 & X_2. X_1 & X_2 indicates the total amount of $good_1$ & $good_2$ the consumer affords to consume, respectively.

Suppose P_1 is the price of X_1 and P_2 is the price of X_2

$P_1X_1 + P_2 X_2 \leq M$ ---------- [budget constraint equation]

P_1X_1 – is the total amount of money spent on good 1 and $P_2 X_2$ – is the total amount of money spent on good 2.

- [1] - - - - - $P_1X_1 + P_2 X_2 \leq M$ implies that the total spending by a consumer on the given two goods cannot exceed the consumer‟s total income, given the prices of the two goods. This implies that, the consumer‟s ***affordable bundles*** are those that do not cost any more than the total income (M). This set of consumption bundles at prices (P_1, P2) and income M, is called the ***budget set*** of the consumer. On the other hand, $P_1X_1 + P_2 X_2 = M$ implies the entire income is used for the consumption of the two goods, X_1 & X_2.

N goods; the consumer chooses how much to consume of each. This is indicated as a vector:

$$x = (x_1, x_2 , ... x_N).$$

She can observe the prices of the goods:

$$\underline{p} = (p_1, p_2 , ... p_N)$$

Income is given by m.

The budget constraint requires that the amount of money spent on the N goods is no more than the total amount the consumer has to spend:

$$p_1 x_1 + p_2 x_2 + ... + p_N x_N \equiv p \bullet \underline{x} \leq m$$

Budget line: it is a line which shows the combination of the maximum amounts of the two goods that the consumer can buy by spending the entire money income only on these goods, given prices.

[2] ------- $P_1X_1 + P_2 X_2 = M$ [budget line equation which shows a set of bundles that costs exactly M]

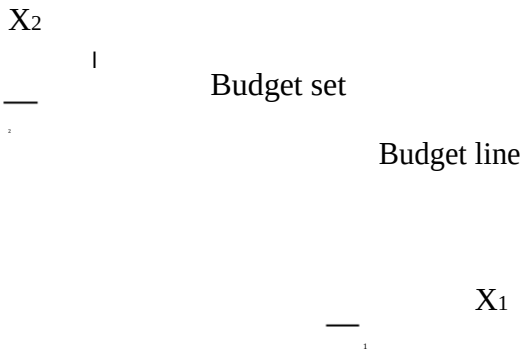


Figure 2.1: budget line and budget set

By rearranging equation [2] we can get

[3] ------- $X_2 = \frac{M}{P_2} - \frac{p_1}{p_2} X_1$ this is a formula for a straight line (budget line) with a vertical intercept of $\frac{M}{P_2}$, a horizontal intercept of $\frac{M}{p_1}$ and a slope of $-\frac{p_1}{p_2}$.

→ $\frac{M}{P_2}$ => The amount of X_2 the consumer can buy by spending the entire income on X_2.

→ $\frac{M}{p_1}$ => The amount of X_1 the consumer can buy by spending the entire income on X_1.

→ $-\frac{p_1}{p_2}$ = > the rate at which the market substitutes good 1 for good 2.

If the individual is going to increase her/his consumption of good1 by ΔX_1, by how much will her/his consumption of $good_2$ changes in order to satisfy the budget constraint?

Let"s say ΔX_1 is change in consumption of $good_1$ &

ΔX_2 is change in consumption of $good_2$

In order to satisfy the budget constraint a change in consumption of $good_1$ should be followed by a change in the consumption of $good_2$.

NOTE: The budget constraint should be satisfied both before and after the change in consumption.

Before the change, the budget line equation is $P_1X_1 + P_2 X_2 = M$ ------- [4]

After the change is made the equation will be $P_1 (X_1 + \Delta X_1) + P_2 (X_2 + \Delta X_2) = M$---- [5]

Subtract [4] from [5]

$P_1(X_1 + \Delta X_1) + P_2(X_2 + \Delta X_2) - (P1X1 + P_2X_2) = 0$ (no change in the income)

$P_1\Delta X_1 + P_2 \Delta X_2 = 0$

$P_2 \Delta X_2 = - P_1\Delta X_1$

$-\frac{p_1}{p_2} = \frac{\Delta x_2}{\Delta x_1}$ This is the slope of the budget line.

ECONOMIC INTERPRETATION OF THE SLOPE OF THE BUDGET SET:

$$\frac{\Delta x_2}{\Delta x_1} = -\frac{p_1}{p_2}$$

This is the **OPPORTUNITY COST** of the good x_1 in terms of x_2, namely the units of x_2 one has to give up to get one more unit of x_1.

How the budget line changes/shift parallel?

a) shift of the Budget Line

- Variation of income: parallel shift, inward or outward.

b) Change of the budget line/pivot inward or outward.

- Increase in a price: budget line becomes steeper
- Decrease in a price: budget line becomes flatter.

The following factors can shift/pivot the budget line.

A change in income (keeping P_1 & P_2 fixed)

Recall equation [2] $P_1X_1 + P_2X_2 = M$

$$X_1=\frac{M - P_2X_2}{P_1} \qquad \text{OR} \qquad X_2=\frac{M - P_1X_1}{P_2}$$

The horizontal and vertical intercepts of the budget line equation are $\frac{M}{P1}$ and $\frac{M}{P2}$ respectively.

- Increases in income *M* shift the constraint outward in a parallel manner, thereby enlarging the budget set and improving choice(set of consumptions).
- Decreases in income *M* shift the constraint inward in a parallel manner, thereby shrinking the budget set and reducing choice. The slope $-p_1 / p_2$ does not change.

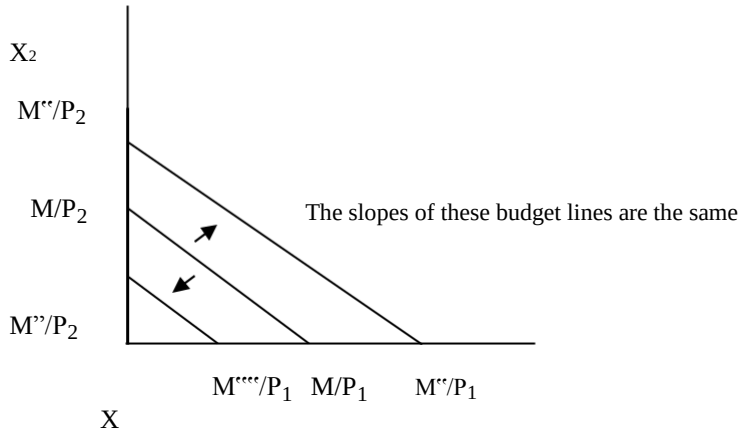


Figure 2.2: shifting budget line

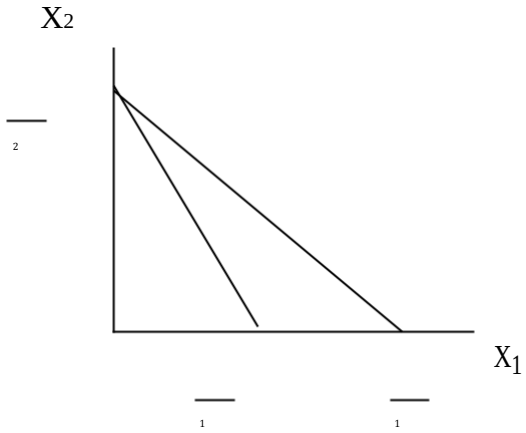
An increase in income from M to M‟‟ shifts the budget line outward while a decrease in income from M to M” shifts the

Change in price(s)

- When income increases, no original choice is lost and new choices are added, so higher income cannot make a consumer worse off.
- When income decreases, the consumer may (typically will) be worse off, as one can no longer afford some of the bundles anymore.

a) A change in the price of one of the two goods

An increase in P_1, keeping P_2 and M constant, doesn‟t affect the vertical intercept but by affecting the horizontal intercept makes the budget line steeper.



When P_1 increase, the slope of the budget line $(-\frac{p_1}{p_2})$ will increase in absolute value and the budget line becomes steeper.

NOTE: The slope of the Budget line in absolute value is $\frac{p_1}{p_2}$.

Figure 2.3: rotation of budget line

♥ **Check your progress 1**

What is the effect of a decrease in P_2 on the budget line (given that M and P_1 are constant)

b) A change in the prices of both goods

❖ **I**f the prices are doubled, ($2P_1$, $2P_2$) both the horizontal and vertical intercepts shift in ward by a factor of ½ = $(\frac{M}{2P_2}, \frac{M}{2P_1})$.

❖ **I**f both prices are multiplied by t, the new equation will be

$tP_1X_1 + tP_2X_2 = M$

$t(P_1X_1 + P_2X_2) = M$

$P_1X_1 + P_2 X_2 = \frac{M}{t}$ => implies that multiplying both prices by the same amount t means dividing income by that constant t. And the vertical and the horizontal intercepts shift inward by the factor of 1/t. In this case the slope of the budget line is not affected.

❖ **I**f the increase/decrease in the two prices is proportional, the effects on the budget constraint are the same to the effect income change has on the budget constraint.

i. **I**f the increase in the two prices is not proportional, what happens to the budget line depends on the strength of their changes.

for innstance **i**f P_2 increases by less proportion than P_1, the slope of the budget line increases in absolute value $\left| -\frac{p_1}{p_2} \right|$ as a consequence the budget line would be steeper.

♥ **Check your progress 2**

1. **W**hat happens to the budget line if we divide both prices by the same constant d?
2. **A**nalyze the effect of a proportional increase in both the prices and income on the budget line.

2.3. Preferences

Always people choose the best bundle of goods they can afford. The budget line tells us what the consumer can afford while consumer‟s preference tells us the best things they prefer.

2.3.1. Consumer's Preference and Preference Relation

We describe consumers‟ preferences depending on how consumers compare and rank alternative consumption bundles.

Suppose that given any two consumption bundles, (X_1,X_2) and (Y_1,Y_2) denoted by X and Y respectively, the consumer can rank them as to their desirability i.e. the consumer can determine that one of the consumption bundles is strictly better than the other, or decide that he/she is indifferent between the two bundles.

$(X_1,X_2) > (Y_1,Y_2)$ - the consumer strictly prefers bundle X to Y.

$(X_1,X_2) \sim (Y_1,Y_2)$ - the consumer is indifferent between the two bundles of goods. (Each bundle gives him/her the same level of satisfaction)

$(X_1,X_2) \geq (Y_1,Y_2)$ - the consumer weakly prefers bundle X to Y. (The consumer prefers or is indifferent between the two) which means bundle **X is at least as good as bundle Y.**

NOTE: If $(X_1,X_2) \geq (Y_1,Y_2)$ and $(Y_1,Y_2) \geq (X_1,X_2)$, the conclusion will be $(X_1,X_2) \sim (Y_1,Y_2)$.

ii. All the preference relation, strict preference, weak preference and indifferent preference, show ordinal relations. They state only the order in which bundles of consumptions are preferred.

Assumptions about Preferences

There are certain axioms that are taken for granted regarding the consistency of consumer‟s preferences. They are called axioms of consumer‟s theory. These are:-

Completeness

Consumer‟s preferences are complete in a sense that a consumer can compare and rank all the consumption possibilities. Given consumption bundles X and Y, the consumer will either prefer X to Y, or Y to X, or will be indifferent between X and Y.

Transitivity of Preference

Given three bundles, X, Y and Z; if a consumer Prefers X to Y and Y to Z, then the consumer prefers X to Z.

If $(X_1,X_2) \geq (Y_1,Y_2)$ & $(Y_1,Y_2) \geq (Z_1,Z_2)$ then $(X_1,X_2) \geq (Z_1,Z_2)$

If $(X_1,X_2) > (Y_1,Y_2)$ & $(Y_1,Y_2) > (Z_1,Z_2)$ then $(X_1,X_2) > (Z_1,Z_2)$

If $(X_1,X_2) \sim (Y_1,Y_2)$ & $(Y_1,Y_2) \sim (Z_1,Z_2)$ then $(X_1,X_2) \sim (Z_1,Z_2)$

Reflexivity of Preference

Any bundle is at least as good as itself, $(X_1, X2) \geq (X_1, X2)$. This implies that the consumer is indifferent between identical bundles => $(X_1, X2) \sim (X_1, X2)$.

More is better

Consumers prefer more of a good to less.

2.4. Indifference Curves

We usually use diagrams called ***indifference curves*** to describe consumer‟s preferences. An indifference curve is a locus of points representing consumption bundles among which the

consumer is indifferent. It is a locus of points which yield the same level of satisfaction to the consumer. It is constructed from consumer‟s ranking of different alternatives.

An indifference map shows all the indifference curves which rank the preferences of the consumer. A combination of goods lying on higher indifference curve yields higher level of satisfaction and should be preferred.

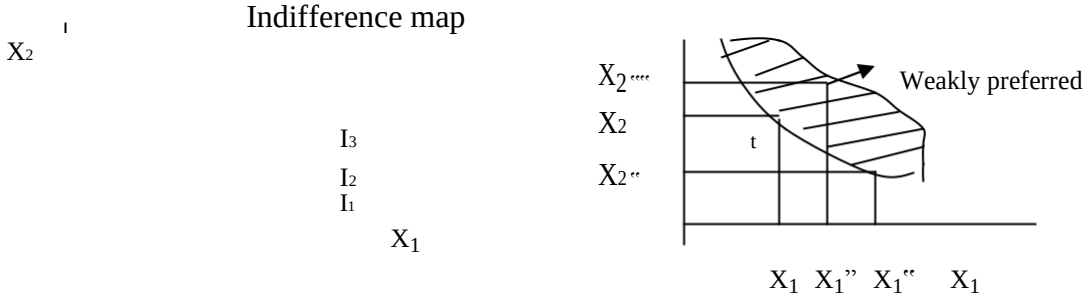


Figure 2.4: indifference map

At point t we have a combination of the two goods (X_1, X_2). All points on the indifference curve are indifferent to the bundle (X_1, X2). Example (X_1, X2) ~($X_1^{„}$, X2„)] On the other hand, the shaded area consists of all bundles that are at least as good as the bundle (X_1, X_2) [eg ($X_1^{„„}$,$X_2^{„„}$) $\geq$ (X_1,X_2)] and it is called ***weakly preferred*** set of bundles.

Bundles	FOOD (F)	CLOTHING (C)
A	20	30
B	10	50
C	40	20
D	30	30
E	30	40
G	10	20

Table 2.1: preference of individual for clothing and food

Suppose **Derartu** reveals her preference so that she gets same level of satisfaction from bundle A, B and C which means A ~ B ~ C.

Points at the right of the indifference curve contains more of either or both of goods, so that they are **weakly preferred** than points on the IC. Points at the left of the indifference curve contain less of either or both of goods, so that points on the indifference curve are preferred to points at the left of the indifference curve.

An indifference curve is obtained by connecting the points of bundles among which the consumer is indifferent [gets the same level of satisfaction], like A, B and C.

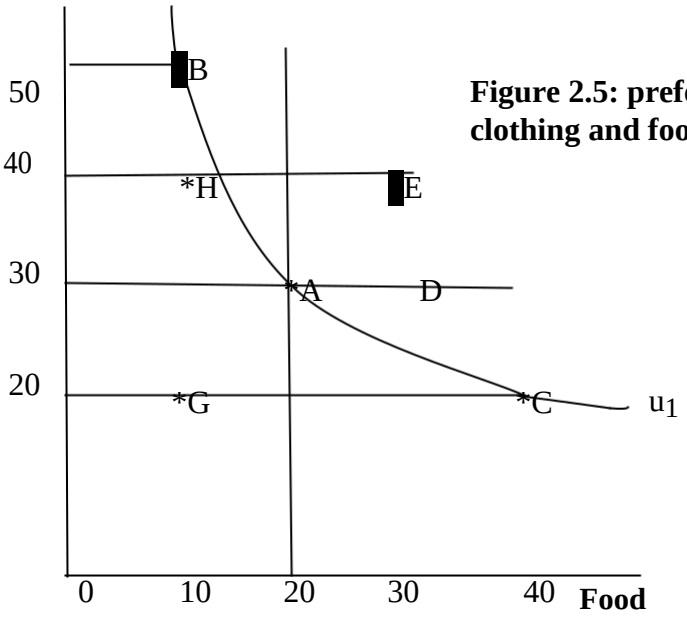


Figure 2.5: preference of individual for clothing and food.

It shows that in moving from market basket A to market basket B, the consumer feels neither better nor worse off in giving up 10 units of food to 20 units of clothing. Likewise, the consumer is indifferent between points A and C. He or she will give up 10 units of clothing to obtain 20 units of food. On the other hand, consumer prefers A to H, which lies below u_1.

Indifference curve in the figure 2.5 slopes downwards from left to right. To understand why this must be the case, suppose instead it sloped upward from A to E. This would violate the assumption that more of any commodity is preferred less. Because market basket E has more of food and clothing than market basket A, it must be preferred to A and therefore cannot be on the same indifference curve as A. In fact, any market basket lying above to the right of indifference curve u_1 in figure 2 is preferred to any market basket on u_1.

Characteristics of indifference curves

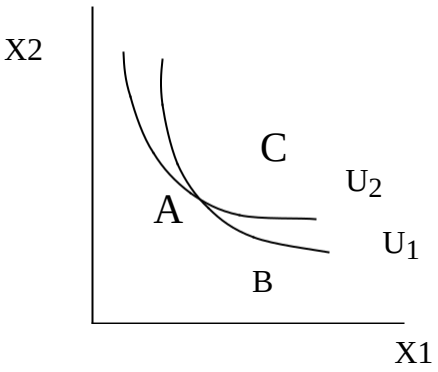
i. The slope of an indifference curve is negative

To keep a consumer at the same level of satisfaction along a curve, a decrease in the quantity of one of the goods must be compensated by an increase in the other, and vice versa, this leads to a down ward sloping curve whose slope is negative.

ii. **The further the utility curve is from the origin, the higher utility it denotes**.

Bundles on the higher indifference curve are preferred than on lower indifference curve by a rational consumer.

iii. **Indifference curves cannot cross each other**. If they cross one or more of the standard axioms will be violated (transitivity of preference).



A ~ B and A~C, according to our assumption, B should be indifferent to C. But here from this diagram we observe that A~B, A~C but C>B because C contains more amount of X2 and same amount of X1 as B

Figure 2.6: the crossing indifference curves

iv. Diminishing Marginal Rate of Substitution (DMRS)

The marginal rate of substitution is defined as the slope of the indifference curve. It measures the rate at which the consumer is willing to substitute one good for the other.

MRS1, 2 – The number of units of commodity 2 that must be sacrificed (given up) in exchange for an extra unit of a commodity, X_1. The MRS decreases with increasing quantity of a good we take on the horizontal axis. Because of this reason, indifference curves are convex from the origin.

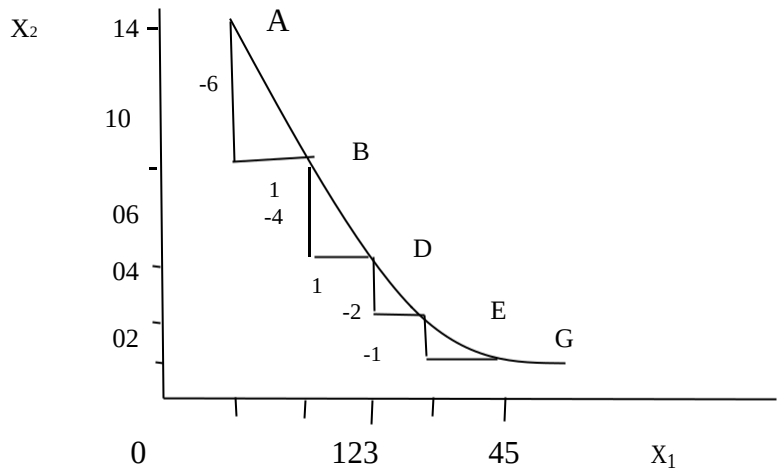


Figure 2.7: diminishing marginal rate to substitute x_1 for x_2

DMRS arises due to the fact that the consumer is willing to give up less and less of one good in order to obtain one more unit of the other. Because, the additional satisfaction that the consumer derives from an additional unit of a good decreases with increasing consumption of that good.

2.5. Exceptional Cases of Indifference Curves

There are some cases where indifference curves are not convex

a) Perfect Substitutes

Two products are said to be perfect substitute if the consumer is willing to substitute one for the other at a constant rate.

Example: Red and Blue Pencils (where color is not a factor for selection)

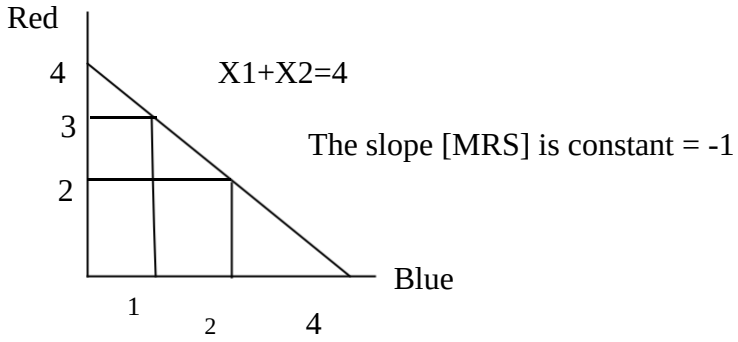


Figure 2.8: linear indifference curve

b) Perfect complement

Goods that are consumed together (in a fixed proportion) are called perfect complements.

Example: Right and left

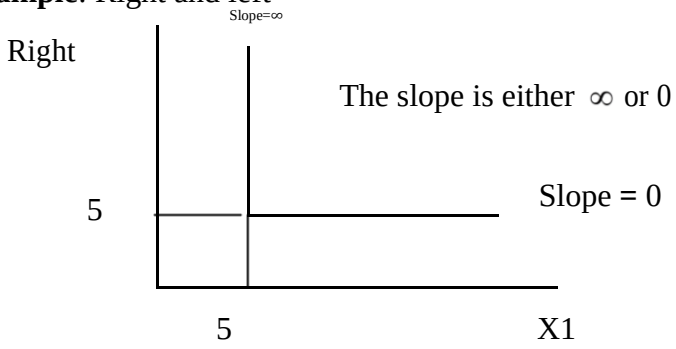
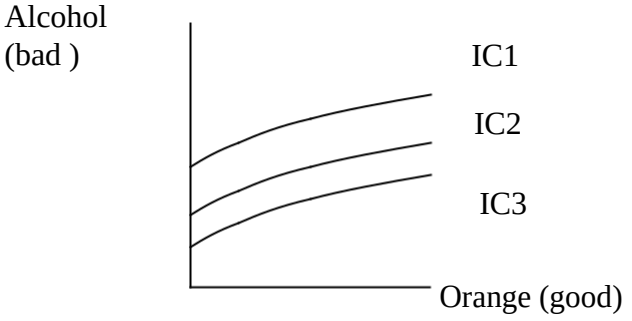


Figure 2.9: L-shaped indifference curve

A consumer wants to have 5 pairs of shoes [5 left, 5 rights]. If we add one additional right shoe, the combination will be 5 left shoes & 6 right shoes but the consumer will be indifferent between the two combinations (5, 5) & (5, 6) because the addition of one more right shoe doesn‟t increase his/her satisfaction. The indifference curve for such preface will be L shaped, having a slope of either 0 or ∞.

c) Bad commodity

A bad is a commodity that the consumer doesn‟t like. To keep the consumer at the same level of satisfaction along an indifference curve, an increase in quantity of the „bad‟ must be compensated by increasing the quantity of the other good. Because of this the indifference curve will be positively sloped.



The lower the indifference curve is, the higher the utility it denotes [given the commodity which is on the vertical axis is „bad‟ good.

Figure 2.10: indifference for bad

NOTE: ***T**he "More is better" axiom doesn‟t hold for the „bad‟. The lower the bad good the higher will be the satisfaction of the consumer.

d) Neutral Good

A good is neutral good if the consumer doesn‟t care about it. We say the consumer is neutral about alcohol, when the consumer‟s satisfaction is not affected by an increase/decrease in alcohol. So the IC will be vertical line.

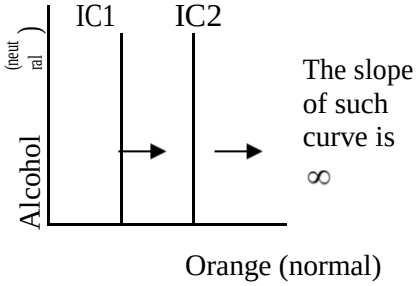


Figure 2.11: indifference curve for neutral good

2.6. Well Behaved Preferences

Are most representatives than the above ones? They depict the general shape of ICs having using some general assumptions. If the goods are substitutes but not perfect, we get some what convex shape of indifference curve.

2.6.1. Properties of Well-Behaved Preferences

a) The more is better- called monotonicity

If there are X- bundle [X_1,X_2] & Y- bundle [X_1‟,X_2] and Y has at least as much of both [X_2 = X_2] goods and more of one[X_1‟>X_1], then Y>X.

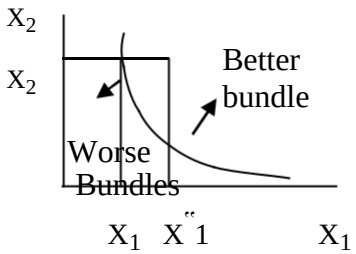
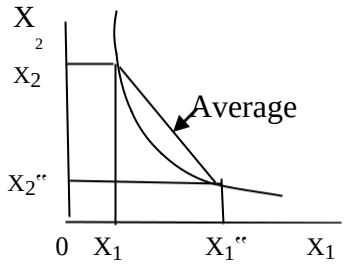


Figure 2.12: monotonic indifference curve

b) Averages are preferred to extremes

If we take two bundles of goods (X_1, X_2) and (X_1‟, X_2‟) denoted by X & Y on the same IC and take a weighted average of the two bundles such as (1/2X, 1/2Y), then the average bundle will be at least as good as or strictly preferred to each of the two extremes.



$X = [X_1, X_2]$ $Y = [X_1", X_2"]$

Average = [1/2X, 1/2Y]

* Convex preference means that averages are prefaced to extremes

Figure 2.13: convexity of indifference

2.7. Utility

Utility is the level of satisfaction a person gets from doing one activity or consuming goods & services. Utility helps to rank the choice of consumers. It is a simplest way of describing preferences.

2.7.1. Total and Marginal Utility

Total Utility (U): Relates consumption of a good to the utility derived from consuming a good. (This could be many units of a good)

Marginal Utility (MU): The change in total utility when consumption of a good change by one unit or it is the rate of change of total utility with respect to a good.

- MU = DTU / D Q consumed of a good

Utility Functions

A utility function is a way of assigning numbers to the level of satisfaction that a consumer drives from alternative bundles, in a way that more preferred bundle gets assigned with higher number than less preferred bundles. For example, that a consumer"s utility function for food (F) and clothing (C) is u(F,C,)=F+2C. In this case, a market basket consisting of 8 units of food and 3 units of clothing generates a utility of 8 + (2) (3) = 14. Consumer is therefore indifferent between this market basket and a market basket containing 6 units of food and 4 units of clothing (6+(2)(4) = 14), but when there exists a market basket containing 10 units of clothing and 6 units of food(10+6*2=22), consumer prefers this to the former bundles.

Not all kinds of preferences can be represented by a utility function. For example, suppose someone had intransitive preferences so that $A \; B \; C \; A$. Then a utility function for these preferences would have to consist of numbers u(A), and u(B) and u(C) such that u(A)>u(B)>u(C)>u(A). However, this is impossible. So such kind of perverse cases not considered for construction of utility function.

Figure 2.14 and illustration gives the details of constructing a utility function. A utility function is a way to label the indifference curves such that higher indifference curves get larger numbers. To do this, draw the diagonal line illustrated and label each indifference curve with its distance from the origin measured among the curve.

How do you know this as a utility function*?* It is not difficult to see that preferences are monotonic then the line through the origin must intersect every indifference curve exactly once. Thus, every bundle is getting larger labels – and that is all it takes to be a utility function. This is one way to find labeling of indifference curves, at least as long as preferences is monotonic. This at least shows that ordinal utility function is quite general: nearly any kind of "reasonable" preferences can be represented by a utility function.

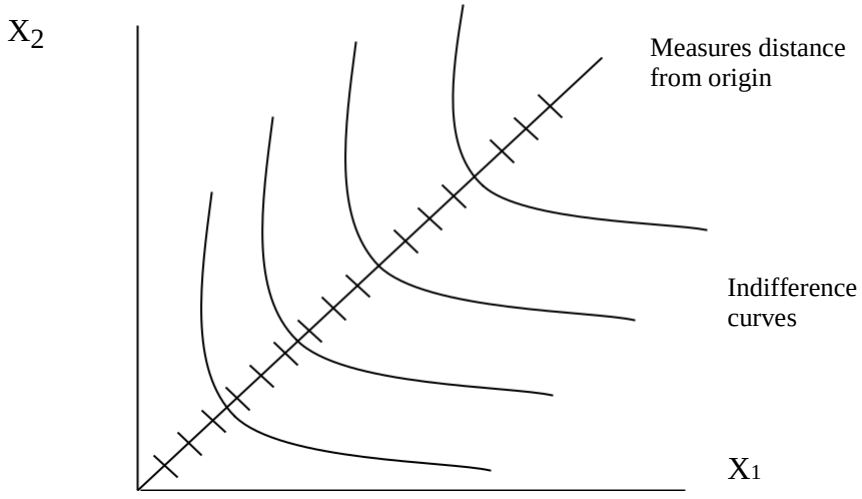


Figure 2.14 *constructing a utility function from indifference curves.* Draw a diagonal line and label each indifference curve with how far it is from the origin measured along the line.

There are two approaches for assigning numerical magnitudes to consumer‟s satisfaction. These are:

-1- Cardinal approach -2- Ordinal approach.

2.7.2. Cardinal Utility

Cardinal approach takes utility as measurable in objective units. It is possible to say bundle X has twice as higher utility as bundle Y and so on. A cardinal utility function attaches a numerical value, to market baskets, that cannot arbitrarily be doubled or tripled.

A*ssumptions* under this approach

i. **Rationality**: consumer is rational in a sense that the consumer aims at maximizing his/her utility subject to income constraint.

ii. Total utility depends on the number of goods consumed.

If bundle X contains n number of goods, U is a function of X_1, X_2, X_3 ---, Xn.

Total utility is U=F(X_1, X_2, X_3, ----, Xn)

iii. **Diminishing marginal utility**: the additional utility gained from successive units of a given good declines.

iv. **Constant marginal utility of a unit of money**

In this approach money is a standard unit of measurement for utility. And the value of a unit of money should be constant for the consumer regardless of the level of Income.

Equilibrium of the Consumer

A consumer is said to be at optimum/equilibrium when he/she maximizes utility subject to income constraint. Given a single commodity X, the consumer can either buy an additional unit of X or keep the income which was to be spent on that additional unit of X unspent. To determine the optimum of the consumer we need to compare the *MUx* and *Px*. **MUx** – is what the consumer is willing to pay

Px – is what the consumer actually pays (has to pay)

If MUx > Px => the consumer can raise his/her satisfaction by purchasing more units of good X.

If MUx < Px => the consumer raises his/her satisfaction by reducing consumption of good X.

In conclusion, the consumer will be at optimum when MUx equals Px.

When the utility function of the consumer contains more than one good U=f(X_1, X_2, ---,

X_n), the optimum of the consumer receives the following condition to be fulfilled.

$$\frac{MU_{X1}}{P_{X1}} = \frac{MU_{X2}}{P_{X2}} = \text{------} = \frac{MU_{Xn}}{P_{Xn}}$$

$\frac{MU_{X1}}{P_{X1}}$ = is the satisfaction that the consumer derives by spending one unit of money on X_1.

Spending one unit of money should result in the **same satisfaction** regardless of the good it is spent on. If spending one unit of money results in higher satisfaction when it is spent on X_1 compared to other goods, the consumer can raise his/her satisfaction by spending more on good one and less on other until the above condition is fulfilled.

Critics of the cardinal approach

1. **M**easurability of consumers‟ satisfaction is doubtful.
2. **T**he assumption of constant marginal utility of a unit of money is unrealistic.

2.7.3. Ordinal Utility

In this approach what matters to analyze consumer‟s choice problems is whether one bundle has greater or smaller utility than the other. What is important about utility assignment is how the consumer ***orders or ranks*** alternative bundles of goods.

The **absolute difference** between the utility of alternative bundles doesn‟t have any behavioral significance. Since only the ranking or ordering of alternative bundles matters, there can be ***no unique*** way of assigning numerical magnitudes to consumer‟s satisfaction.

Example: Suppose **Ruth** reveals her preference as A>B>C

Bundles	U_1	U_2	U_3
A	3	6	9
B	2	4	6
C	1	2	3

All U_1, U_2 & U_3 can be valid way of representing **Ruth's** preference stated above.

Table 2.2 preference ordering by monotonic transformation

Monotonic transformation: is a way of re labeling indifference curves without any difference in their order. Monotonic transformation of an ordinal utility function gives us a utility function

which is **as valid as** the original utility function to represent the same set of the consumer‟s preference.

Example: Multiplying by a positive constant, adding or subtracting a constant, raising to the power of a positive constant - - -

Generally, the ordinal utility function is a mechanism of assigning numerical labels to indifference curves in such a way that larger numerical values are assigned to higher indifference curves and smaller numerical values to lower indifference curves.

Examples of Utility Functions

$U = f(X_1, X_2, - - - -, X_n)$

i.Well – behaved Preference

.

$U(X_1, X2) = X_1X_2$ $K = X_1X_2$ K will have different values depending on utility assignment (Note that Utility is constant on a given Indifference curve). The graph of well-behaved preference is convex from the origin and is asymptotic to the

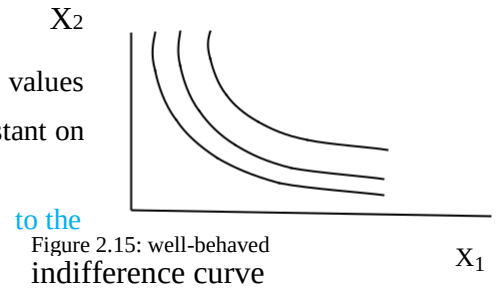


Figure 2.15: well-behaved indifference curve

ii. *Perfect Substitutes*

For perfect substitutes we have a general formula of

$U(X_1, X2) = aX_1 + bX_2$, where a & b are some positive numbers which measure the values of X_1 & X_2.

$K = aX_1 + bX_2$ $\quad X_2 = \frac{K}{b} - \frac{a X_1}{b}$, Slope = $\frac{-a}{b}$ =MRS

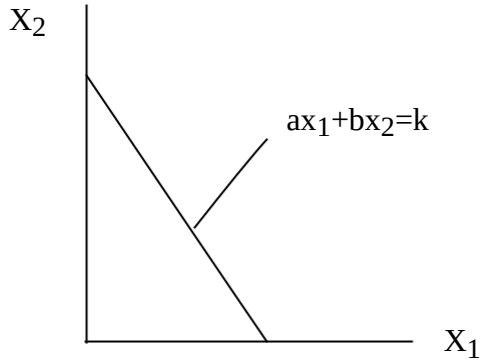


Figure 2.16: indifference curve of linear utility function

If the consumer equally values X_1 and X_2 (substitutes the two goods in one to one proportion), the equation will have the form of $X_1 + X_2$. But if X_1 is twice as valuable as X_2, the equation will have the form of $2X_1 + X_2$.

iii. Perfect Complements

In this case, utility depends on the number of pairs rather than singles and the general formula is => $U(X_1, X_2) = \text{Min}(aX_1, bX_2)$ Where a & b are positive numbers that indicate the proportion in which the goods are consumed.

Example: A consumer who always consumes two spoons of sugar (X_2) with each cup of tea (X_1) has a utility function of $U = \text{Min}(X_1, 2X_2)$

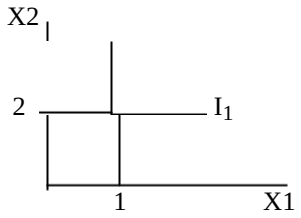


Figure 2.17: indifference curve of perfect complement utility function

iv. Cobb – Douglas Preferences

Another commonly used utility function is the Cobb-Douglas utility function.

$U(X_1, X_2) = X_1^c X_2^d$, where c & d are positive numbers. The specific values of c & d will be different for different types of consumer preferences, but in all the cases it gives rise to convex indifference curves. Cobb Douglas preferences are the standard example of indifference curves that looks well-behaved.

Marginal Utility (MU): MU is the rate of change of utility with respect to a good (X_1, X_2) total utility function.

The marginal utility of X_1 measures the rate by which the total utility will change, if we give a little more of X_1 to the consumer, keeping X_2 constant.

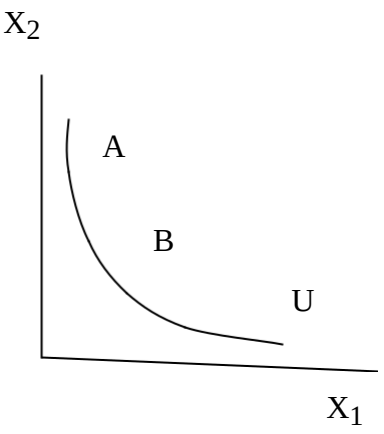
$U(X_1 + \Delta X_1, X_2) \Rightarrow (X_1 + \Delta X_1, X_2)$

$$MUX_1 = \frac{\Delta U}{\Delta X_1} = \frac{U(X1+\Delta X1, X2) - U(X1, X2)}{\Delta X1}$$

$$\Delta u = MUX_1 . \Delta X1$$

$$MUX_2 = \frac{\Delta U}{\Delta X_2} = \frac{U(X1, \Delta X2 + X2) - U(X1, X2)}{\Delta X2} \qquad \Delta u = MUX_2 . \Delta X2$$

MU in the ordinal utility function depends on the scale used to assign total utilities. **H**ence, the MU as well **does not have specific behavioral significance** in the ordinal approach. But they can be used to determine the MRS which has behavioral meaning.



Let"s see the movement from point A to B. The total utility doesn"t change if we move from one point to another on the same indifference curve.

Pt A = (X_1, X_2) Pt B = $(X_1 + \Delta X_1, X_2 + \Delta X_2)$

$\Delta u = MUX1 * \Delta X_1 + MUX_2 * \Delta X_2 = 0$

$MUX_1 * \Delta X_1 = - MUX_2 * \Delta X_2$

$MRSx_1x_2 = \frac{\Delta X_2}{\Delta X_1} = - \frac{MU X_1}{MU X_2}$

Figure 2.18

M$RS_{1, 2}$ is the willingness of the consumer to substitute X_2 in order to get one additional unit of X_1. It can be observed from the **actual behavior** of the consumer. Monotonic transformation will affect marginal utilities in similar proportion to total utilities but doesn"t affect the MRS.

Example: $U (X_1, X_2) = aX_1 + bX_2$

Multiply the utility function by 3

$U (X_1 , X_2) = 3(aX_1 + bX_2)$

$= 3aX_1 + 3bX_2$

Find MUX_2, MUX_1 & $MRS_{1,2}$ for both the original and the new function.

For the original $MUX_1 = aMUX_2 = b$ $MRS_{1,2} = -a/b$

For the new $MUX_1 = 3aMUX_2 = 3b$ $MRS_{1,2} = -3a/3b = -a/b$

Thus, monotonic transformation i.e. scaling up or down the utility function by some constants affects only the marginal utilities by same proportion but does not affect the MRS

Know days because of conceptual problems, economists have abandoned the old-fashioned view of utility as being a measure of happiness. Instead the theory of consumer behavior has been reformulated entirely in terms of consumer preferences, and utility is seen only as a way to describe preferences.

2.8. Consumer Choice

Given preferences and budget constraints, it is possible to determine how individual consumers choose how much of each good to buy. The basic assumption is that consumers make this choice in a rational way – which they choose goods to *maximize the satisfaction they can achieve, given the limited budget available to them.*

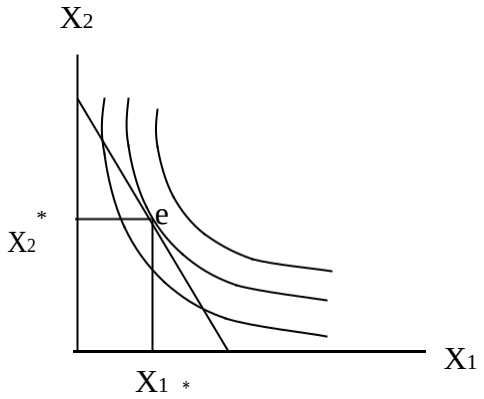
2.8.1 Optimum of the Consumer

Optimum of the consumer is the point at which consumer reaches at equilibrium level of consumption or feels full satisfaction binding by his/her income and prices constraints.

The maximizing (reaching at equilibrium level of consumption) market basket must satisfy two conditions:

1. It must be located on the budget line.
2. It must give the consumer the most preferred combination of goods and services.

These two conditions reduce the problem of maximizing consumer satisfaction to one of picking point on the budget line. These two conditions are attained through equating MRS (slope of the indifference curve) to the ratio of the commodities‟ prices (the slope of the budget line) We can graphically illustrate the solution to the consumer‟s choice problem.



e - (X_1*, X_2^*) is an optimal choice. The equilibrium point (e) is defined by the point of tangency of the budget line and the highest possible (affordable) indifference curve.

Figure 2.19: optimality of consumer

Ratio of prices=$\frac{p1}{p2}$ = the rate at which the market substitutes X_1 for X_2.

MRS=$\frac{MUX}{1}$ the rate at which the consumer is willing to substitute X_1 for X_2.

Note that, when we compare slopes we have to put the values in ***absolute value,*** as a result the values will be positive.

To the **left** of tangency point

$\frac{MUX1}{MUX2} > \frac{p1}{p2}$ The consumer is willing to substitute X1 for X2 at a higher rate than the market offers.

To the **right** of the tangency point

$\frac{MUX1}{MUX2} < \frac{p1}{p2}$ The consumer is willing to substitute X1 for X2 at a smaller rate than the market offers.

The consumer will not be satisfied in both cases. But will be satisfied at point e (tangency point) because what he/she is doing is consistent with what is offered by the market.

$\frac{MUX1}{MUX2} = \frac{p1}{p2} \Rightarrow \frac{MUX1}{P1} = \frac{MUX2}{P2}$

2.8.2 Optimality Condition for Exceptional Indifference Curves

(1) Perfect substitutes

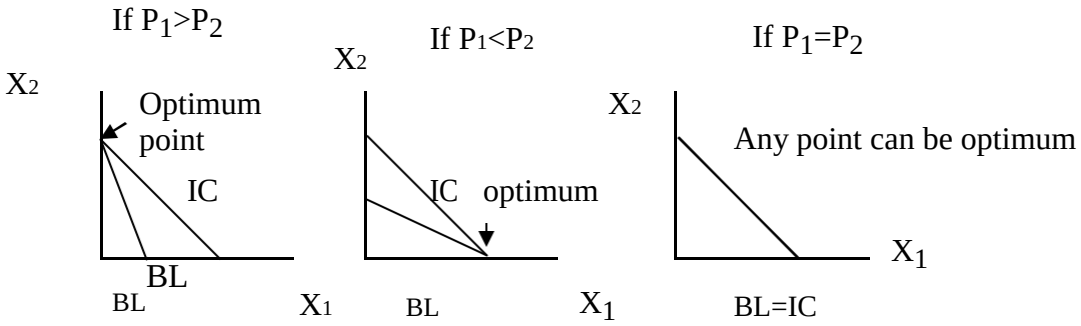


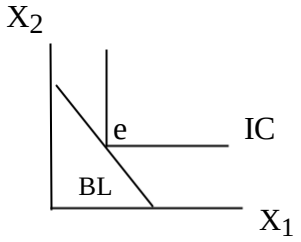
Figure 2.20: optimality of consumer for exceptional indifference curve Case of perfect substitutes

If the goods are perfect substitutes the optimal choice is usually on the boundary.

Demand function

For good 1 $X_1 =$ $\frac{M}{P1}$ For P1 < P2; any point between 0 and $\frac{M}{P1}$ for $P_1 = P_2$; 0 for $P_1 > P_2$

(2) ***Perfect complement***



If the goods are perfect complements the optimal choice is usually at the corner and it is called a corner solution.

Figure 2.21: optimality of consumer for exceptional

Let $X_1 = X_2$, then „e" is optimum point where the consumer is purchasing equal amount of both goods. So that, at equilibrium $X_1 = X_2 = X$

$P_1X_1 + P_2X_2 = M$

$=> P_1X + P2X = M$

$X(P1+P2)=M$

$X_1=X_2=X= \frac{M}{P1+P2}$

If $X_1= 2X_2$,

$P_1X_1 + P_2X_2 = M$

$=> P_1 [2X_2 + P_2X_2] = M$

$X_2 (2P_1 + P_2) = M$

$X_2 = \frac{M}{2P1+P2}$

Derivation of Consumer Demand

The derivation of demand is based on the axiom of diminishing marginal utility. The marginal utility of commodity x may be depicted by a line with a negative slope (fig. 2.22b). Geometrically the marginal utility of x is the slope of the total utility function $U=f(q_x)$. The total utility increases, but at a decreasing rate, up to quantity x and then starts declining (fig. 2.22a).

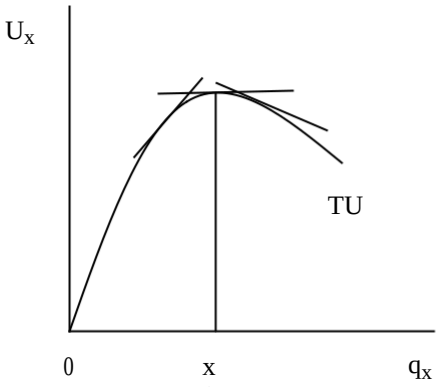


Fig. 2.22a

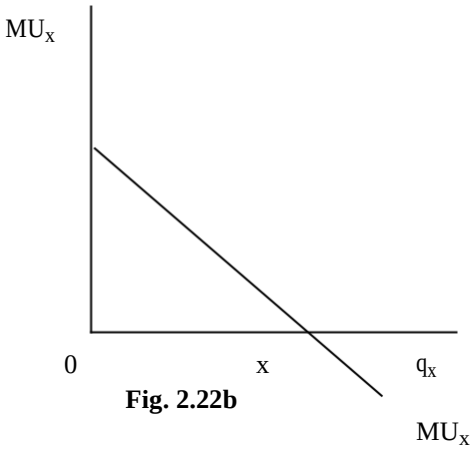


Fig. 2.22b

Accordingly, the marginal utility of x declines continuously, and becomes negative beyond quantity x. If the marginal utility is measured in monetary units, the demand curve for x is identical to the positive segment of the marginal utility curve. At x_t the marginal utility is MU_1 (fig. 2.23a). This is equal to P_1, by definition. Hence, at P_1 the consumers demand x_1 quantity (fig. 2.23b).

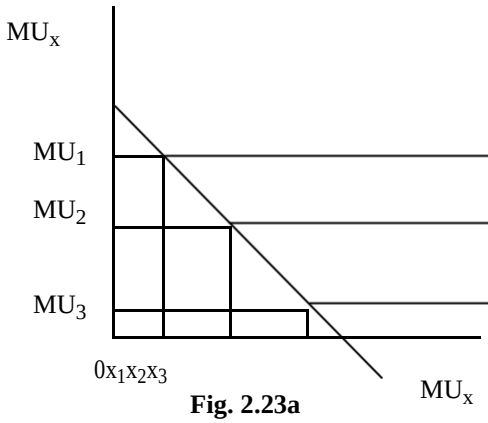


Fig. 2.23a

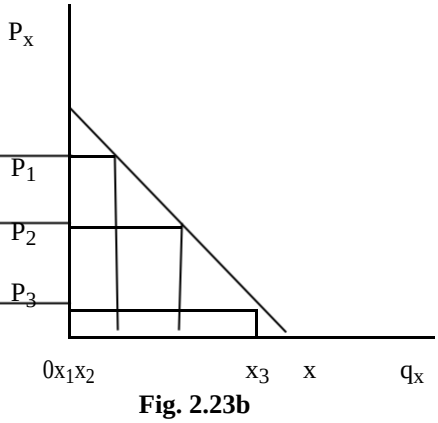


Fig. 2.23b

Similarly, at x_2 the marginal utility is MU_2, which is equal to P_2. Hence, at P_2 the consumer will buy x_2, and so on. The negative section of MU curve does not form part of the demand curve, since negative quantities do not make sense in economics.

2.9.1. Derivation of the Market Demand

The market demand for a given commodity is the horizontal summation of the demand of the individual consumers. In other words, the quantity demanded in the market at each price is the sum of the individual demands of all consumers at that price.

Table 2.3 Individual and Market Demand

Price	quantity demanded by consumer A	quantity demanded by consumer B	quantity demanded by consumer C	demanded by consumer D	market demand
2	40	4	45	18	107
6	24	5	30	13	72
10	14	10	15	11	50
14	8	5	10	6	29
18	4	2	0	0	6
20	3	0	0	0	3

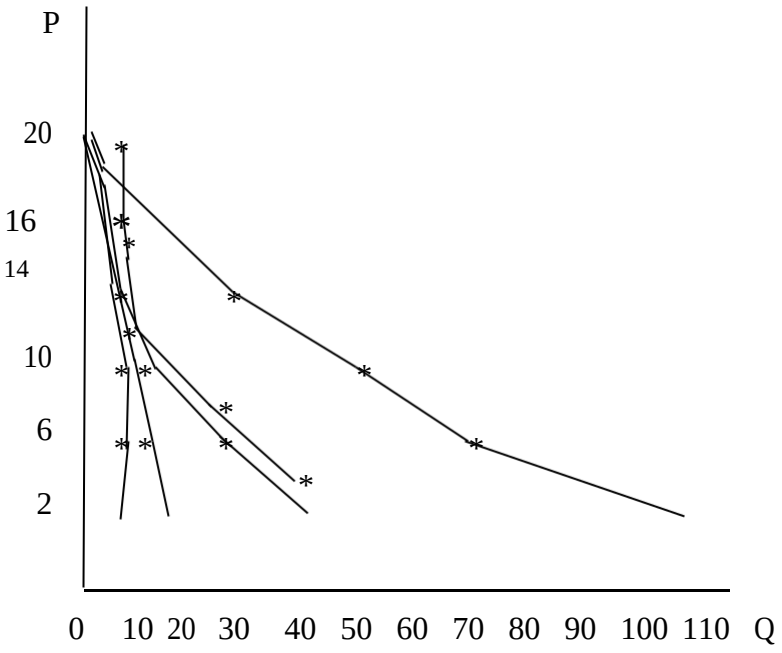


Fig. 2.24: derivation of market demand curve

Economic theory does not define any particular form of the demand curve. Market demand is sometimes shown in textbooks as a straight line (linear demand curve) and sometimes as a curve convex to the origin. The linear demand curve (Fig 2.22b) may be written in the form: $Q = b_0 - b_{1P}$

and implies a constant slope, but a changing elasticity at various prices. **A**s shown in the above diagram summing up such individual demands at different prices we can arrive at the market demand curve. Notice that the market demand curve is *flatter* than the individual demand curves.

Demand is expressed not only in schedules and curves but also in functions. Competition, of course, entails many more than three buyers of a product. To avoid hundreds or thousands or millions of additions, we suppose that all the buyers in the market have the same demand functions. That is all the buyers are willing and able to buy the same amounts at each of the possible prices. Then we just multiply those amounts by the number of buyers to obtain the market demand. To find the market demand function first we rewrite the demand curve of the typical/representative consumer in terms of quantity demand. [$Q_d = f(P)$]. Then we multiply it by the number of identical consumers in the market to find the market demand for a product.

Example: - **S**uppose the demand of a typical consumer is $Q_d = 20 - 3P$ and that there are 200 identical consumers in the market for corn. What is the market demand?

So l$^{\underline{n}}$ $Q_M = 200X\ Q_d$

$= 200\ (20-3P)$

$\underline{Q_M = 4{,}000 - 600P}$

♥ Check your progress 3

Suppose there are 100 identical consumers in Wolaita butter market, and the inverse demand of a typical consumer is given as $P = 20 - 1/5/Q_d$. Find the market demand function for Wolaita butter market. [Ans. Q = 10,000-500P].

-8- Suppose there are 500 consumers in Arba Minch banana market and they are grouped in three categories as follows – 150 consumers have identical demand function

Q_1 = 9-1/2P; 100 have identical demand equation of Q_2 = 4 - 1/5P, and the other 250 consumers have the same demand equation of the form Q_3 = 8 - P. Find the aggregate/ market demand for Arba Minch Banana Market [Ans. Qm= 3750 – 345P]

[Hint: First find the demand equation of each group and then add the three equations together to find the market demand.]

2.10. Consumer's Surplus

Let‟s assume that a consumer receives an additional amount of some goods. How much are these goods worth to the consumer? To know this we should know the maximum amount the person is willing to pay for the extra goods he gets.

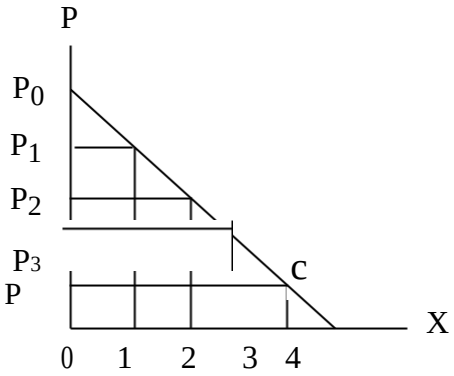


Figure 2.25: consumer surplus

Suppose the prevailing market price of good X is P at which the consumer purchases 4 amount of X.

There is a difference between what the consumer is willing to pay for each unit of X and what the consumer actually pays. *The difference between the amount the consumer is willing to pay and what he/she actually pays for a good is called* ***consumer's surplus****.*

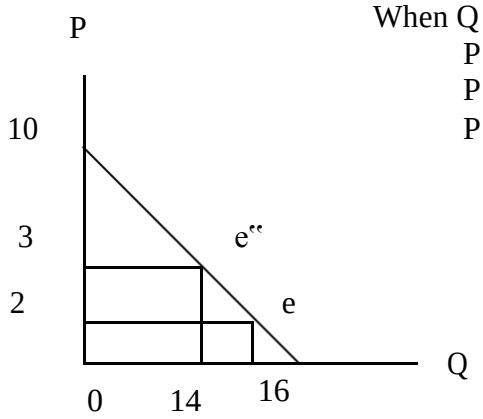
The consumer is willing to pay P_1 for the first and P_2 for the 2^{nd} unit of X. The fact that the market price is lower than the price the consumer is willing to pay for the initial units of X implies that actual expenditure is less than what he/she is willing to spend. The difference between the figures yields the consumer‟s surplus.

The consumer‟s surplus = Area (OPoC4) – (0PC4)

= PPoC

The consumer‟s surplus is a measure of the net benefit received by the consumer. It is the area under the demand curve and above the price line.

Example: - **G**iven a linear demand curve equation Q=20 – 2P, what is the associated change in consumer surplus if price changes from 2 to 3.



When Q = 0 P=10
P = 0 Q=20
P = 2 Q=16
P = 3 Q=14

Figure 2.26: graphical derivation of consumer surplus

At P = 2 Consumer‟s surplus is ½ (8 X 16) = 64

At P = 3 Consumer‟s surplus is ½(7 X 14) = 49

ΔCS=CS‟–CS=49–64=**-15**

Generally, the consumer surplus declines as the quantity of the good decreases.

2.11. Elasticity of Demand

The law of demand tells us that consumers will respond to a decline in a products price by buying more of that product. But how much more of it will they purchase? That amount can vary considerably by product or over different price ranges for the same product.

The *responsiveness, or sensitivity*, of consumers to a change in price, income, or price of other goods… is measured by the elasticity of demand. Accordingly, we *have price elasticity, income elasticity and cross-price elasticity of demand.*

(A) **Price Elasticity of Demand**

It is a measure of responsiveness, or sensitivity, of consumers to a change in the price of a product, other things being constant. We measure the degree of price elasticity or inelasticity of demand with the coefficient **Ed**, defined as

Ed = % Change in Quantity Demand

% Change in Price

$$Ed = \frac{change\ in\ quantity\ dmand\ of\ x}{original\ quantity\ demanded\ of\ x} \div \frac{channge\ in\ price\ of\ x}{orginal\ price\ of\ x}$$

Symbolically, $Ed = \frac{\Delta Qdx}{Qdo} \div \frac{\Delta Px}{Po}$

$$Ed = \frac{\Delta Qdx}{\Delta Px} \cdot \frac{Po}{Qdo}$$

Where $\frac{\Delta Qdx}{\Delta Px} \cdot$ = slope of DD curve at that Particular point.

E*limination of the Minus Sign*

We know from the down sloping demand curve that price and quantity demanded are *inversely* related. Thus, the price elasticity coefficient of demand, Ed, will always be a *negative number*. Therefore, we usually *ignore the minus sign* and simply present the absolute value of the elasticity coefficient to avoid an ambiguity which might otherwise arise.

As a matter of fact demand for some products is such that consumers are highly responsive to price changes; modest price changes lead to very large changes in the quantity purchased. For other products, consumers are quite unresponsive to price changes; substantial price changes result only in small changes in the amount purchased. In extreme cases, demand for a few products is totally unresponsive while for others it is perfectly responsive.

Interpretation of Ed

(A) E*lastic Demand* -demand is said to be elastic if a specific percentage change in price results in a larger percentage change in quantity demanded. Then Ed will be greater than 1.

The demand curve for elastic demand is drawn somewhat *flatter*. Most luxury goods & comforts have elastic demand.

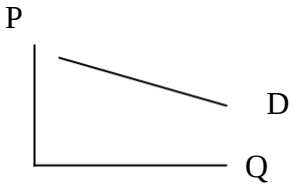


Figure 2.27: elastic demand curve

Example: **I**f a 3% decline in price results in a 9% increase in quantity demanded, then demand is elastic and Ed= 0.09/ 0.03 = 3> 1.

(B) ***Inelastic demand*****: -**if a given percentage change in price is accompanied by a relatively smaller change in the quantity of the good or service, then demand is said to be inelastic.

for example, if a 10% increase in the price of a product is accompanied by only a 2% decrease in the quantity demanded of that product Ed = 0.02/0.1 = 0.2< 1. The demand curve in this case is drawn *steeper*. Most of the essential goods or necessities have inelastic demand. 0< Ed < 1

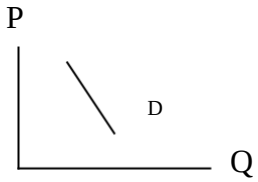


Figure: 2.28: inelastic demand curve

(C) U*nitary Elastic*: - Demand is said to be unitary elastic if a specific percentage change in price results an equal percentage change in quantity demanded. Then, Ed will be equal to one. The demand curve for unitary curve is a rectangular hyperbola.

For example if, a 6% change in price results in 6% change in quantity demanded, then Ed= $\frac{6\ \%}{6\ \%}$ =1. the demand curve for unitary curve is a *rectangular hyperbola*.

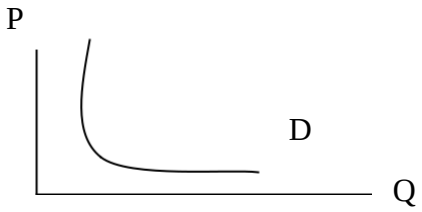


Figure 2.29: unitary elastic demand

(D) P*erfectly Inelastic*: - This is the extreme situation where a price change (what so ever the change be) results in no change in the quantity demanded, In this case consumers are completely unresponsive. A good example is an acute diabetic patient‟s demand for insulin or an addicted person‟s demand for Cigarette. The demand curve for perfectly inelastic demand is a *vertical line* parallel to the price axis.

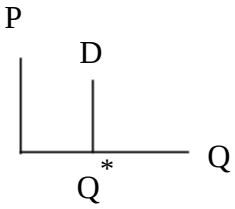


Figure 2.30: perfect inelastic

(E) P*erfectly Elastic*: - this is also the extreme case where a small price reduction would cause buyers to increase purchase from zero to all they could obtain (Nothing else at some other prices). The demand curve for a perfectly elastic demand is a horizontal line drawn parallel to the quantity axis.

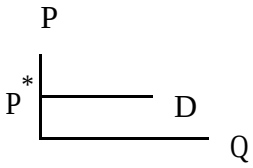


Figure 2.31: perfect elastic demand curve

There are two types of measurement of elasticity

- Point elasticity – This measures elasticity at a specific point on a demand curve.

$$Ed = \frac{\Delta Qdx}{\Delta Px} \cdot \frac{Po}{Qdo}$$

- Arc elasticity – refers to price elasticity over a distance on the demand curve. It measures the average responsiveness of consumer demand to changes in price.

$$\text{Ed} = \frac{\Delta Qd_x}{\Delta P_x} \cdot \frac{P_0 + p_1}{Q_0 + Q_1}$$

- As a convention, we generally refer to take the absolute value of elasticity, despite the fact that the derivative is usually negative. We will say that:

$$x \text{ has } \begin{cases} \text{an elastic demand if} & \left|\varepsilon_{x,p}\right| > 1 \\ \text{a unit elastic demand if} & \left|\varepsilon_{x,p}\right| = 1 \\ \text{an inelastic demand if} & \left|\varepsilon_{x,p}\right| < 1 \end{cases}$$

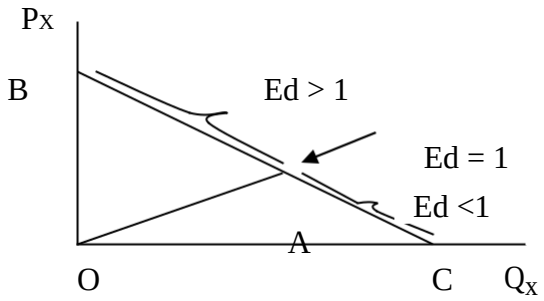
Determinants of Price Elasticity of Demand

- **A*vailability of close substitutes*: -** The more and better substitutes that exist for a good, the more elastic its demand are. For example, Insulin – has no close substitute. Because of this reason, the demand for insulin is inelastic on the other hand; the demand for a particular brand of car is likely to be very elastic because there are many substitute brands available in the market.

- **T*he proportion of income consumers spends on the commodity*: -** the demand for a product on which a consumer spends large percentages of his/her income is likely to be quite elastic.

- **T*he nature of a commodity*: -** The commodity might be either necessary or luxury. The demand for necessities is inelastic, whatever are the changes in the price of a good, and certain quantities will still be purchased by consumers. The demand for luxury good is elastic, because a consumer can postpone his/her consumption to buy luxury goods when its price is low.

- **P*rice level*: -** Assuming that the demand curve for a product is linear, demand tends to be more elastic at higher price than at lower prices.



Note that slope doesn‟t measure elasticity because; elasticity measures the relative/percentage change, unlike the slope.

Figure 2.32: elasticity measure on linear demand curve

- ***Adjustment time*: -** In general, demand tends to be more elastic with longest time because the consumer can find more substitutes for the product in the long run. Thus, in the short-run demand is inelastic while in the long-run it is elastic/relatively elastic.

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

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

This coefficient (E_m) can either be positive or negative. Goods that have positive income of demand are called **normal goods**. Normal goods are goods whose demand increases as income increases. In contrast, goods that have negative income elasticity of demand are called **inferior goods**. Inferior goods are goods whose demand decreases as income increases.

Normal goods may be either necessary or luxury. Necessity goods have income elasticity which is greater than 0 & less than one. But if the income elasticity coefficient is greater than unity, the commodity is luxury.

A commodity is likely to be a luxury at “low” level of income, a necessity “intermediate: level of income & inferior at “high” level of income.

Summary:

Table 2.4 summary of income elasticity

$E_m < 0$	$E_m > 0$	
	Normal	
Inferior	$0 < E_m < 1$	$E_m > 1$
	Necessity	Luxury

(C) Cross Elasticity of Demand: Is another useful price elasticity concept, which measures the sensitivity of purchases of one good (X) to changes in the price of another good (Y).

$$E_{xy} = \frac{\% \Delta Qx}{\% \Delta py} = \frac{\Delta Qx}{\Delta py} \cdot \frac{py}{Qx}$$

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

(i) **Substitute goods**: - If cross elasticity of demand is positive that is, the quantity demanded of X moves in the same direction as a change in the price of Y- then X and Y are substitute goods. Hence, the larger the positive cross elasticity coefficient, the greater the substitutability between the two products, ceteris paribus.

(ii) **Complementary goods**: - are goods that are consumed together. An increase in the price of one of the good leads to a decrease in the quantity demanded of the other. So that E_{xy} becomes negative. Sugar & coffee

(iii) **Independent goods**: - A zero or near-zero cross elasticity suggests that the two products are unrelated or independent goods.

Example: the demand for tea and price of pen are unrelated; that is, we would not expect a change in the price of pen to have any effect on purchases of tea. **Exercise**: Consider two goods X & Y and assume that the price of Y rises from 10 birr to 20 birr, the quantity demanded of X decreases from 40 to35 units. Calculate the cross elasticity of demand and identify what type of commodities are X & Y?

Self-Check Exercise

Part I: Completion items

Direction: **Complete the blank space with appropriate word or term.**

1. The locus of points which provide the same level of satisfaction to the consumer refers to _____.
2._____ is the amount of change in the holdings of one commodity that will just offset a unit change in the holdings of another commodity, so that the consumer's total utility remains the same.
3. The locus of combinations or bundle of goods that can be purchased if the entire money income is spent is descibed by _____.
4. The curve connecting all the points of consumer equilibrium as prices change is called _____.
5. _____is the difference between what a consumer is willing to pay and what he actually pays.

Part II: Multiple-choice items

Direction: Select the correct answer from the given alternatives and write the letter of your choice.

1. Given two commodities X and Y and level of income M, then if price of one of the Commodities or price of X commodity decreased which of the following is not true?

   A) The budget line shifts to the right.
   B) The budget line shifts to the left.
   C) The slope of the budget line changes.
   D) The X and Y intercept changes together.
   E) None

2. Suppose two goods X and Y. If the income of the consumer raised by 8 %, the prices of good X increased by 4 % and the price of Y decreased by 6. Which of the following is true?

   A) The budget line shifts outward
   B) The budget line rotates inward on the horizontal axis
   C) The same slope of the budget line
   D) The budget line rotates inward on the horizontal axis and rotates outward on the vertical axis
   E) All

3. If the price elasticity of demanded is less than 1 and price increase by 8%, the quantity demanded will be:

    A. Decrease by less than 8%.

    B. Decrease by greater than 8%.

    C. Increase by greater than 8%.

    D. Remain the same.

4. If a 5% increase in the price of one good results in a decrease of 2% in the quantity of demanded of another good, then it can be concluded that the two goods are:

    A. Complements

    B. Substitutes

    C. Independent

    D. Normal

CHAPTER THREE
Choice and Uncertainty
Introduction

So far we have assumed that prices, incomes and other variables are known with certainty. However, many of the choices the people make involve considerable uncertainty. For example, most people borrow to finance large purchase such as houses and college education, and plan to payout from future income. But for most of us future incomes are uncertain. Our earnings can go up and down; we can be promoted, demoted or even loss our jobs. Or if we delay buying a house or investing in a college education, we risk having its price in real terms, making it less affordable. How should we take these uncertainties into account when we are making a major consumption or investment decision?

Sometimes we must choose how much risk we bear. What, for example, should you do with your saving? Should you invest your money in something in safe, such as saving account, or something riskier but potentially more lucrative, such as stock market? Another example is the choice of a job or even a career. Is it better to work for a large, stable company where a job security is good but chances of advancement is limited, or to join (form) a new venture which offer less job security but more opportunity for advancement?

To answer questions such as these we must be able to quantify risk so we can compare the riskiness of alternative choices. We therefore begin this chapter by discussing the way in which risk is measured. After wards, we will examine people‟s preferences toward risk. (Most people find risk undesirable but some people find it more undesirable than others). Next, we will see how people can deal with risk. Finally the mechanisms that reduce risk will be discussed.

Objectives of the chapter

The main objective of this chapter is to study about how consumers make optimal decisions when their choices are characterized by the problem of uncertainty and hence risk. Information is not always easily and freely available and the existence of uncertainty and the consequent risk is unavoidable in reality. Thus, on the compilation of this chapter students will

- Understand the problem of uncertainty and resulting risk.
- Be able to calculate the expected returns of the choices of the consumers under uncertainty using the concept of probability.
- Be able to differentiate consumers examining their attitudes towards risk.

- Understand the various mechanisms in which risk averse consumers reduce the level of risk occur.

3.1. The Concept of Risk and Uncertainty; and Quantification

To describe risk quantitatively, we need to know all the possible outcomes of particular action and the likelihood that each outcome will occur. Suppose, for example, that you are considering investing in a company that is exploring oil around lake chamo, if exploration effort is successful, the company‟s stock will increase from birr 30 to birr 40 per share; if not, it will falls to birr 20 a share. Thus, there are two possible future outcomes, a birr 40 per share price and birr 20 per share price.

Dear student try to define risk and uncertainty before you go deep in the note on the following provided space.

Uncertainty can refer to situations in which many outcomes are possible but their likelihood is unknown. Risk then refers to situations in which we can list all possible outcomes will occur with a known probability.

Note that: we will always refer to risky situations, but to simplify our discussion we use risk and uncertainty interchangeably.

a. Probability

Probability refers to the likelihood that an outcome will occur. In our example given above, the probability that oil exploration is successful might be ¼, and the probability that is unsuccessful 3/4. Of course, probability is difficult concept to formalize because its interpretation can depend on the nature of uncertain events and on the belief of the individual involved. Therefore, probability attachment to uncertain events might be in to two different ways based on the nature of events occur, i.e. objective and subjective probability attachment methods.

Objective probability: objective interpretation of relies on the frequency of with which certain events tend to occur. Suppose we know that of the last 100 offshore oil explorations 25 have succeed and 75 have failed. The probability of success of ¼ is objective because it is based directly on the frequency of similar experience, i.e. probability attachment to events objectively need past data.

Subjective probability: Dear our reader what alternative method of probability measure if there is no similar experience or past data about events going to occur? Try to give your own idea on the following lines.

Great! In this case objective measures of probability cannot be deduced, and a more subjective measure is needed. Subjective probability is the perception that an outcome will occur. This perception may be based on a person‟s judgment or experience, but not necessarily on the frequency with which a particular outcome has actually occurred in the past. When probabilities are subjectively determined, different people may attach different probabilities to different outcomes and thereby make different choices. For example, if the search oil were to take place in the area for the first time different people may attach different probabilities for success and failure of the project subjectively because they may have different understanding about oil business.

Whatever the interpretation of probability, it is used in calculating two important measures that help us describe and compare risky choices. One measure tells us the expected value and the other one is the variability of the possible outcomes.

b. Expected Value

The expected value associated with uncertain situation is weighted average of the payoffs or values associated with all possible outcomes, with the probabilities of each outcome used as weights. The expected value measures central tendency, that is, the average payoff. E.g. Take an event that can result in two possible outcomes.

X1 = Outcome 1

X2 = Outcome 2

E(X) = Expected value

Let Π_1 is the probability of outcome 1 and

Π_2 is the probability of outcome 2, then $E(X) = \Pi_1 X1 + \Pi_2 X2$.

c. ***Variability***

Variability – refers to the event to which the individual outcomes are likely to vary from their expected value. We use variance or standard deviation to see the variation of individual outcomes from their expected value.

Variance = $\delta^2 = \Pi i \sum_{i=1}^{n} (Xi - x)_2$

$= \Pi 1\,[X1 - E(X1)]^2 + \Pi 2\,[X2\text{-}E(X2)]^2 + \text{------} + \Pi n\,[Xn\text{-}E(Xn)]^2$

Choice with high variability results in high risk and similarly choice with low variability results in low risks.

Example

	Outcome 1		Outcome 2	
	Income	Probability	Income	Probability
Business 1	2000	0.5	1000	0.5
Business 2	1510	0.99	510	0.01

Table 3.1 variability of risk

Expected income of business 1 =>E(1) = 0.5(2000)+0.5(1000)=1500

Expected income of business 2 =>E(2) = 0.99(1510) +0.01(510) = 1500

Variance= $\delta^2 = \Pi i \sum_{i=1}^{n} (Xi - x)_2$

Variance 1=0.5(250,000) +0.5(250,000) = 250,000

Variance 2= 0.99(100) +).01(980100) = 9900

The outcome of the first business deviate from their expected value more than the second business and so is more risky. The preference of an individual will depend on his risk behavior.

3.2. Utility Function under Uncertainty

If the consumer has reasonable preferences about consumption in different circumstances, a utility function can be used to describe these preferences. However, under conditions of uncertainty some additional structure, called probability, needs to be added to the choice problem.

Thus the utility function is defined based on the consumption levels as well as the probabilities of the state of nature. Let C1 & C2 represent consumptions in two states and let

Π1 & Π2 be their respective probabilities, then we can write our utility function for the different consumption states as U (C1, C2, Π1 & Π2).

The formalization of consumer choice theory under uncertainty was initially by Neumann and Morgenstern. The central premise of the theory is that consumer‟s choose the alternative with the highest expected utility rather than the highest value.

Like other utility functions, the expected utility function can be subject to monotonic transformation. The specific form of the utility function depends on the nature of individual consumer preferences. In consumption possibilities state 1 & 2 are perfect substitute U(C1, C2, Π1 & Π2) = Π1X1 + Π2 X2.

There are compelling reasons why expected utility is a reasonable for choice problems in the face of uncertainty. The fact that outcomes of the random choice are consumption goods that will be consumed in different circumstances means that ultimately only one of those outcomes is actually going to occur.

The consumption that will be available to the consumer under the two states of nature can be taken as independent with what the consumer will have if it didn‟t occur. And such additive form of expected utility function is acceptable for mutually exclusive uncertain outcomes.

If there are n outcomes with their respective probability, C1- Π1 , C2- Π2 , C3- Π3 - - -Cn- Π*n* , then the Expected utility will be E(U) = Π1 C1+ Π2 C2 + Π3 C3+-- - - + Π*n* Cn

3.4. Individual Preference toward Risk

3.4.1. Risk Aversion

Dear learner state what risk aversion mean is before you go deep in the reading.

Risk aversion is a tendency to prefer a given amount of income with certainty than taking a gamble with high possible return and possible loss. For risk averse person the utility from a given amount of income is greater than the expected utility from different levels of income with similar expected value.

Example:

Take a person whose utility depends on the level of income as follows. Suppose the person currently has 20,000 and she is considering a business which will increase her wealth to 30,000 if the business succeeds but reduce her wealth to 100,000 if it fails.

Each success and failure has equal probability of 0.5. A utility for each state is given as follows.

U(20,000) = 16, U(10,000) = 10, U(30,000) = 18

Since we are measuring payoffs in terms of utility, the expected utility must be calculated. The expected utility is the sum of the utilities associated with all possible outcomes, weighted by the probability that each outcome will occur.

Thus, expected utility of wealth denoted by E(U)= 0.5U(30) + 0.5U(10)

= 0.5(18) + 0.5(10)

= 14

But when we compare this with the utility of initial capital (i.e, 20,000),

U (20) > E (U), for U (20) is 16 and E (U) is 14. Because of this the risk averse consumer accepts this gamble. Therefore, the woman would prefer a certain income of birr 20,000(with a utility of 16) to a gamble with a 0.5 probability of ending up with birr 10,000 and a 0.5 probability of getting 30,000 (whose expected utility is 14).

***Note that**: Risk aversion* **prefers a certain income to a risky income with the same expected value.**

This is shown diagrammatically as depicted in the following figure (figure 3.2)

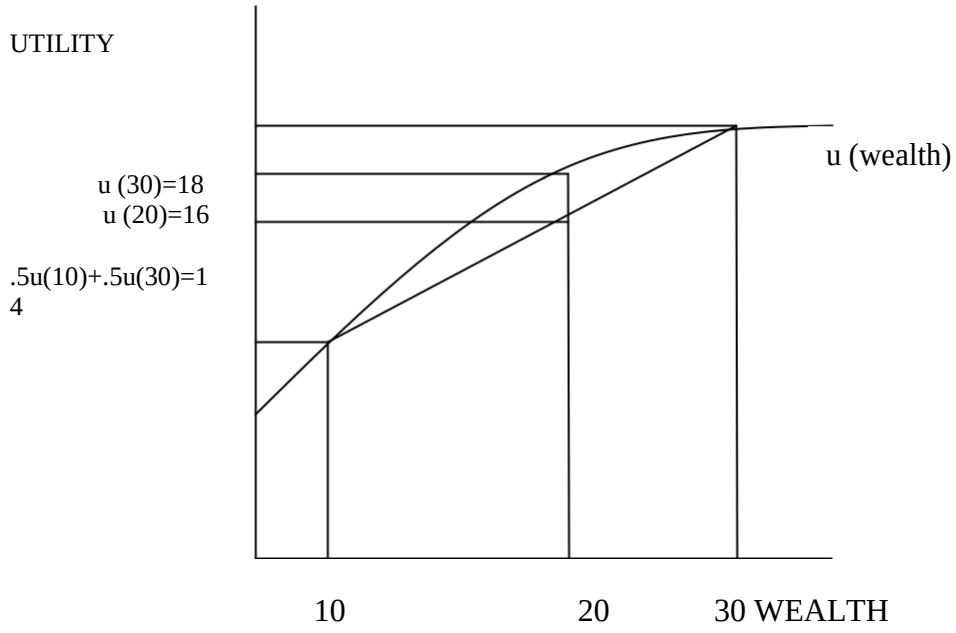


Figure 3.2: Risk Aversion. For a risk-averse consumer the utility of the expected value of wealth, u(20), is greater than the expected utility of wealth, .5u(10)+.5u(30).

The risk averse consumer has a concave utility curve. This implies that the slope of a utility curve gets flatter as wealth increases. The reason is that for risk adverse consumer losses are more important (in terms of the change in utility) than gains so the person has a diminishing marginal utility of income.

The marginal utility of income decreases with increasing level of wealth. This implies that the gain in utility from a given amount of additional wealth is smaller than the loss in utility from a comparable loss in wealth. That is why such a person always refuses to accept a gamble whose expected value is less than expected utility.

3.4.2. Risk Loving

An individual who is risk loving prefers an uncertain income one, even if the expected value of the uncertain income is less than that of the certain income.

This is a situation where the utility from a given amount of wealth (income) is less than the expected utility.

Example:

Take a person whose utility depends on the level of income as follows. Suppose the person currently has 20,000 she is considering a business which will increase her wealth to 30,000 if the business succeeds but reduce her wealth to 100,000 if it fails.

Each success and failure has equal probability of 0.5. A utility for each state is given as follows. The utility level associated with an income of birr 10,000bis 3 and the utility level associated with an income of birr 30,000 is 18. The risky business must be compared with the certain initial capital birr 20,000 for which the utility is 8

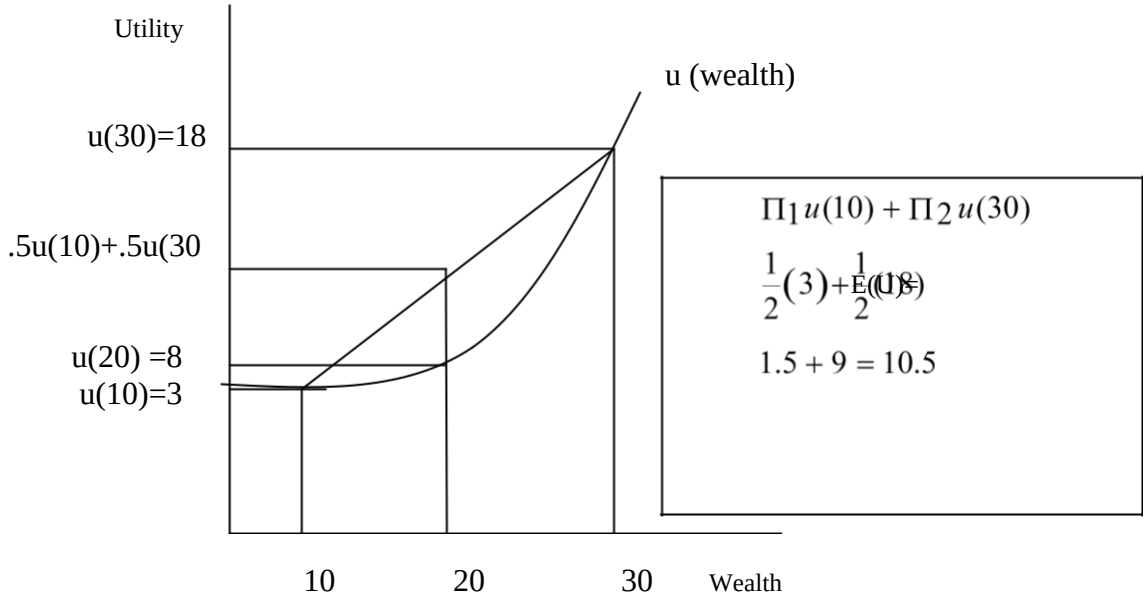


Figure 3.2: risk-loving preference

U (20,000) = 8, U (10,000) = 3, U (30,000) = 18

Expected utility of wealth denoted by E (U) = 0.5U (30,000) + 0.5U (10,000)

= 0.5(18) + 0.5(3)

= 10.5

U (20) < E (U), for U (20) is 8 and E (U) is 10.5.

Income and an uncertain income with the same expected value, the person is said to be risk neutral. So, the risk lover consumer has a convex utility function. The slope of the utility function gets steeper and steeper as wealth increases. For such consumer, marginal utility increases with increasing level of wealth. This implies that the gain in utility from a given amount of additional wealth is greater than the loss in utility from a comparable loss in wealth.

The curvature of the utility function measures the consumer‟s attitude towards risk. The more concave the utility curve it has, the more risk averse the consumer is. In contrast, the more convex the utility curve, the more risk lover the consumer is.

3.4.3 Risk Neutral

If a person is indifferent between a certain income and uncertain income with the same expected value, the person is said to be risk neutral.

Suppose the person currently has 20,000 she is considering a business which will increase her wealth to 30,000 if the business succeeds but reduce her wealth to 100,000 if it fails. Each success and failure has equal probability of 0.5. A utility for each state is given as follows.

The utility level associated with an income of birr 10,000 is 6 and the utility level associated with an income of birr 30,000 is 18. The risky business must be compared with the certain initial capital birr 20,000 for which the utility is 12.

U (20,000) = 12, U (10,000) = 6, U (30,000) = 18

Expected utility of wealth denoted by E (U) = 0.5U (30,000) + 0.5U (10,000)

= 0.5(18) + 0.5(6)

= 12

Thus, U (20,000)=E (U)=12

See the graphical illustration of this as follows in figure 3.3:

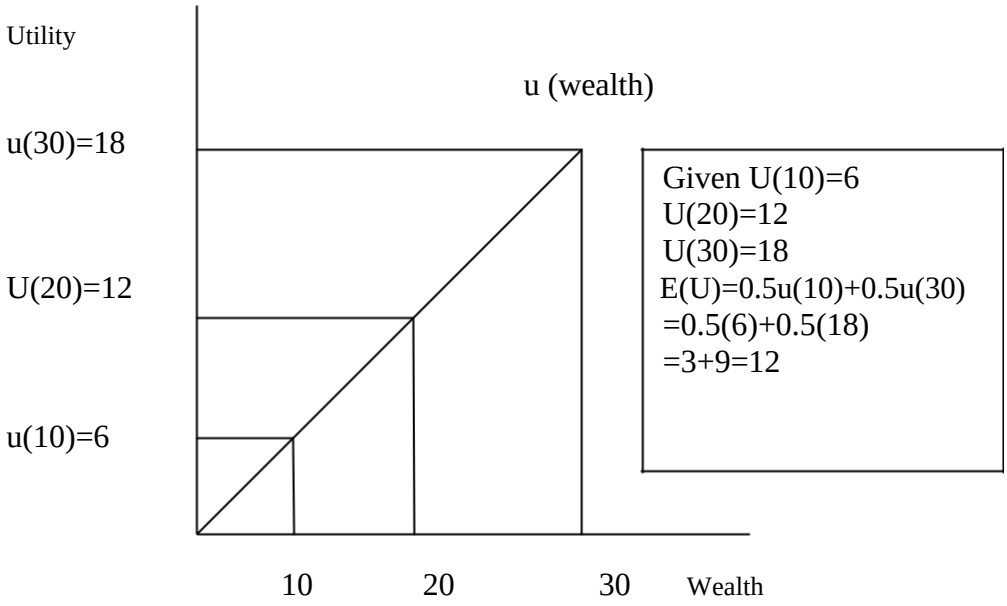


Figure 3.3: risk neutral preference

A risk neutral consumer has straight line utility curve that shows the marginal utility of wealth is constant. This implies that the gain in utility from a given amount of additional wealth is equal to the loss in utility from a comparable loss in wealth.

♥ Check your progress 1

There are two outcomes if the person an initial capital K. if the person succeeds he will get additional birr of 20, and if he loses he will losses 20 birr. Each, loss and success, have 0.5 probability. What type of attitude should the person have towards risk if he is willing to accept the gamble?

3.5. Reducing Risk

Given that the consumer is a risk averse, he/she minimizes the risk of uncertainty through different ways. In this section two ways by which consumers and business firms reduce risk will be discussed; diversification and risk spreading.

3.5.1. Diversification

"Don't put all your eggs in one basket." Ignoring this advice is unnecessary risky; because all might be lost at once. However, when one puts his effort in different types of (unrelated) activities, the loss from badly performing activities can be compensated by a gain from well

performing activities. By this method one can minimize his/her risk, this method of minimizing risk is said to be **diversification.**

Example: Consider a person thinking of investing Br. 1000 in two companies, one is heater producing and the other is air conditioners producing company. The share of stock for both companies currently is sold for Br. 100 each. The next season is equally likely to be hot or cold. If the next season turns out to be cold, the securities of the heaters company will be worth Br.200 each and securities of Air Conditioners Company will be worth of Br.50 each. And if the next season turns out to be hot the reverse will happen. Let‟s compare two cases:

Case 1: suppose the person puts the whole investment in one of the companies say heater, the person may have 10,000 shares and the expected outcome can be calculated as follows.

A. If the weather turns to be cold the securities of heater producing company will be worth of birr 200 each and if the weather turns to be hot the share will have a value of birr 50.

If the weather turns to	Income	Probabilities
Cod	Birr 200,000(birr 200*1000 shares)	0.5
Hot	Birr 50,000(birr 50*1000 shares)	0.5

Table 3.2 expected value with no diversification

If the person invests all his money on air conditioner producing company, the person can have 1,000 shares and the expected outcome can be calculated as follows.

Expected value=0.5(200,000)+0.5(50,000)= 125,000

If the weather turns to be cold the securities of air conditioner producing company will be worth of birr 50 each and if the weather turns to be hot the share will have a value of birr 200.

If the weather turns to	Income	Probabilities
Cod	Birr 50,000(birr 50*1000 shares)	0.5
Hot	Birr 200,000(birr 200*1000 shares)	0.5

Table 3.3 expected value with no diversification

In the above case one is not sure as the weather turns to be hot or cold

and Expected value=0.5(50,000) +0.5(200,000) = 125,000

Case 2: if the person equally divides his investment and put in the two companies, the person can purchase 500 shares from each company.

A. If the weather turns out to be cold.

Table 3.4 risk diversification when weather turns cold

Types of investment	**income**
Shares from heater producing company	Birr 100,000=(birr 200*500)
Shares from air conditioner producing company	Birr 25,000=(birr 50*500)

The total income is income from heater producing company (birr 100,000) added to income from air conditioner producing company (birr 25,000) equals 125,000

B. If the weather turns to be hot,

Types of investment	**income**
From heater producing company	Birr 100,000=(birr 200*500)
From air conditioner producing company	Birr 25,000=(birr 50*500)

Table 3.5 risk diversification when weather turns hot

The total income is income from heater producing company (birr 25,000) added to income from air conditioner producing company (birr 100,000) equals 125,000.

In **case 2** the person has put his income in the two unrelated business that the person gets birr 125,000 with certainty whether the weather turns out to be hot or cold. That means by diversifying his investment in the two companies he has managed to reduce the overall risk of his investment, while keeping the expected payoff the same at birr 125,000.

3.5.2. Risk Spreading

In the absence of formal insurance, a group of individuals can agree to share a loss incurred by each individual from their group. That means, consumer (individual) in a group spreads his/her risk over all of the other consumers and there by reduces the amounts of risk.

Example:

Consider a situation of an individual who had Br.3500 and faced a 0.1 probability of Br.10, 000 losses. Suppose that there were 1000 such individuals. Then On an average, 10 losses

are expected to occur, thus Br.100, 000 will be lost each year. Suppose that there were 1000 such individuals. Then on average, there would be 10 losses incurred, and thus birr 100,000 each year. Each of the 1000 people would face an expected loss of 0.1 times 10000. Suppose the probability that any person incurs a loss does not affect the probability that any of the others incur losses. That is, let us suppose that the risks are independent.

Suppose each individual decides to diversify the risk that he/she faces. How can they do this?

Answer: by selling some their risk to other individuals. Suppose that the 1000 individuals decide to insure one another. If anybody incurs the birr 10,000 loss, each of the 100 individuals will contribute birr 10 to loss facing individual. This way, an individual‟s house burns down is compensated for his loss, and other individuals have the safety cover, that they will be compensated, if they happened to face similar disaster. This is an example of risk spreading, in which each individual spreads his risk over all of the other individuals and thereby reduces the amount of risk he bears.

Now on average, 10 houses will burn down a year, so on average each of the 1000 individuals will be paying out birr 100 a year. But this is just on average. Some years there might be 12 losses, and other years there might 8 losses. The probability is very small that an individual would actually have to pay out more than birr 200 in a year, but even so, the risk is there.

But there is also a way to diversify this risk. Suppose that the house owners agree to pay birr 100 a year for certain whether or not there are any losses. Then they can build up a cash reserve fund that can be used in those years, when there are multiple fires. They are paying birr 100 a year for certain, and on average that money will be sufficient to compensate homeowners for fires.

This entire setup resembles some kind of cooperative company. If a few more features are added: the insurance company gets to invest its cash reserve fund and earn interest on its assets and so on. But the fundamental nature of the insurance company is clearly present.

Summary

The traditional economic view of perfect information and its costless propagation is not realistic in most cases. This means in other words, the choices individuals make are under great uncertainty and hence assumes risks.

Uncertainty is a situation which can result in a number of outcomes but one is not sure as to which outcome is to be materialized. On the other hand, **risk** is in a consequence that one has to face as a result of the variability of outcomes from uncertain situation.

The consumer‟s preference of risky choices depends on his/her attitude towards risky choices.

People differ in their preferences toward risk. That means they differ in their willingness to bear risk. They are classified as risk averse, risk lover and risk neutral based on their willingness to bear risk.

- Risk adverse person prefers a given amount of income with certainty than taking a gamble/uncertain income with high possible returns and losses.
- Risk loving individual prefers an uncertain income to a certain one even if the expected value of the uncertain income is less than that of the certain income.
- A person is said to be risk neutral if he/she is indifferent between a certain income and an uncertain income with the same expected value.

If a consumer is risk a risk averse, he/she minimizes the risks of uncertainty through different ways. The major ones are risk diversification and risk spreading.

Self-Check Exercise

Part I: discussion- items

1) Explain widely the distinguishing features of risk and uncertainty?

2) Mr. Cocket‟s utility of certain income is greater than average utility he earns from uncertain income. How do you explain Mr. Cocket‟s attitudes toward risk?

3) Discuss in detail mechanism of reducing the level of risk.

Part II: Work out- items

1) Suppose the likelihood of occurrence of bad and good outcome is fifty-fifty. If bad outcome occurs the consumer will generate utility of 100 while he/she will generate utility of 300 if the outcome is good. Estimate consumer‟s expected utility?

CHAPTER FOUR
THE THEORY OF PRODUCTION

Objectives

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

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

4.1 Introduction: Definition and basic concepts

Dear learner, how do you define production? What is needed to undertake production? Attempt to answer these questions and then read the following paragraphs to be sure on the answer.

_____

_____

Production is a process in which factors of production (inputs) are combined to produce an output. It is process of converting inputs (costs) into outputs (revenue).

Inputs (costs) ⟶ output (Revenue)

In studying and making decisions about production, the time period (long run and short run) is an important factor. The short run is a time period in which production is carried out by the help of two categories of inputs, fixed and variable inputs while the long run is a time period over which all inputs including the scale of plant or industry are available.

Variable inputs

Variable inputs are inputs whose use rate varies with level outputs while fixed inputs are inputs whose use rate does not vary with level of output. In other words, the quantity of fixed

inputs cannot be changed when the market conditions indicate an immediate change in output (eg land and building) while the quantity of variable inputs may be changed almost instantaneously in response to desired changes in output (eg. Labor input). Therefore, changes in output are accomplished exclusively by changes in the usage of variable inputs.

In the short run, the amount of output depends on the amount of other fixed inputs including the technology. The length of time period in short run therefore depends on the type of the fixed input in the production.

The task of firm manager in the short run is determine the amount variable input(s) to be combined with the fixed the fixed inputs while in the long run his task is to evaluate alternatives and expand the industry. He/she must decide which input to use, how much of each to use, and how to combine them in the most efficient production process. These decisions generate important information to produce the desired level of output.

Production function

is the schedule (either table, mathematical equation, or curve) showing the maximum amount of output that can be produced from any specified set of inputs at any particular time period , given the existing technology. The production function is a purely technical relation which connects factor- inputs and outputs. It describes a technical relationship between various combinations of factor inputs (variable inputs used in combination with a bundle of fixed inputs) and maximum attainable units of output from such combination.

The production is purely **physical concept** which relates the physical quantity of inputs and outputs within a given state of technology. It is defined for given technology because improve in technology increases the maximum output from any combination of inputs and results in a new production function.

Graphically, the production function is usually presented as a curve on two dimensional graphs. Changes of the relevant variables are shown either by movements along the curve that depicts the production function, or by shifts of this curve. The most commonly used diagrams of a single product are shown in figures 4.1a and 4.1b.

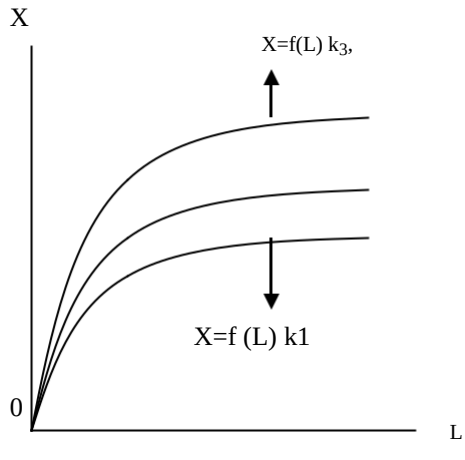


Figure 4.1

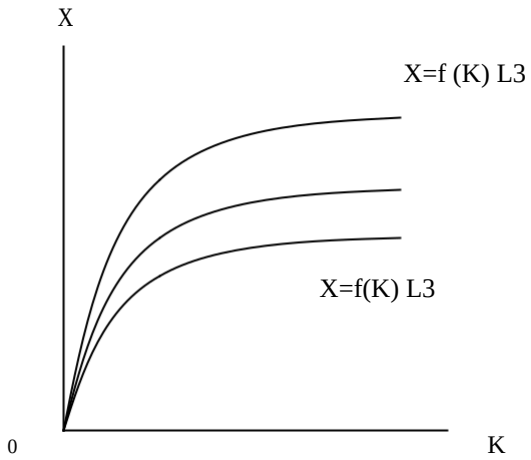


Figure 4.2

Each curve shows the relation between X and L for given K and the relation between X and K given L. As labor increases, we move along the curve depicting the production function. If capital increase, the production function X= f(L) moves upwards.

Output=f (inputs)

Q=f (L, K, M)

Q= output, L=labor, M=raw materials

In order to undertake economic analysis about production function concepts such as total product, average product, marginal product and input elasticity (or partial elasticity of production) is important.

i. **Total product (TP)** is the overall amount of outputs produced by the factors of production employed over the given time period.

ii. **Average physical product (AP_L)**, other things being the same, is defined as the quantity of the total product (Q) divided by the corresponding amount of variable input used in production, $AP_L=Q/L$

iii. Marginal product (MP_L) of variable input is obtained by computing the rate at of change of output as the input changes, which is the partial derivative of the total product curve with respect to the variable input. Thus it is defined as **the change in output resulting from a very small change in the unit of the variable input, keeping all other factors constant**. Alternatively, it is the slope of the total product curve. Graphically, therefore, the marginal product of variable input is shown by the slope of production function.

Marginal product therefore measures the quantity of additional output obtained for each successive additional unit of input employed. For a discrete change MP of variable input L is measured by MP_L —

Example table 4.1

Land/hectares	Number of labour	TP	AP_L	MP_L
1	0	2	--	--
1	1	10	10	8
1	2	24	12	14
1	3	39	13	15
1	4	52	13	13
1	5	61	12.5	9
1	6	66	11	5
1	7	66	9.4	0
1	8	64	8	-2

ii. **Partial elasticity of factor input of production (E)**is defined as the percentage **change** in output resulting from a given percentage change in the variable input.

4.2. Short run production: Stages of production

A functional relationship between observed between total product(TP), average product(AP) and Marginal product(MP) help to describe stages in production function (see fig. 4.3) states that as more of variable input is applied, output(Q) increases until the maximum TP at which input usage L_3 is reached. Further application of variable input beyond L will only serve to reduce the total output.

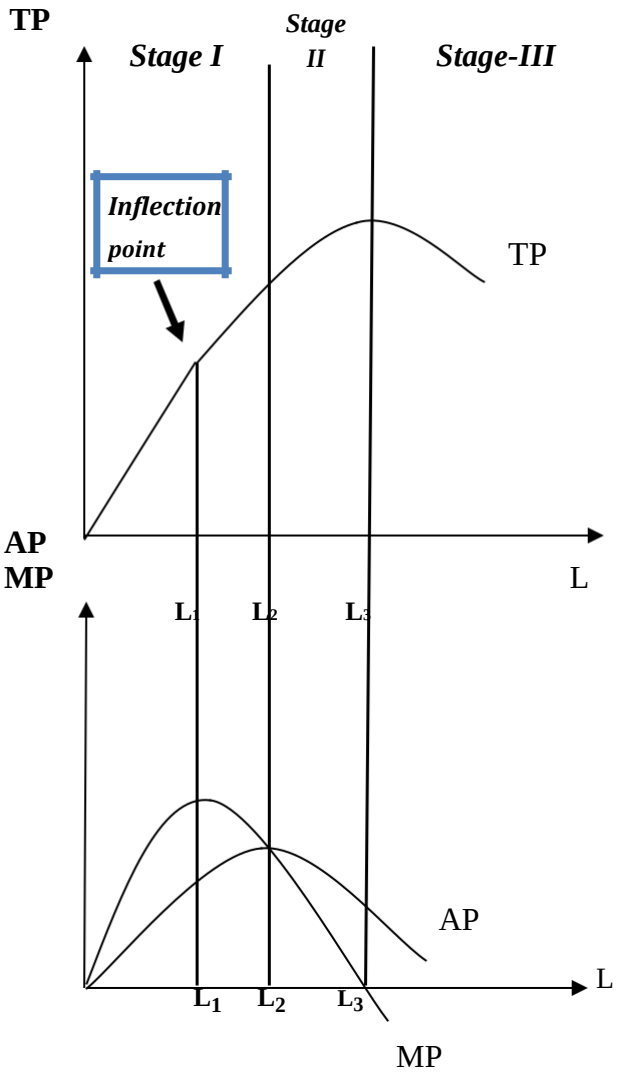


Fig 4.3 Stages of Production

Some Important points in the figure

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

Stage I

This is stage of production in range of zero output to maximum of AP obtained.

- MP>AP and AP is increasing.
- It is always profitable for the producer to add more variable inputs into production process.
- TP increases at an increasing rate.
- Since MP is greater than AP and AP is increasing, limiting production within this stage limits the productive capacity of fixed inputs, even though they are fixed.

- Within stage I rational producer do not want to produce because the fact that fixed input is not utilized efficiently.

Therefore, this stage is the stage in which variable input is underemployed and fixed input is over utilized.

Stage II

This is stage of production in which the production function lies in between maximum AP and maximum TP (MP=0).

- TP increases at decreasing rate.
- AP is greater than MP but AP is decreasing.
- MP is decreasing but positive and less than AP.
- Since AP and MP are decreasing, this region emphasizes diminishing returns to variable inputs but positive.

It is the phase in which rational producers prefer to produce because it enables them to make profit implying rational firm will always prefers to produce at output level for which the average variable cost is increasing and for which the marginal returns to factor inputs are diminishing but not negative. It would therefore be predicted that the optimum position in terms of variable input usage will lie somewhere in stage II.

The rational producers seek always maximum efficiency in production, which at the point where total production is at maximum. The point at which MP becomes zero represents the maximum quantity of variable input which will ever be profitable to use in combination with other inputs, efficient level of production. This would be profitable to add variable input up to the point where the return is at the maximum or simply MP= zero. If the variable input is added beyond the point, the MP is negative, and it does pay negative return to the firm. Therefore, the theory of production concentrates on the levels of employment of the factors over which their marginal products are positive but decreasing. The range of employment of L examined by theory of production in the stage II is over the range $MP_L>0$ but slope of MP_L is less than zero.

Stage III

This stage of production in which TP is decreasing and AP>MP; and MP is negative. Since additional quantity of input in this stage reduces total output (that is, MP <0), it is not profitable to operate with a combination of resources existing in this phase. This stage is therefore the stage of production in which variable input is over utilized (or overloaded)

In general:

- When MP_L is increasing TP is also increasing at increasing rate.
- When MP_L is decreasing until it reaches to zero, TP_L increase but at decreasing rate.
- When MP_L is zero TP_L is at maximum and
- When MP_L <0, TP_L is declining.
- When MP_L<AP_L, AP_L is increasing.
- when MP_L=AP_L, AP_L is at maximum and
- When MP_L<AP_L, both AP_L and MP_L are declining.

In other words, marginal products exceed when average product is rising; equals average product is at maximum; and lies below average product when average product is falling. The two curves intersect when at a point where the average product curve reaches its maximum. As the input ratio declines, the marginal product of the variable input decreases. The area of diminishing marginal returns on production function occurs when MP<AP, but it is not negative, i.e. 0<E<1. The case E> 1 and E<0 defines the production in which it would not be economically logical for the producer to operate. The case E>1 means that producer could always gain by using more of the input. The second case E<0 because output decreases as a consequence of using more input and the producer clearly does better by reducing input use.

Moreover, all production functions must satisfy two conditions to make economic justification acceptable. First, the MP should be positive and declining, i.e. the equation should have a positive first derivative ($dQ/d_x>0$); and second, the response of output to increasing level of input must be rising but at decreasing rate, i.e. the equation should have a negative second derivative($d^2Q/d_x^2<0$).

4.3. The law of diminishing marginal returns (LDMR)
short –run law of production

The LDMR states that as the use of an input increases in equal increments (with other inputs being fixed), a point will eventually be reached at which the resulting additions to output decreases. When the labor input is small (and capital is fixed), extra labor adds considerably to output, often because workers get the chance to specialize in one or few tasks. Eventually, however, the LDMR operates: when the number of workers increases further, some workers will inevitably become ineffective and the MPL falls (this happens when the number of workers exceeds L1 in fig 3.2)

Note that the LDMR operates (MP of successive units of labor decreases) not because highly qualified laborers are hired first and the least qualified last. Diminishing marginal returns results from limitations on the use of other fixed inputs (e.g. machinery), not from decline in worker quality.

The LDMR applies to a given production technology (when the level of technology is fixed). Over time, however, technological improvements in the production process may allow the entire total product curve shift upward, so that more output can be produced with the same input.

4.4. Efficient Techniques of Production

A method of production is a combination of factor inputs required for the production of one unit of output. Usually a commodity may be produced by various methods of production which combine factor inputs in different. The basic theory of production concentrates only on efficient methods. Inefficient methods will not be used by rational producer. For example, a unit of commodity X may be produced by the following three alternative techniques of production processes (A, B and C)

Table 4.2

inputs		alternative methods of production			
		A	B	C	
L		2	3	1	
K		3	2	2	

Alternative can be presented graphically by the length of lines from the origin to the point determined by the labour and capital inputs as shown in fig.4.4.

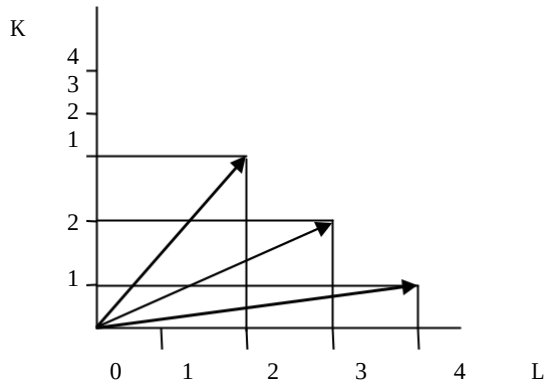


Figure 4.4

The most efficient level of variable input use in production depends on the relationship between the price of input and the price of the output. Process A uses less of some factors(s) and more of some other(s) as compared to process B, then A and B cannot be directly comparable on the criterion of technical efficiency. Note that technically efficient method is not necessarily economically efficient. There is difference between the technical and economic efficiency. Making choice of one alternative among the available alternatives at any particular time depends on the prices of the factor inputs. In other words, the economic choice of any particular technique is based on prices of factor inputs but not only on the technical aspects.

Suppose price of labor is birr 3 and price of capital is birr 4, then production technique A will cost 2(3)+3(4)=birr 18, production technique B cost 3(3)+2(4)=birr birr 17, and production technique C will cost 1(3)+4(4)=birr 19. Therefore, production technique B is more efficient because it will cost less.

♥ Check your progress 1

1. Define production, what are the major inputs required for production?
2. Which of the following activities is / are considered as production in economies?
   a) A mother washing her child‟s cloth
   b) A farmer producing wheat for self-consumption
   c) A farmer fattening beef for sale
3. Differentiate between:
- Fixed and variable input
- Short run and long run
4. List and explain the assumptions of short run production

5. Explain the following terms and concepts: TP, MP, AP, and LDMR.
6. Which stage of production is efficient region of production? Why?

4.5. Long run Production: Production with two variable inputs

Dear learner, we have completed our analysis of the short-run production function in which the firm uses one variable input (labor) and one fixed input (capital). Now we turn to the long run analysis of production. Remember that long run is a period of time (planning horizon) which is sufficient for the firm to change the quantity of all inputs. For the sake of simplicity, assume that the firm uses two inputs (labor and capital) and both are variable.

The firm can now produce its output in a variety of ways by combining different amounts of labor and capital. With both factors variable, a firm can usually produce a given level of output by using a great deal of labor and very little capital or a great deal of capital and very little labor or moderate amount of both. In this section, we will see how a firm can choose among combinations of labor and capital that generate the same output. To do so, we make the use of isoquant. So it is necessary to first see what is meant by isoquants and their properties. Dear learner, what is an isoquant?

4.5.1 Isoquant

An isoquant is a curve that shows all possible efficient combinations of inputs that can yield equal level of output. If both labor and capital are variable inputs, the production function will have the following form.

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

Given this production function, the equation of an isoquant, where output is held constant at q is

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

Thus, isoquants show the flexibility that firms have when making production decision: they can usually obtain a particular output (q) by substituting one input for the other.

Isoquant maps: when a number of isoquants are combined in a single graph, we call the graph an isoquant map. An isoquant map is another way of describing a production function. Each isoquant represents a different level of output and the level of out puts increases as we move up and to the right. The following figure shows isoquants and isoquant map.

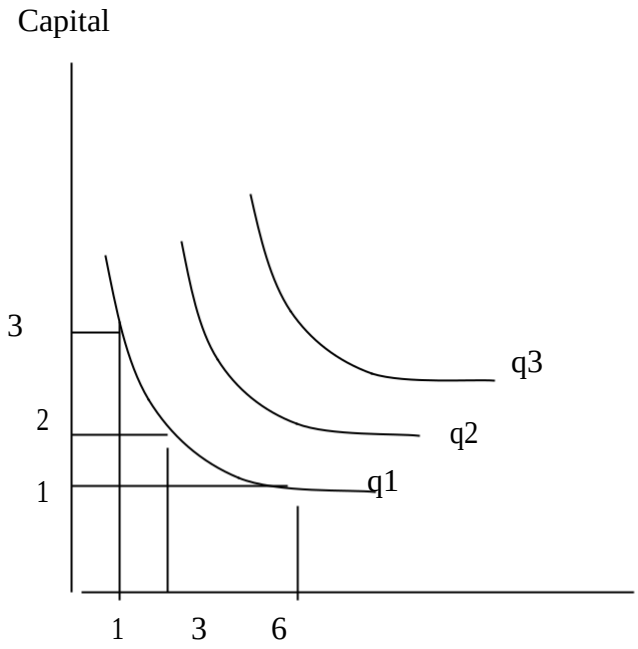


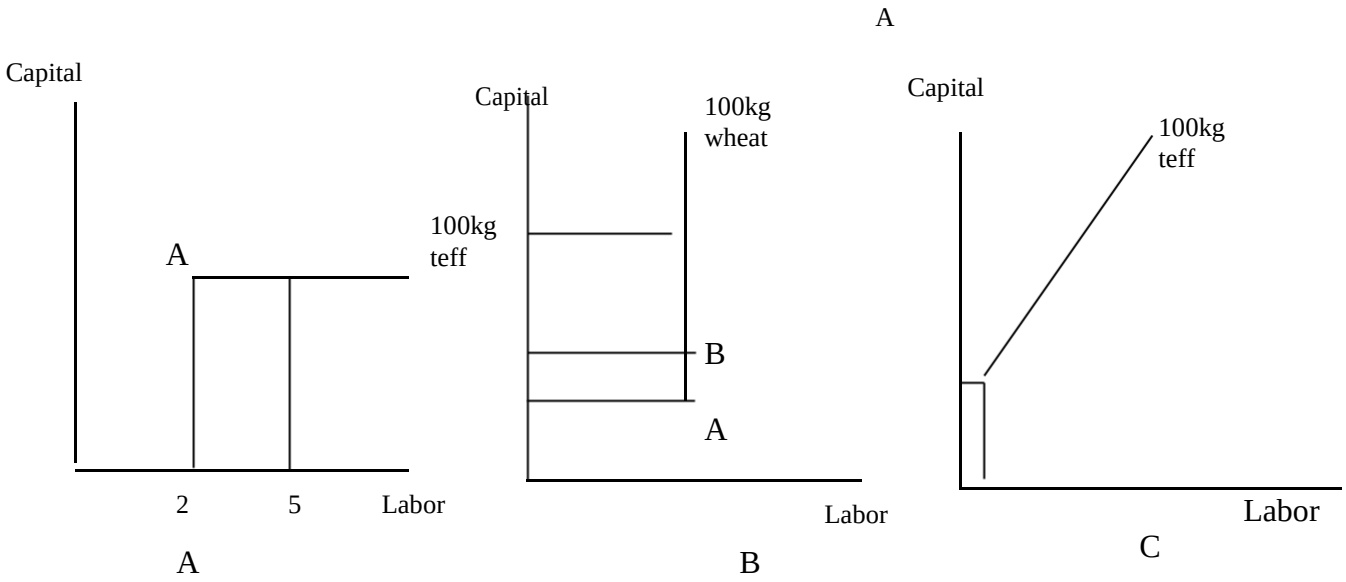
Figure 4.5: Isoquant and Isoquant map. Isoquants show the fact that long run production process is very flexible. A firm can produce q_1 level of output by using either 3 capital and 1 labor or 2 capital and 3 labor or 1 capital and 6 labor any other combination of labor and capital curve. The set of isquant curves q_1, q_2 and q_3 are called Isoquant map.

4.5.2 Properties of Isoquant

Dear learner, do you remember the properties of a well behaved indifference curve? Use this place to enumerate them. ----------

Isoquant have most of the same properties as indifference curves. The biggest difference between them is that output is constant along an isoquant whereas indifference curves hold utility constant. Most of the properties of isoquant, results from the word „***efficient'*** in its definition.

1. ***Isoquant slope down ward***. Because isoquant denote efficient combination of inputs that yield the same output, isoquant always have negative slope. Isoquant can never be horizontal, vertical or upward sloping. If for example, isoquant have to assume zero slopes (horizontal line) only one point on the isoquant is efficient. See the following figures.



An isoquant can never be horizontal. In this figure, the firm can produce 100kg of teff by using either of the following alternatives: 4 capital and 2 labor,4 capital and 5 labor or any other combination of labor and capital along the curve. Obviously, only the first alternative is efficient as it uses the least possible combination of inputs. Thus, all points, except A, are inefficient and not part of

In this figure, a firm can produce 100kg of wheat by using any combination of labor and capital along the isoquant. But only point A is efficient. For example, point B shows the same number of labor as point A, but higher capital. Thus point B is in efficient because it shows higher combination of inputs. Thus, isoquants can never be vertical line

In this figure, all points above point A utilize higher combination of both inputs to produce the same output (100 kg coffee). Point A shows the least combination of inputs that can yield 100 kg coffees. Thus all other points are inefficient and not part of the isoquants.

Figure 4.6

Thus, efficiently requires that isoquants must be negatively sloped. As employment of one factor increases, the employment of the other factor must decrease to produce the same quantity efficiently.

2. ***The further an isoquant lays away from the origin, the greater the level of output it denotes***. Higher isoquants (isoquants further from the origin) denote higher combination of inputs. The more inputs used, more outputs should be obtained if the firm is producing efficiently. Thus efficiency requires that higher isoquants must denote higher level of output.

3. ***Isoquants do not cross each other***. This is because such intersections are inconsistent with the definition of isoquants.

Consider the following figure.

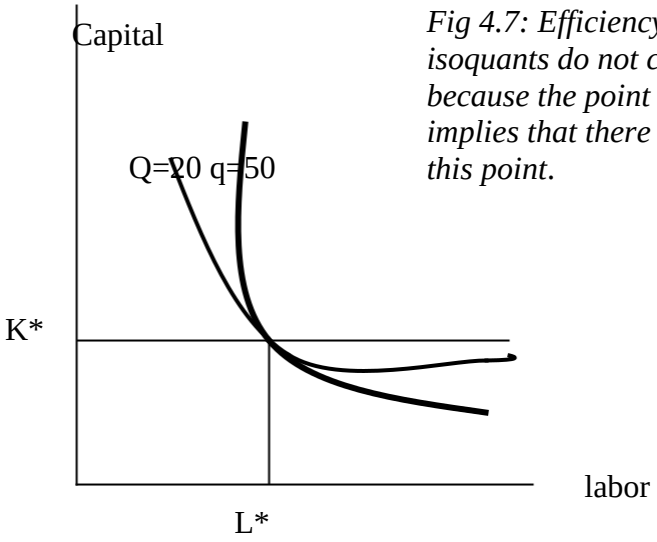


Fig 4.7: Efficiency requires that isoquants do not cross each other, because the point of their intersection implies that there is inefficiency at this point.

This figure shows that the firm can produce at either output level (20 or 50) with the same combination of labor and capital (L* and K*). The firm must be producing inefficiently if it produces q = 20, because it could produce q = 50 by the same combination of labor and capital (L* and K*). Thus, efficiency requires that isoquants do not cross each other..

4. ***Isoquant must be thin***. If isoquants are thick, some points on the isoquant will become inefficient. Consider the following isoquant.

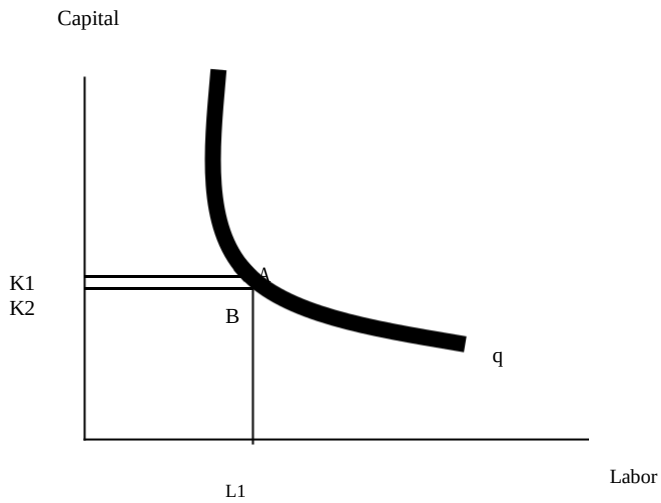


Fig.4.8: Isoquants can never be thick. Points A and B are on the same isoquant. But point A denotes higher amount of capital and the same amount of labor as point B. Hence point A denotes inefficient combination of inputs and thus it lies out of the isoquant. The isoquant should be thin if point A is to be excluded from the isoquant.

5. No Isoquants can touch either axis: if an isoquant touches the x-axis it would mean that the product is being produced with the help of labor alone without using any capital at all and vice versa.

4.5.3 Shape of Isoquant

Isoquants can have different shapes (curvature) depending on the degree to which factor inputs can substitute each other.

1-Linear isoquants

Isoquants would be linear when labor and capital are perfect substitutes for each other. In this case the slope of an isoquant is constant. As a result, the same output can be produced with only capital or only labor or an infinite combination of both. Graphically,

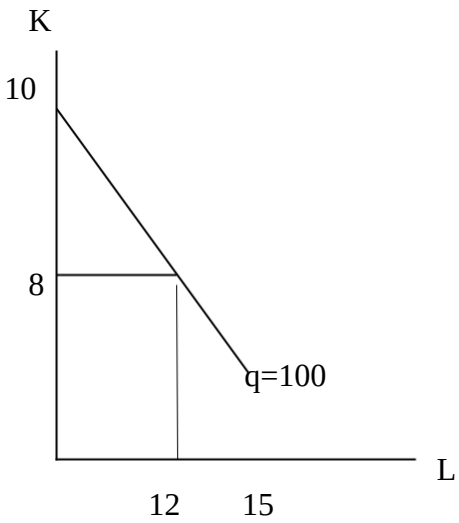


Figure 4.9: linear Isoquant, capital and labor can perfectly substitute each other so that the same output (q=100) can be produced by using either 10K or 8K and 12L or 15L or infinite combinations of both.

2. Input output isoquant

It is also called Leontief isoquant. This assumes strict complementarities or zero substitutability of factors of production. In this case, it is impossible to make any substitution among inputs. Each level of output requires a specific combination of labor and capital:

Additional output cannot be obtained unless more capital and labor are added in specific proportions. As a result, the isoquant are L-shaped. See following figure.

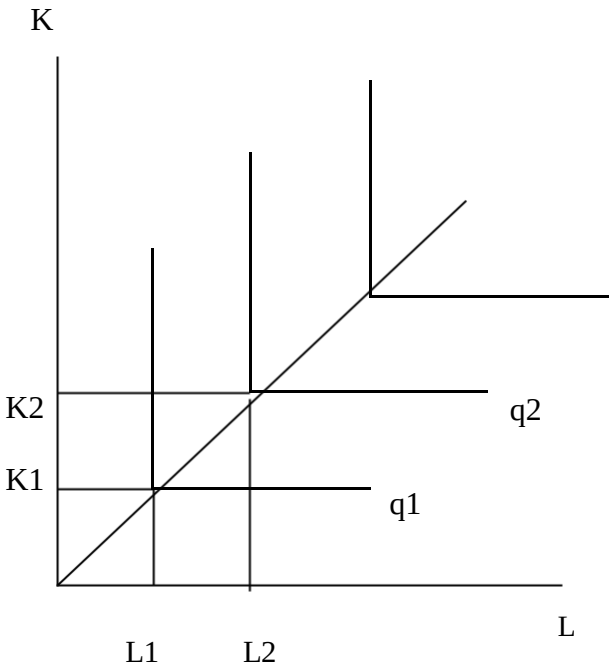


Figure 4.10: L-shaped Isoquant. When Isoquant are L-shaped, there is only one efficient way of producing a given level of output: only one combination of labor and capital can be used to produce a given level of output. To produce q_1 level of output there is only one efficient combination of labor and capital (L_1 & K_1). Output cannot be increased by keeping one factor (say labor) constant and increasing the other (capital). To increase output (say from q_1 to q_2) both factor inputs should be increased by equal proportion.

3. Kinked isoquants

This assumes limited substitution between inputs. Inputs can substitute each other only at some points. Thus, the isoquant is kinked and there are only a few alternative combinations of inputs to produce a given level of output. These isoquants are also called linear programming isoquants or activity analysis isoquants. See the figure below.

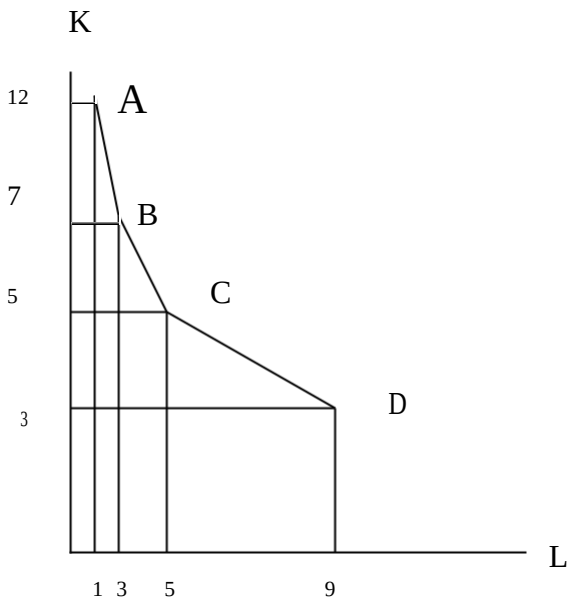


Figure 4.11: kinked Isoquant. In this case labor and capital can substitute each other only at some point at the kinked (A, B, C and D). Thus, there are only four alternative processes of producing q=100 output.

4. Smooth, convex isoquants

This shape of isoquant assumes continuous substitution of capital and labor over a certain range, beyond which factors cannot substitute each other. Basically, kinked isoquants are more realistic: There is often limited (not infinite) method of producing a given level of output. However, traditional economic theory mostly adopted the continuous isoquants because they are mathematically simple to handle by the simple rule of calculus, and they are approximation of the more realistic isoquants (the kidded isoquants). From now on we use the smooth and convex isoquants to analyze the long run production.

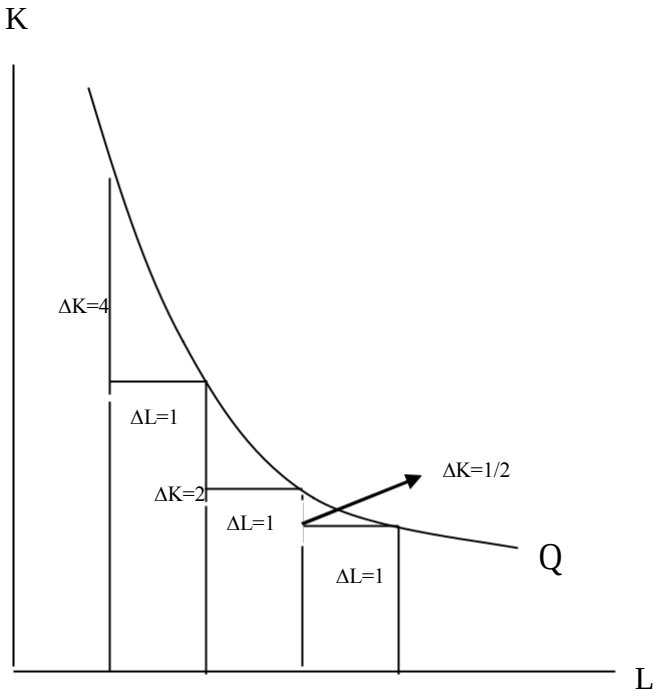


Figure: 4.12: the smooth and convex Isoquant.

This type of isoquant is the limiting case of the kinked isoquant when the number kink is infinite. The slope of the isoquant decrease as we move from the top (left) to the right (bottom) along the isoquant. This indicates that the amount by which the quantity of one input (capital) can be reduced when one extra unit of another inputs (labor) is used (so that output remains constant) decreases as more of the latter input (labor) is used.

4.5.4 The slope of an isoquant: marginal rate of technical Substitution (MRTS)

The slope of an isoquant (-ΔK/ΔL) indicates how the quantity of one input can be traded off against the quantity of the other, while output is held constant. The absolute value of the slope of an isoquant is called marginal rate of technical substitution (MRTS). The MRTS shows the amount by which the quantity of one input can be reduced when one extra unit of another input is used, so that output remains constant. MRTS of labor for capital, denoted as $MRTS_{L, K}$ shows the amount by which the input of capital can be reduced when one extra unit of labor is used, so that output remains constant.

This is analogues to the marginal rate of substitution (MRS) in consumer theory.

$MRTS_{L, K}$ decreases as the firm continues to substitute labor for capital (or as more of labor is used). In fig.4.12 to increase the amount of labor from 1 to 2, the firm reduces 4 units of capital (ΔK=4), to increase labor from 2 to 3, the firm reduce 2 unit of capital (ΔK=2), and so on. Hence, the firm reduces lower and lower number of capital for the successive one unit of labor. Dear learner, why does this happen?

The reason is that when the number of capital is large and that of labor is low, the productivity of capital is relatively lower and that of labor is higher (due to the law of diminishing marginal returns). Thus, at this point relatively large amount of capital is required to replace one unit of labor (or one unit of labor can replace relatively large amount of capital). As the employment of labor increases and that of capital decreases (as we move down ward along the isoquant), quite the reverse will happen. That is, productivity of capital increases and that of labor decreases. Hence, the amount of capital that needs to be reduced increase when one extra labor is used decreases. The fact that the slope of an isoquant is decreasing makes an isoquant convex to the origin.

MRTS L, K (the slope of isoquant) can also be given by the ratio of marginal products of factors. That is,

$$MRTS_{L,K} = -\frac{\Delta K}{\Delta L} = \frac{MPL}{MPK}$$

This can be shown algebraically as follows:

Let the production function is given as:

q= f (L, K)

Where q- is output
L- is unit of labor employed
K-is the amount of capital employed.

Given this production function, the equation of a specific isoquant can be obtained by equating the production function with a given level of output, say $\bar{q}$.

$\bar{q}$ = f (L, K) = $\bar{q}$

Total differential of $\bar{q}$ measures the total change in $\bar{q}$ that happens as a result of a simultaneous change in L and K. i.e,

$$dq = \frac{\partial \bar{q}}{\partial L}.d\bar{L} + \frac{\partial \bar{f}}{\partial k}.dk = d\bar{q}$$

But since $\bar{q}$ is constant, d $\bar{q}$ is zero (d $\bar{q}$ =0)

So, $\frac{\partial \bar{q}}{\partial L}.d\bar{L} + \frac{\partial q}{\partial k}dk = 0$

(But, $\frac{\partial \bar{q}}{\partial L} = MPl$ and $\frac{\partial q}{\partial k} = MPk$)

Thus, the above equation can be written as:

MPL. dL + MPK.dk = 0

$$\Rightarrow \frac{MPL}{MPk} = -\frac{dK}{dL}$$

Therefore, the slope of an isoquant can be given as the ratio of marginal products of inputs.

4.6. The efficient region of production: long run

In principle the marginal product of a factor may assume any value, positive, zero or negative. However, the basic production theory concentrates only on the efficient part of the production function, i.e. over the range of output over which the marginal products of factors are positive and declining. In the short run production function efficient region of production prevails in stage two (stage II), where MP_L >O, but $\frac{\partial MPL}{\partial L} < 0$

Similarly, efficient region of production in the long run prevails when the marginal product of all variable inputs is positive but decreasing. Graphically this can be represented by the negatively slopped part of an isoquant. The locus of points of isoquants where the marginal products of factors are zero form the ridge lines. The upper ridge line implies that the MP of capital is zero. MP_k is negative for all points above the upper ridge line and positive for

points below the ridge line. The lower ridge line implies that the MPL is zero. For all points below the lower ridge line the MPL is negative and positive for points above the line. Production techniques are technically efficient inside the ridge lines symbolically; in the long run efficient production region can be illustrated as:

MPL >0, but $\frac{\partial MPL}{\partial L}$ <0

$\underline{\partial MPk}$

MP_k >0, but $\frac{}{\partial K}$ <0

Graphically, efficient region of production is shown as follow:

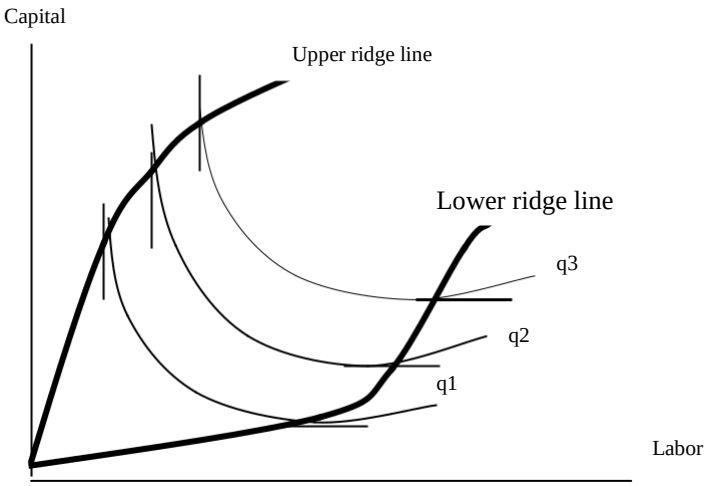


Figure 4.13: thus efficient region of production is defined by the range of Isoquant over which they are convex to the origin

4.7. The long run law of production: The law of returns to scale

The laws of production describe the technically possible ways of increasing the level of production.

Output may increase in various ways. In the long run output can be increased by changing all factors of production. This long run analysis of production is called ***Law of returns to scale***. In the short run output may be increased by using more of the variable factor, while capital (and possibly other factors as well) are kept constant. The expansion of output with one factor (at least) constant is described by the ***law of variable proportion or the law of (eventually) diminishing returns of the variable factor***.

Now let‟s have a deep examination of law of returns to scale.

Laws of returns to scale: long run analysis of production

In the long run all inputs are variable. Expansion of output may be achieved by varying all factors of production by the same proportion or by different proportions.

The traditional theory of production concentrates on the first case, i.e. the study of output as all inputs change by the same proportion. The term returns to scale refers to the change in output as all factors change by the same proportion. Suppose initially the production function is

$X_0 = f(L, K)$

If we increase all factors by the same proportion ***t***, we clearly obtain a new level of output X* where,

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

- If X* increases by the same proportion t or if $X^* = tX_0$, we say that there is constant returns to scale.
- If X* increases less than proportionally with the increase in the factors (or if X* increases by a proportion less than ***t***), we have decreasing returns to scale.
- If X* increases more than proportionally with the increase in the factors (by a more than ***t*** proportion), we have increasing returns to scale.

Returns to scale and homogeneity of production function

Suppose we increase both factors of the function $X_0=f(L, K)$ by the same proportionate", and we get the new level of output $X = f(tL, tK)$

If ***t*** can be factored out (that is, may be taken out of the brackets as a common factors), then the new level of output X* can be expressed as a function of ***t*** (to any power V) and the initial level of output, and the production function is said to be homogeneous.

$X^* = t^v f(LK)$ or $X^* = t^V X_0$

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

If V=1, we have constant returns to scale. This production function is sometimes called linear homogeneous

If V<1, decreasing return to scale prevails

If V>1, increasing return to scale prevails

For a Cobb-Douglas production function

$X = b0L^{b1} K^{b2,}$ V = b1 +b2 and it is a measure of returns to scale.

Proof: Let L and K increase by t. The new level of output is

$X^* = b0 (tL)^{b1} (tk)^{b2}$

$X^* = b0\, t^{b1} l^{b1}\, t^{b2} k^{b2}$

$X^* = b0 L^{b1} K^{b2}\, t^{b1+b2}$

$X^* = X (t^{b1+b2})$

Thus V = b1+b2

♥ *Check your progress 2*

1. Which of the following production function is/are homogeneous?

A. q = L+K

B. q = 10L +K

C. $q = L+L^{\alpha} K^{\beta} +K$

D. $q = L^2+K$

2. Suppose the production function is

$q = L^{\frac{3}{4}} K^{\frac{1}{4}}$

A. what is APL, holding capital fixed?

B. Calculate MPL & MPK?

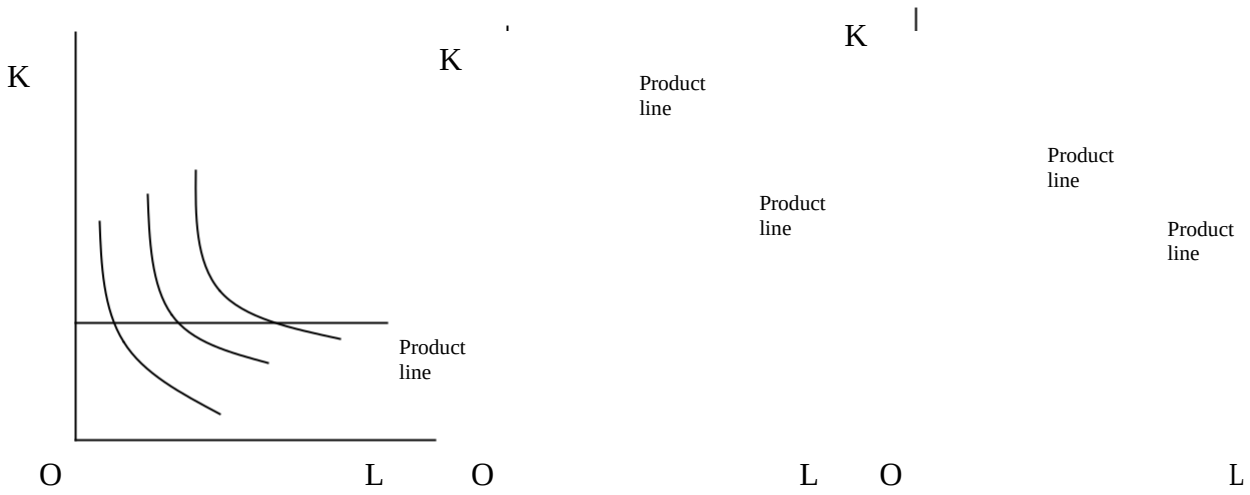
C. Does this production function have increasing, constant or decreasing returns to scale?

For a homogeneous production function the returns to scale may be represented graphically in an easy way. Before explaining the graphical representation of the returns to scale it is useful to introduce the concept of product line and isocline.

4.8. Product Lines

A product line shows the (physical) movement from one isoquant to another as we change the employment of either factors or both factors, and it describes the technically possible alternative paths of expanding output. Which path actually chosen by the firm will depend on the prices of factors.

The product line (curve) passes through the origin if all factors are variable. If only one factor is variable (the other being constant) the product line is a straight line parallel to the axis of the variable factor. For such product lines the K/L ratio diminishes along the product line.



Product line for one factor (K) constant

Product line for homogeneous production function

Product line for non - homogeneous production function

Figure 4.14: product line for different production function

A product line along which the MRTS of factors is constant is called an isocline. So an isocline is the locus of points of different isoquants at which MRTS of factors is constant. If the production function is homogeneous the isoclines are straight lines through the origin. Along any one isocline the K/L ratio is also constant (as is the MRTS of the factors). But K/L ratio and the MRTS are different for different isoclines.

If the production is non-homogeneous the isocline will not be straight line, but their shape will be twiddle. The K/L ratio changes along each isocline and on different isoclines.

4.9. Graphical presentation of returns to scale for homogeneous Production function

The returns to scale may be shown graphically by the distance (on an isocline) between successive "***multiple level-of-output***" isoquant, i.e. isoquants that show levels of output which are multiple of some base level such as ***X, 2X, 3X*** etc.

Constant returns to scale

Along any isocline the distance between successive multiple- isoquant is ***constant***. Doubling the factor inputs doubles the level of initial output; trebling inputs trebles output, and so on.

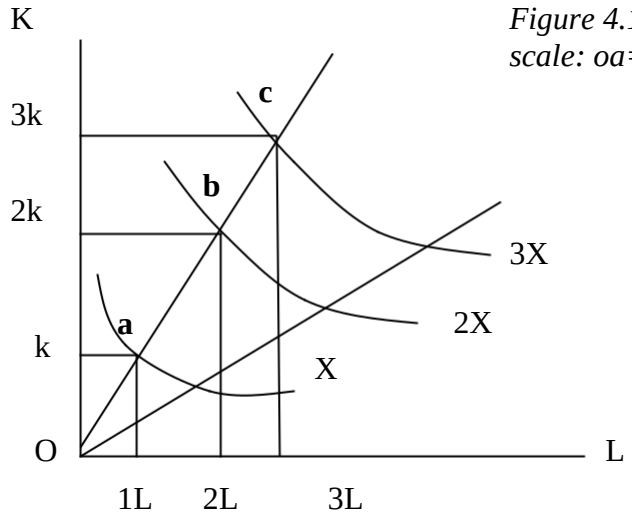


Figure 4.15: Constant returns to scale: oa= ab = bc

Decreasing returns to scale

Here, the distance between consecutive multiple- isoquants increases. By doubling inputs output increases by less than twice of its original level.

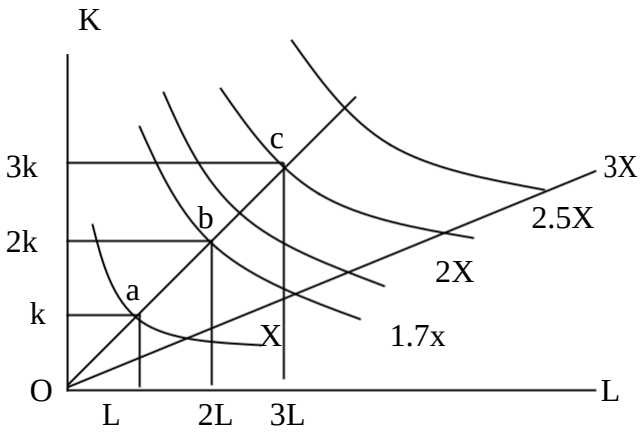


Figure 4.16: Decreasing returns to scale: oa<ab <bc

Increasing returns to scale

The distance between consecutive multiple isoquants decrease, by doubling the inputs, output is more than doubled.

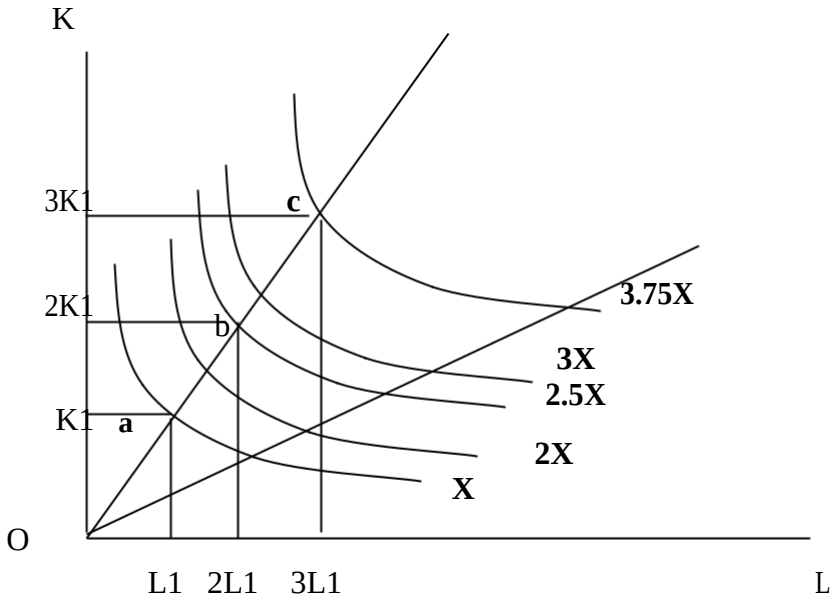


Fig 4.17:Doubling K and L leads to b which lies above an isoquant denoting 2X(i.e.,2.5X),and trebling K&L results in an isoquant which lies above 3X(i.e.,3.75X) and so on.

Returns to scale are usually assumed to be the same everywhere on the production surface i.e., the same along all the expansion product lines. All processes are assumed to show the same returns to scale over all ranges of output. Either constant returns to scale everywhere, or decreasing returns everywhere, or increasing returns everywhere. However, the technological conditions of production may be such that returns to scale may vary over different ranges of output. Over some range we may have constant returns to scale, while over another range we may have increasing or decreasing returns to scale.

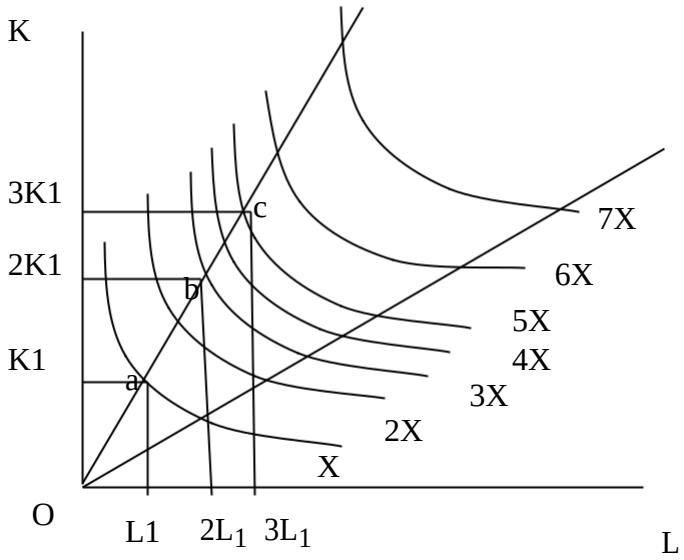


Fig.4.18: Up to point a, increasing returns to scale prevails in the firm, from c to b constant returns to scale prevails, and beyond b decreasing returns to scale prevails.

4.10 Equilibrium of the firm: Choice of optimal combination of factors of production

Dear learner, in our previous discussion we have said that an isoquant denotes efficient combination of labor and capital required to produce a given level of output. But, this does not mean that the monetary cost of producing a given level of output is constant along an isoquant. That is, though different combinations of labor and capital on a given isoquant yield the same level of output, the cost of these different combinations of labor and capital could differ because the prices of the inputs can differ. Thus, isoquant shows

only technically efficient combinations of inputs, not economically efficient combinations. Technical efficiency takes in to account the physical quantity of inputs whereas economic efficiency goes beyond technical efficiency and seeks to find the least cost (in monetary terms) combination of inputs among the various technically efficient combinations. Hence, technical efficiency is a necessary condition, but not a sufficient condition for economic efficiency. To determine the economically efficient input combinations we need to have the prices of inputs.

To determine the economically efficient input combination, the following simplifying assumptions hold true:

Assumptions

1. The goal of the firm is maximization of profit ($\prod$) where $\prod = R - C$
   $\prod$ -Profit, R-revenue and C-is cost outlay.
2. The price of the product is given and it is equal to $\overline{P_X}$.
3. The prices of inputs are given (constant).Price of a unit of labor is $\overline{w}$ and that of capital is $\overline{r}$.

Now before we go to the discussion of optimal input combination (or economically efficient combination), we need to know the isocost line, because optimal input is defined by the tangency of the isoquant and isocost line.

Isocost line

Dear learner, do you remember what the budget line denotes?

Isocost lines have most of the same properties as that of budget lines, an isocost line is the locus points denoting all combination of factors that a firm can purchase with a given monetary outlay, given prices of factors.

Suppose the firm has *C* amount of cost out lay (budget) and prices of labor and capital are *w* and *r* respectively. The equation of the firm‟s Isocost line is given as:

$C = rK + wL$, *where* *K and L* Are quantities of capital and labor respectively.

Given the cost outlay *C* , the maximum amounts of capital and labor that the firm can purchase are equal to $\frac{C}{\overline{r}}$ and $\frac{C}{\overline{w}}$ respectively. The straight line that connects these points is the Isocost line. See the following figure:

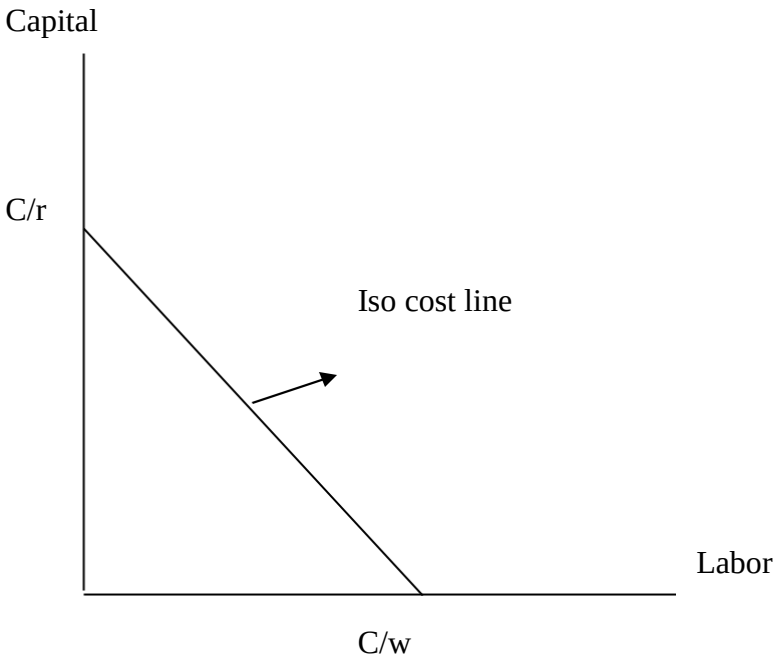


Fig: 4.19: the iso cost line: shows different combinations of labor and capital that the firm can buy given the cost out lay and prices of the inputs.

Now we are in a position to determine the firm‟s optimal in put combination. However, the problem of determining optimal input combination (economic efficiency) takes two forms. Sometimes, situations may happen when a firm has a constant cost outlay and seek to maximize its output, given this constant and cost out lay and prices of inputs. Still, there are also situations when the goal of the firm is to produce a predetermined (given) level of output with the least possible cost.

Case1: Maximization of output subject to cost constraint

Suppose a firm having a fixed cost out lay (money budget) which is shown by its Isocost line. Here, the firm is in equilibrium when it produces the maximum possible output, given the cost outlay and prices of input. The equilibrium point (economically efficient combination) is graphically defined by the tangency of the firm‟s Isocost line (showing the budget constraint) with the highest possible isoquant. At this point, the slope of the Isocost line ($\frac{w}{r}$) is equal to the slope of the isoquant ($\frac{MP_L}{MP_K}$)

The condition of equilibrium under this case is, thus:

$$\frac{w}{r} = \frac{MP_L}{MP_K} \quad or \quad \frac{MP_L}{w} = \frac{MP_K}{r}$$

This is the first order (necessary) condition. The second order (sufficient) condition is that isoquant must be convex to the origin. See the following figure:

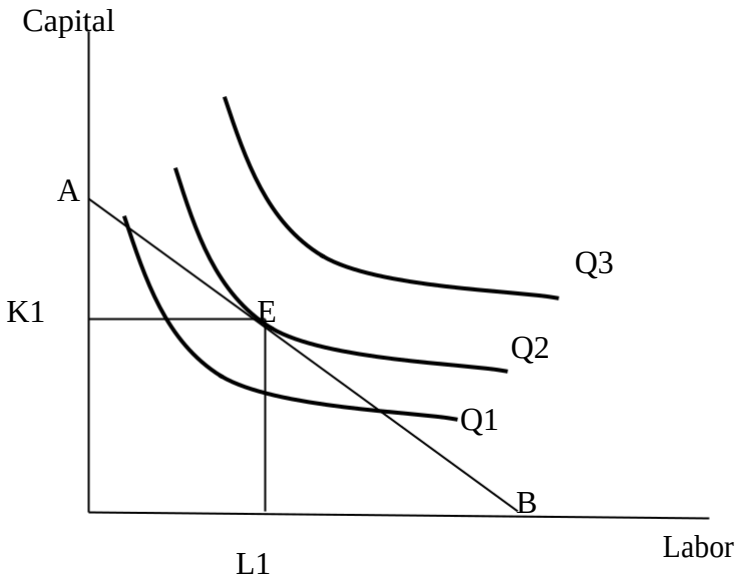


Fig: 4.20: the optimal combination of inputs (L_1 and K_1) is defined by the tangency of the Isocost line (AB) and the highest possible isoquant (X_2), at point E. At this point slope of Isocost line ($\frac{w}{r}$) is equal to the slope of isoquant ($\frac{MP_L}{MP_K}$).The second order condition is also satisfied by the convexity of the isoquant.

Dear learner, do you think that the point of tangency of the iso-cost line and the isoquant represents equilibrium point when the isoquant is concave?

If isoquant is concave to the origin the point of tangency of the iso cost line and the isoquant does not define the equilibrium combination of factor inputs. With a concave isoquant, we have a corner solution. Refer the figure below:

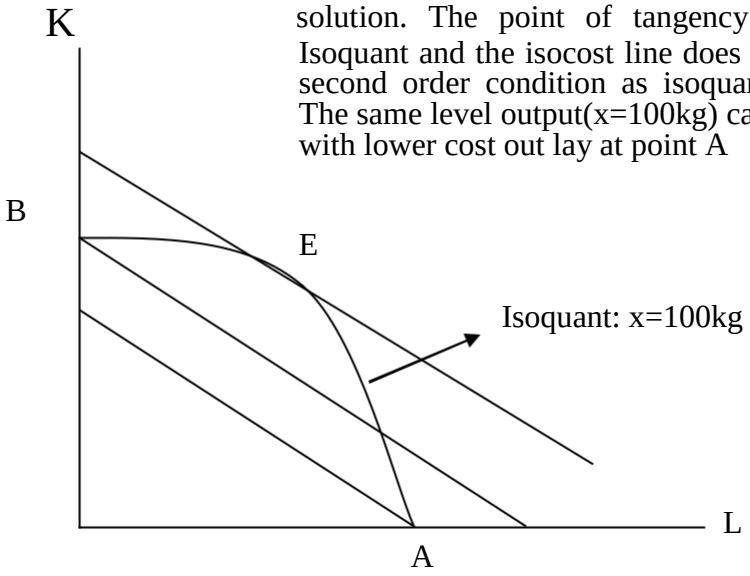


Figure 4.21: concave Isoquant results in corner solution. The point of tangency between the Isoquant and the isocost line does not satisfy the second order condition as isoquant is concave. The same level output(x=100kg) can be produced with lower cost out lay at point A

Case -2: Minimization of cost for a given level of output

In this case, consider an entrepreneur (a firm) who wants to produce a given output (for example a bridge or a building or x tones of a commodity) with minimum cost outlay. That is, we have a single isoquant which denotes the desired level of output, but there are a set of isocost lines which denotes the different cost outlays. Higher isocost lines denote higher production costs. The production costs of a desired level of output will therefore be minimized when the isoquant line is tangent to the lowest possible isocost line (see fig) At the point of tangency, the slope of the isoquant and isocost lines are identical. That is $\frac{w}{r} = \frac{MPL}{MPK}$

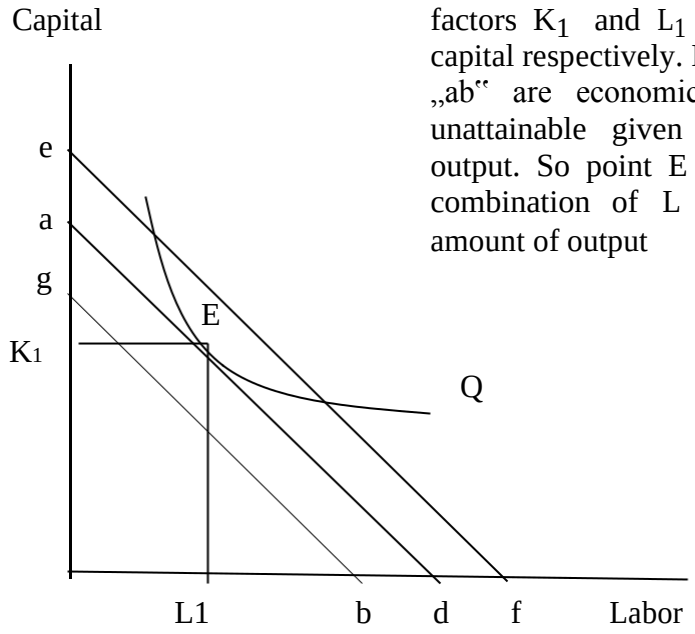


Figure 4.22: the equilibrium combination of factors K_1 and L_1 amounts of labor and capital respectively. Lower cost lines such as „ab" are economically desirable but unattainable given the desired level of output. So point E shows the least cost combination of L and K to produce X amount of output

Summary

In economics, production means the act of creating those goods or services that have exchange values. The process of production requires inputs such as land, labor, capital and entrepreneurial ability, Fixed inputs are those inputs whose quantity cannot readily be changed when market conditions indicate that an immediate change in output is required, Variable inputs are those inputs whose quantity can be changed almost instantaneously in response to derived changes in output.

A production function describes the maximum output that a firm can produce for each specified combinations of inputs. In the short run, one or more inputs to the production process are fixed. In the long run, all inputs are potentially variable.

In the short run the firm is said to be efficient when it operates over the range of employment of the variable inputs where marginal product of the variable input is positive but declining.

Analysis of long run production makes the use of isoquants (equal product lines).Isoquants show efficient combination of inputs that yield the firm equal level of output. Isoquants are always down ward sloping. Higher isoquants show higher level of output. Isoquants cannot intersect each other. They are convex to the origin, and they must be thin.

In the long run, efficient region of production is represented by the convex part of isoquants map.

Self-check Exercise

Give brief answer for the following

1. What does an isocost line show?
2. Why is an isoquant curve convex to the origin?
3. Describe the efficient region of production in the long run.
4. Explain the properties of an isoquant
5. Distinguish between
    - Increasing and decreasing returns to scale
    - Technical efficiency and Economic efficiency
6. What is the impact of technological progress on
    - The Total product Curve
    - The isoquant
7. What does the production function denote?
8. Suppose production function is given as: $Q=10L+5L^2-L^3$, where Q is output and L is lobour, find:
    A. TP, MP and AP.
    B. TP where MP=AP
    C. The lobour required to maximize output.
9. State verbally the law of diminishing marginal return.

CHAPTER FIVE

5. Theory of Costs of Production

5.1. Introduction

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

Objectives of the chapter

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

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

5.2. Basic Concepts of Cost

Dear learner! Do you know about costs?

(Use the space left below to write your response)

_____

_____

The concepts of production and cost are inseparable facts. A production process in it‟s pursue to secure profits will not exist without incurring the related costs. And the existence of costs without production or any addition to the total output will be of no economic meaning. Cost of production generally stands for the monetary outlays associated with production activity or it is the total expenditures and sacrifices made in the entire process of production and distribution of goods and services.

Types of costs: -to produce goods and services, we need factors of production. These factors of production (resources) are bought through monetary outlays from factor markets. Thus, costs are defined as the monetary values of inputs used in production of items.

Explicit and implicit costs

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

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

Explicit costs +implicit costs=Economic costs (opportunity costs)

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

Economic versus accounting profits

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

The term profit refers to the difference between total revenue and total cost. But economists and accountants define it differently for they treat costs differently. Economists define costs in terms of opportunity costs and they include implicit costs in profit calculations. ***Thus economic profit =Total revenue- (implicit + explicit costs)***

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

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

♥ Check your progress 1

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

5.3. Cost Functions

Cost function shows the algebraically relation between the cost of production and various factors which determine it. They are derived from the production function, which describes the available efficient methods of production at any one time. Because, the cost of production depends on the level of output produced, technology of production, prices of factors, etc. hence; cost function is a multivariable function. Symbolically the general cost function seems:

$C = f(x, t, p_i)$

Where c- is total cost of production

x - is the amount of output

T – is the available technology of production.

P_i – is the price of input

Economic theory distinguishes between short-run and long-run costs. Short-run costs are the costs over a period during which some factors of production (usually capital equipment and management) are fixed. The long-run costs are those cost over a period long enough to permit the change of all factors of production. In the long-run all factors become variable.

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

$C = f(X,T,P_f)$ and the short-run cost function

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

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

Graphically, costs are shown on two-dimensional diagrams. Such curves imply that cost is a function of output, C=f(X), *ceteris paribus* (other things being equal or unchanged). The clause ceteris paribus implies that all other factors which determine costs are constant. If these factors do change, their effect on costs is shown graphically by a shift of the cost curve. This is the reason why determinants of cost. Other than output, are called shift factors. Mathematically there is no difference between the various determinants of costs. The distinction between movements along the cost curve (when output changes) and shifts of the curve (when the other determinants change) is convenient only pedagogically, because it allows the use of two-dimensional diagrams. But it can be misleading when studying the determinants of costs. It is important to remember that if the cost curve shifts, this does not imply that the cost function is indeterminate.

The factor technology is itself a multidimensional factor, determined by the physical quantities of factor inputs, the quality of the factor inputs, the efficiency of the entrepreneur, both in organizing the physical side of the production (technical efficiency of the entrepreneur), and in making the correct economic choice of techniques (economic efficiency of the entrepreneur). Thus, any change in these determinants (e.g., the introduction of a better method of organization of production, the application of an educational program to the existing labor) will shift the production function, the application of an educational program to the existing labor) will shift the production function, and hence will result in a shift of the cost curve. Similarly the improvement of raw materials or the improvement in the use of the same raw materials will lead to a shift downwards of the cost function.

The short-run costs are the costs at which the firm operates in any one period. The long-run costs are planning costs or *ex ante* (based on prior assumptions or expectations) costs, in that they present the optimal possibilities for expansion of the output and thus help the entrepreneur is in a long-run situation, in the sense that he can choose any one of a wide range of alternative investments, defined by the state of technology. After the investment decision is taken and funds are tied up in fixed-capital equipment, the entrepreneur operates under short-run conditions; he is on a short cost curve.

A distinction is necessary between internal (to the firm) economies of scale and external economies. The internal economies are built into the shape of the long-run cost curve, because they accrue to the firm from its own action as it expands the level of its output. The external economies arise outside the firm, from improvement (or depreciation) of the environment in which the firm operates. Such economies external to the firm may be realized from actions of other firms in the same or in another industry. The important characteristic of such economies is that they are independent of the actions of the firm, they are external to it. Their effect is a change in the prices of the factors employed by the firm, they are external to it. Their effect is a change in the prices of the factors employed by the firm (or in a reduction in the amount of inputs per unit of output), and thus cause a shift of the cost curves, both the short-run and the long-run.

In summary, while the internal economies of scale relate only to the long-run and are built into the shape of the long-run cost curve, the external economies affect the position of the cost curves; both the short-run and the long-run cost curves will shift if external economies affect the prices of the factors and/or the production function.

Any point on a cost curve shows the minimum cost at which a certain level of output may be produced. This is the optimality implied by the points of accost curve. Usually the above optimality is associated with the long-run cost curves. Usually the above optimality is associated with the long-run cost curve. However, a similar concept may be applied to the short-run, given the plant of the firm in any one period.

5.4. Traditional Theory of Cost

Dear learner! What do we mean by short run and long run in economics?
(Use the space left below to write your response)

_____

_____

Economics theory distinguishes between short run costs and long run costs. Short run costs are the costs over a period during which some factors of production (usually capital equipment and management) are fixed. The long- run costs are the cost over a period long enough to permit the change of all factor of production.

5.4.1. Short Run Costs of the Traditional Theory

In the traditional theory of the firm, total costs are split into two groups: total fixed costs and total variable costs:

TC = TFC + TVC

Where – TC is short run total cost

TFC is short run total fixed cost

TVC is short run total variable cost

By fixed costs, we mean a cost which doesn‟t vary with the level of output. The fixed costs include:

a. Salaries of administrative staff
b. Expenses for building depreciation and repairs
c. Expenses for land maintenance
d. The rent of building used for production , etc

All the above costs are regarded as fixed costs because whether the firm produces much output or zero output, these costs are unavoidable, and the firm can avoid fixed costs only if he / she shuts down the business stops operation.

Variable costs, on the other hand, include all costs which directly vary with the level of output. The variable costs include:

a. The cost of raw materials
b. The cost of direct labor
c. The running expenses of fixed capital such as fuel, electricity power, etc.

All these costs are regarded as variable costs because their amount depends on the level of output. For example, if the firm produces zero output, the variable cost is zero. Graphical presentation of short run costs will be seen as follows:

Total Fixed Cost (TFC)

Graphically, TFC is denoted by a straight line parallel to the output axis. The point of intersection of the TFC line with the cost axis (vertical axis) shows the amount of the fixed. For example if the level of fixed cost is $ 100, it can be shown as.

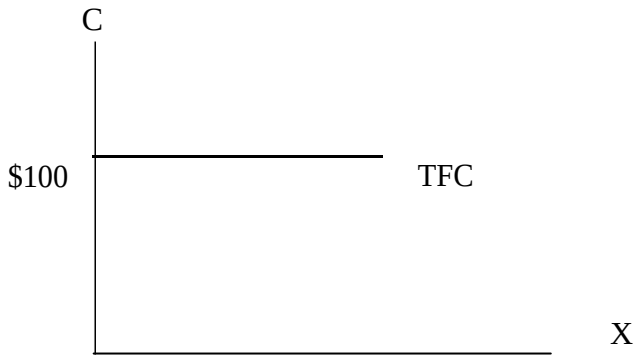


Figure 5.1: Total fixed cost

Total Variable Cost (TVC)

The total variable cost of a firm has an inverse s- shape. The shape indicates the law of variable proportions in production. According to this law, at the initial stage of production with a given plant, as more of the variable factor (s) is employed, its productivity increases. Hence, the TVC increases at a decreasing rate. This continues until the optimal combination of the fixed and variable factors is reached. Beyond this point, as increased quantities of the variable factors(s) are combined with the fixed factor (s) the productivity of the variable factor(s) declined, and the TVC increases by an increasing rate. Thus, the TVC has an inverse s-shape due to the law of diminishing marginal returns. Graphically, the TVC looks the following.

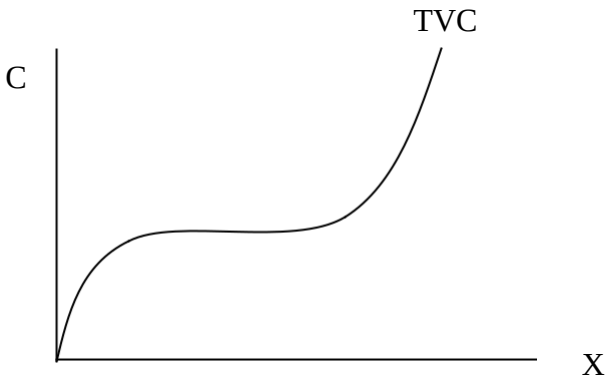


Figure 5.2: Total variable cost

Total Cost (TC)

The total cost curve is obtained by vertically adding the TFC and the TVC i.e., by adding the TFC and the TVC at each level of output. The shape of the TC curve follows the shape of the TVC curve. i.e. the TC has also an inverse S-shape. But the TC curve doesn‟t start from the

origin as that of the TVC curve. The TC curve starts from the point where the TFC curve intersects the cost axis.

TC=TFC+TVC

Where, TC=Total Cost; TVC =Total Variable Cost; TFC=Total Fixed Cost **Table 5.1.** Short run marginal and average costs of a firm

Output	AFC (TFC/Q)	AVC (TVC/Q)	AC (TC/Q)	MC (ΔTC/ΔQ) or (ΔTVC/ΔQ)
0	-	-	-	-
1	60	25	85	25
2	30	20	50	15
3	20	20	40	20
4	15	21.25	36.25	25
5	12	24	36	35
6	10	30	40	60

Table 5.2 short run total costs of a firm

Q (output)	TFC (birr)	TVC (birr))	TC (birr))
0	60	0	60
1	60	25	85
2	60	40	100
3	60	60	120
4	60	85	145
5	60	120	180
6	60	180	240

We can also show the above data graphically, as follows:

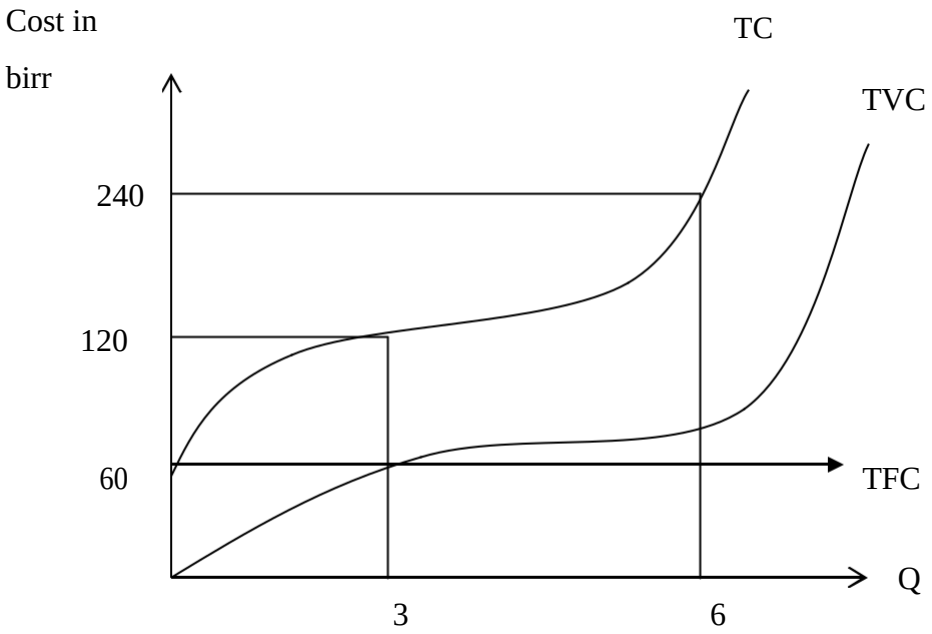


Figure 5.3: short run total cost curves

From the table 5.3 above, we observe that TFC is birr 60 even if the output is zero. Moreover, the TFC curve is parallel to the quantity axis and birr 60 above it. TVC is however, zero when output is zero and rises as output rises. The TVC initially rises at a decreasing rate but later on it increases at an increasing rate. This is true because the firm initially uses few variable inputs with fixed inputs and at this point the TVC increases at a decreasing rate but later on, as the firm employs more and more variable inputs with the fixed inputs the cost of the firm tends to rise at an increasing rate due to the law of diminishing returns. The TC is the sum of the TVC and TFC at every output level. For this reason the TC curve has the same shape as TVC, except that it has scale-up by the amount of TFC. The gap between TVC and TC is the same throughout.

♥ Check your progress 2

1. What does the cost function show?
2. Why does the TC curve possess the inverse S-shape? is it due to the law of variable proportions as that of the TVC curve?
3. Differentiate between TVC and TFC, and give at least three examples of each.

Average Costs

From total costs we can derive per-unit costs. These are even more important in the short run analysis of the firm.

Average fixed cost (AFC) - is found by dividing the TFC by the level of output. This means:

AFC = ——

Graphically, the AFC is a rectangular hyper parabola. The AFC curve is continuously decreasing curve, but decreases at a decreasing rate and can never be zero. Thus, AFC gets closer and closer to zero as the level of output increases, because a fixed amount of cost is being divided by increasing level of output.

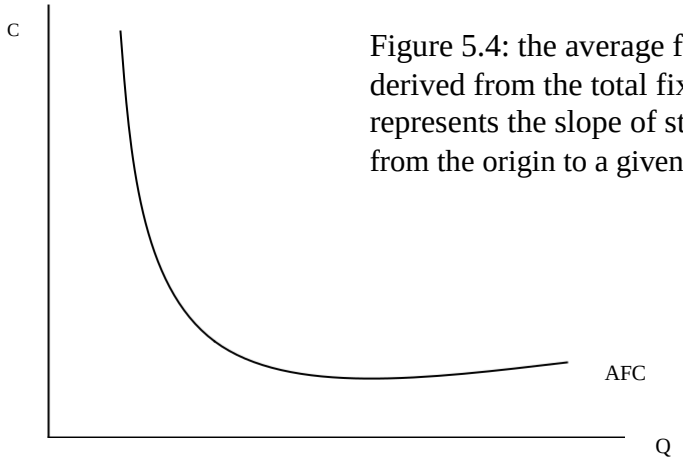


Figure 5.4: the average fixed cost curve is derived from the total fixed cost, and it represents the slope of straight lines drawn from the origin to a given point on the TFC.

Average variable cost (AVC)

The AVC is similarly obtained by dividing the TVC with the corresponding level of output.

$$AVC = \frac{TVC}{X}$$

Graphically, the AVC at each level of output is derived from the slope of a line drawn from the origin to the point on the TVC curve corresponding to the particular level of output.

The following graph clearly shows the process of deriving the AVC curve from the TVC curve.

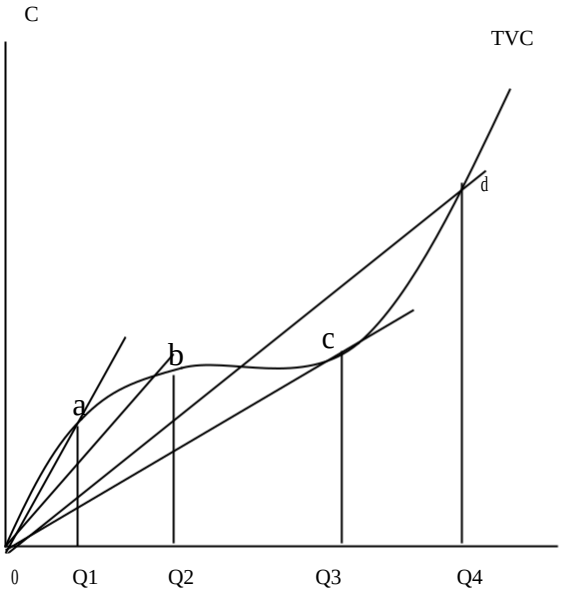


Figure 5.5, panel A

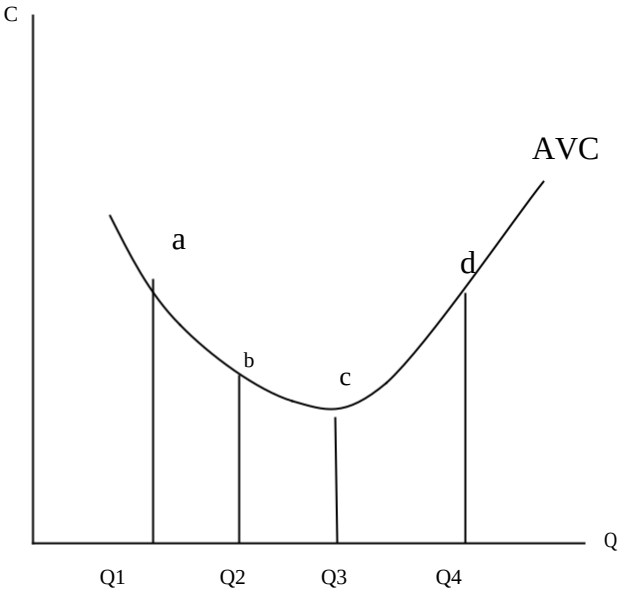


Figure 5.5, panel B

Fig 5.5 in the figure above, the AVC at Q1 from panel A is given by the slope of the ray 0a, the AVC at Q2 is given by slope of the ray 0b, and so on. The slope of the rays decreases until Q3 and starts to rise beyond Q3.

It is clear from this figure that the slope of a ray through the origin declines continuously until the ray becomes tangent to the TVC curve at C. To the right of this point (Point c) the slope of the rays through the origin starts increasing. Thus, the short run AVC (SAVC now on) falls initially, reaches its minimum and then start to increase. Hence, the SAVC curve has a U-shape and the reason behind is the law of variable proportions. Had the TVC not been inverse S-shaped, the SAVC would never assume a U-shape.

Generally, at initial stage of production, the productivity of each additional unit a variable input increases, thus, the variable input requires to produce each successive units of output decreases at this stage, implying that the AVC (Variable Cost Incurred to produce a unit of output) decreases. This process continues until the point of optimal combination between the fixed input and the variable input is reached. Beyond this point, the productivity of each additional unit of the variable combined with the existing fixed input decreases because the fixed input is over utilized. As the productivity of such variables decreases, more and more of

the variables are required to produce successive units of the output, implying that the VC incurred to produce each successive unit (AVC) increases.

Average total cost (ATC) or simply, Average cost (AC)

ATC (or AC, now on) is obtained by dividing the TC by the corresponding level of output. It shows the amount of cost incurred to produce each unit of successive outputs.

$$AC = \frac{TC}{Q}$$

Or equivalently, $AC = \frac{TVC + TFC}{Q}$

$$= \frac{TVC}{Q} + \frac{TFC}{Q}$$

= AVC + AFC

Thus, AC can also be given as the vertical sum of AVC and AFC.

Graphically, AC curve can be obtained by vertically adding the AVC and AFC for each level of successive outputs. Alternatively, the AC curve can also be derived in the same way as the SAVC curve. The AC curve is U-shaped because of the law of variable proportions. Observe the figure that follows.

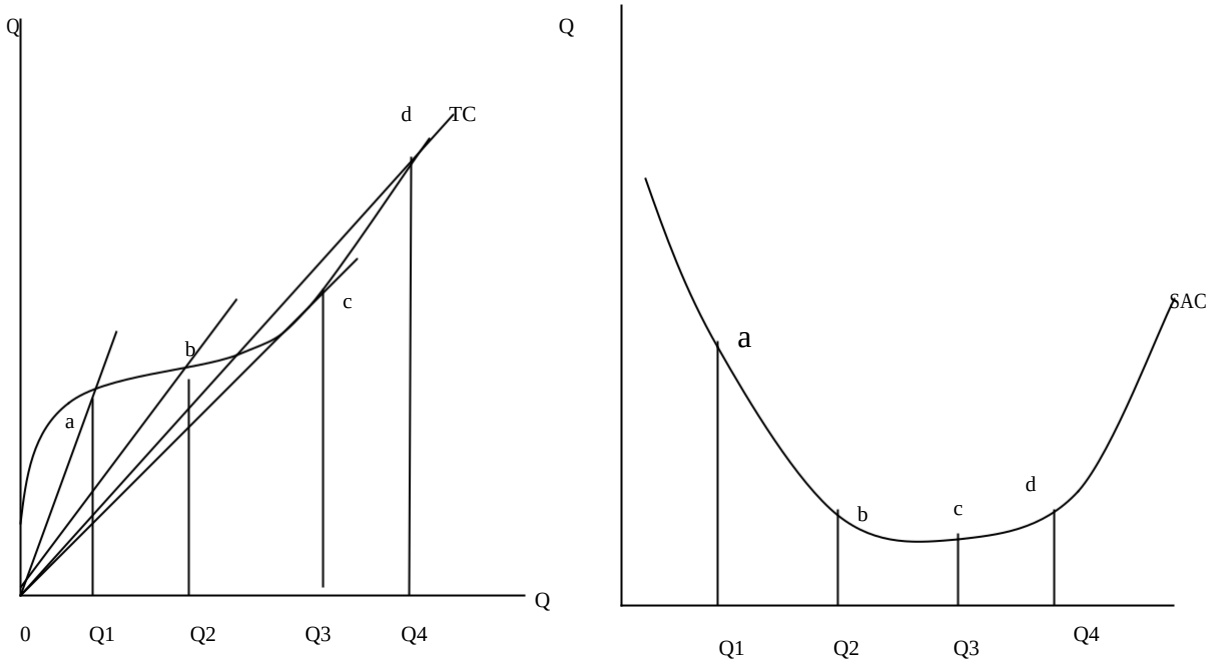


Figure 5.6: derivation of average cost from total cost

From this figure (Panel A), the AC at any level of output is the slope of the straight line from the origin to the point on the TC curve corresponding to that particular level of output. That is, for example, the AC of producing Q1 level of output is given by the slope of the line 0a, the AC of producing Q2 level of outputs is given by the slope of the line Ob and so on.

Marginal Cost (MC)

The marginal cost is defined as the additional cost that the firm incurs to produce one extra unit of the output. One thing to be noted here is that, the additional cost that the firm incurs to produce the 10^{th} unit of output is not equal to the additional cost of producing the 100^{th} unit. They would be equal if the TC curve is straight line.

To sum up, the MC is the change in total cost which results from a unit change in output i.e. MC is the rate of change of TC with respect to output, Q or simply MC is the slope of TC function and given by:

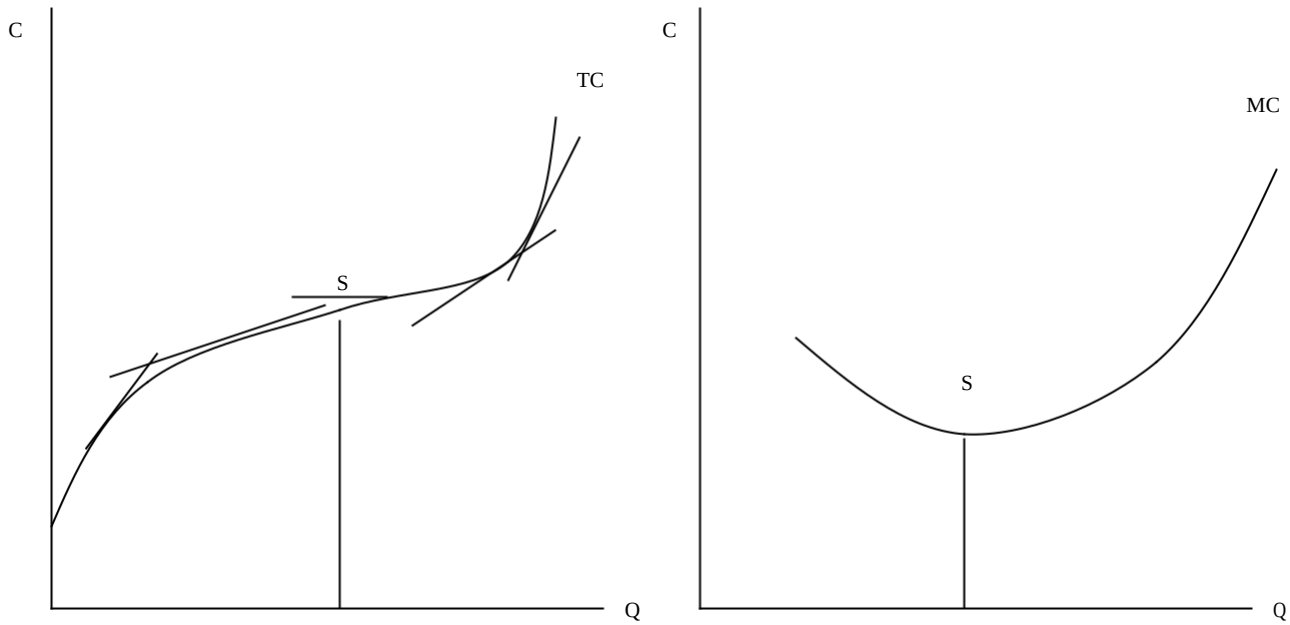
$$MC = \frac{dTC}{dQ}$$

In fact MC is also the rate of change of TVC with respect to the level of output.

$$MC = \frac{dTFC + dTVC}{dQ} = \frac{dTVC}{dQ}, \text{ since } \quad \frac{dTFC}{dQ} = 0$$

Graphically, the MC the TC curve (or equivalently the slope of the TVC curve) obviously, the slope of curved lines at a given point is measured by constructing a tangent line to the curve at each point. So, the slope of the curve at a given point is equal to the slope of the tangent line at that specific point. Given the inverse S-shaped TC (or TVC) curve, the MC curve will be U-shaped. Thus given inverse S-shaped TC or TVC curve, the slope of the TC or TVC curve (i.e. MC) initially decreases, reaches its minimum and then starts to rise.

From this, we can logically infer that the reason for the U-shaped ness of MC is also the law of variable proportion. That is, had the TC or TVC curve not been inverse S-shaped, the MC curve have would never assumed the U-shape, and obviously, the TC or TVC is inverse S-shaped due to the law of variable proportions. Observe the figure that follows for more discussion.



Panel-1 Qs Panel-2 Qs

In Panel 2 the slopeFigureofthe5.7:tangentderivationlinesoftomarginaltheTC **c**osturvefrom(MC)totalde **c**reasesost up to point **S** and then starts to rise.

In summary, AVC, ATC and MC curves are all U-shaped due to the law of variable proportions. The simplest total cost function which would incorporate the law of variable proportions is the cubic polynomial of the following form.

$$TC = bo + b1Q - b2Q^2 + b3Q^3$$

Where Q- is the level of output and b0, b1, b2 &b3 – are none zero constants. From this type of total cost function,

b_o- represents the TFC, and AFC = $\frac{b_0}{Q}$

$b_1Q - b_2Q^2 + b_3Q^3$ - represents TVC and

$$AVC = \frac{b_1Q - b_2Q^2 + b_3Q^3}{Q} = b_1 - b_2Q + b_3Q^2$$

ATC = AFC + AVC

$$= \frac{b_0}{Q} + b1 - b2Q + b3Q^2$$

5.4.2. The relationship between AVC, ATC and MC

Given ATC = AVC + AFC, AVC is part of the ATC. Both AVC and ATC are u – shaped, reflecting the law of variable proportions however, the minimum of ATC occurs to the right of the minimum point of the AVC (see the following figure) this is due to the fact that ATC includes AFC which continuously decreases as the level of output increases.

After the AVC has reached its lowest point and starts rising, its rise is over a certain range is more than offset by the fall in the AFC, so that the ATC continues to fall (over that range) despite the increase in AVC. However, the rise in AVC eventually becomes greater than the fall in AFC so that the ATC starts increasing. The AVC approaches the ATC asymptotically as output increases.

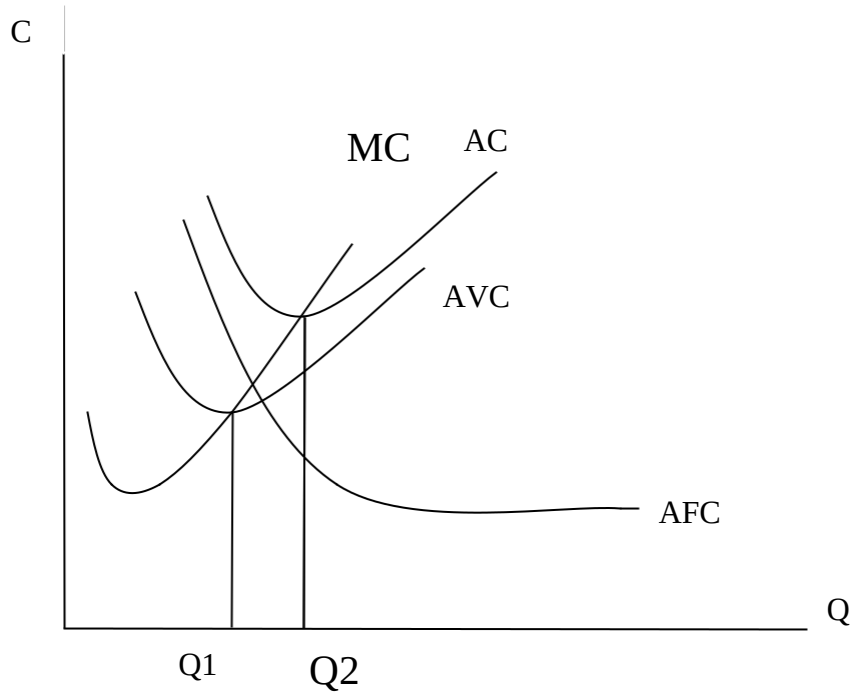


Figure 5.8: the relationship between average costs and marginal cost

The AVC curve reaches its minimum point at Q1 output and ATC reaches its minimum point at Q2. The vertical distance between ATC and AVC (AFC) decrease continuously as output increases. The MC curve passes through the minimum point of both ATC and AVC

Finally, the MC curve passes through the minimum point of both ATC and AVC curves. This can be shown by using calculus.

Suppose the TC = f (Q)

$$MC = \frac{d(f(Q))}{dQ} = f(Q) \qquad AC = \frac{TC}{Q} = \frac{f(Q)}{Q}$$

$$AC = d\frac{\text{d (f (Q))}}{dQ} = \frac{(f(Q))Q - Q.f(Q)}{Q2}$$ But f (Q) is MC and Q1 (or dQ/dQ) =1

Thus, slope of $$AC = \frac{\text{M C.Q- f(Q)}}{Q2} = \frac{\frac{MC}{Q} - \frac{f(Q)}{Q}}{Q}$$

$$\text{Slope AC} = \frac{1}{Q}(MC - AC), \text{ where } \frac{f(Q)}{Q} = AC$$

Now,

i) when MC<AC, the slope of AC is negative, i.e. AC curve is decreasing (initial stage of production)

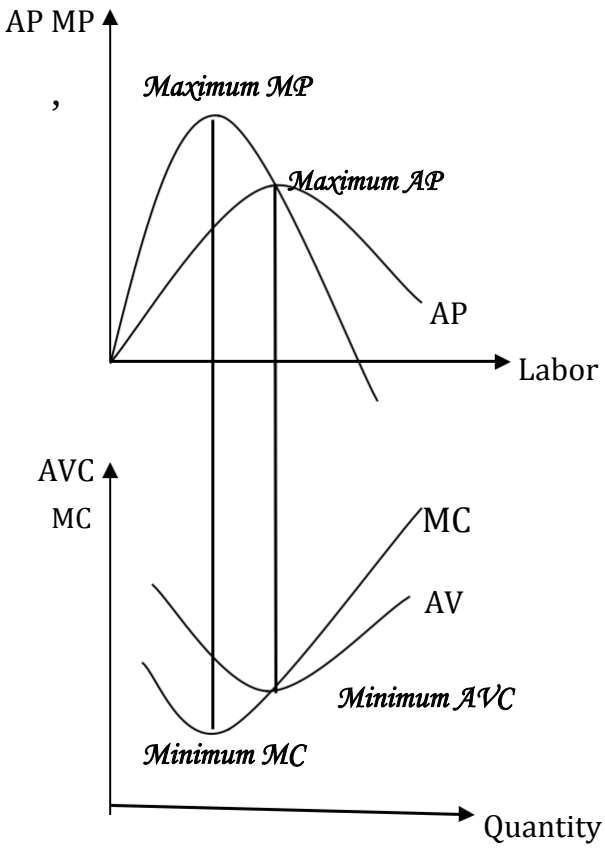
ii) When MC >AC, the slope of AC is positive, i.e. the AC curve is increasing (after optimal combination of fixed and variable inputs.

iii) When MC = AC, the slope of AC is zero, i.e. the AC curve is at its minimum point.

The relationship between AVC and MC can be shown in a similar fashion.

5.4.3. The Relationship between Production and Cost

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



The link between Production and Cost:

- ✓ When MP increase, MC decrease
- ✓ When MP decrease, MC increase
- ✓ When MP at its maximum, MC at its minimum

- ✓ When AP increase, AVC decrease
- ✓ When AP decrease, AVC increase
- ✓ When AP at its maximum, AVC at its minimum

- ✓ When MC=AVC, MP=AP

Therefore,

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

Fig 5.9: The Link between Production and Cost

The MC curve and AVC curve are the mirror reflections of the MP and AP curves respectively. For the output level where MP is above AP, the MC is below AVC. For the output level where MP is below AP, the MC is above AVC. And for the output level where MP is equal to AP, the MC is equal to AVC. MP is equal to AP when AP is at its maximum point and hence MC equals AVC when AVC is at its minimum.

♥ Check your progress 3

1. Why are AVC, ATC and MC curves U shaped.
2. Graphically derive the ATC curve from TC curve
3. Define the „Marginal cost"
4. Show (mathematically) that AVC and MC are inversely related with AP and MP of the variable input respectively.

5.5. Traditional Theory of Long Run Costs

Dear learner, in this section we will discuss the long run costs of a firm. The basic difference between long-run and short run costs is that in the short run, there are some fixed inputs which results in some amount of fixed costs. However, in the long run all factors are assumed to become variable. In the long run the firm can change the quantities of all inputs including the size of the plant. This implies that all costs are variable in the long-run in the sense that it is always possible to produce zero units of output at zero costs. That is, it is always possible to go out of business.

The long –run cost curve is a planning curve, in the sense that it is a guide to the entrepreneur in his decision to plan the future expansion of his plant.

5.5.1. Derivation of The Long- Run Average Cost Curve

The long run average cost curve is derived from the short run average cost curves. Each point on the long run average cost (LAC, now on) corresponds to a point on the short run cost curve, which is tangent to the LAC at that point. Now let us examine in detail how the LAC is derived from the short run average cost (SAC) curves.

Assume that the available technology to the firm at a particular point of time includes three methods of production, each with a different plant size: a small plant, medium plant and large plant. The operation cost of the small plant is denoted by SAC1, the operating cost of the medium size plant is denoted by SAC2 and that of the large size plant is denoted by SAC3 in the following figure.

If the firm plans to produce X1 units of output, it is well advised to choose the small size plant to minimize its cost. For example, if the firm choose to use the medium size plant to produce X1 units of output, the per unit costs will be C4 (a point corresponding to X1 units

of output on the SAC2) but, the firm can produce X1 units of output at a lower unit cost (C1) if it uses the small size plant. Similarly, if it plans to produce X2 units of output, it will choose the medium size plant. If the firm wishes to produce X3 units, it will choose the large size plant.

If the firm starts with the small plant and its demand gradually increases, it will produce at lower costs (up to x1 level of output). Beyond that level of output costs start increasing. If its demand reaches the level x1" the firm can either continue to produce with the small plant or it can install the medium size plant. The decision, at this point, whether to install the medium size plant or not depends not on the costs but on the firm‟s expectation about its future demand. If the firm expects that the demand will expand further than X1" it will install a medium size plant because with this plant out puts larger than X1" are produced with a lower cost.

Similar considerations hold for the decision of the firm when it reaches the level X2". If the firm expects its demand to stay constant at X2" level, the firm will not install the large plant, given that it involves a large investment which is profitable only if demand expands beyond X2". If the firm expects that its demand will expand further, it will install the large size plant to reduce its cost. For example the level of output X3 is produced at a cost C3 with the large plant, while it costs C2" if produced with the medium size plant (C2" > C3).

Now if we relax the assumption of the existence of only three plant sizes and assume that the available technology includes large number (infinite number) of plant sizes, each suitable for a certain level of output, the points of intersection of consecutive plants cost curves (which are the crucial points for the decision of whether to switch to a larger plant) are numerous and we obtain a continuous curve, which is the planning LAC curve of the firm.

The LAC curve is then the tangent to these SATC curves of various plant sizes and shows the minimum cost of producing each level of output.

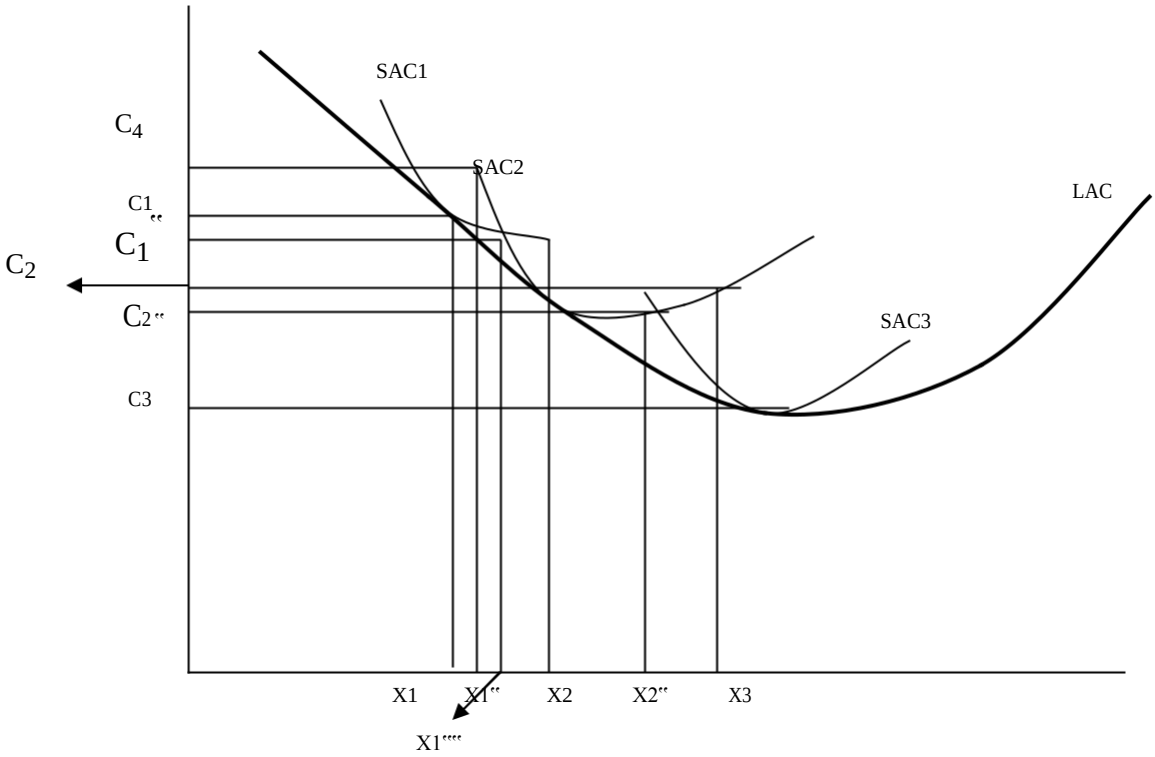
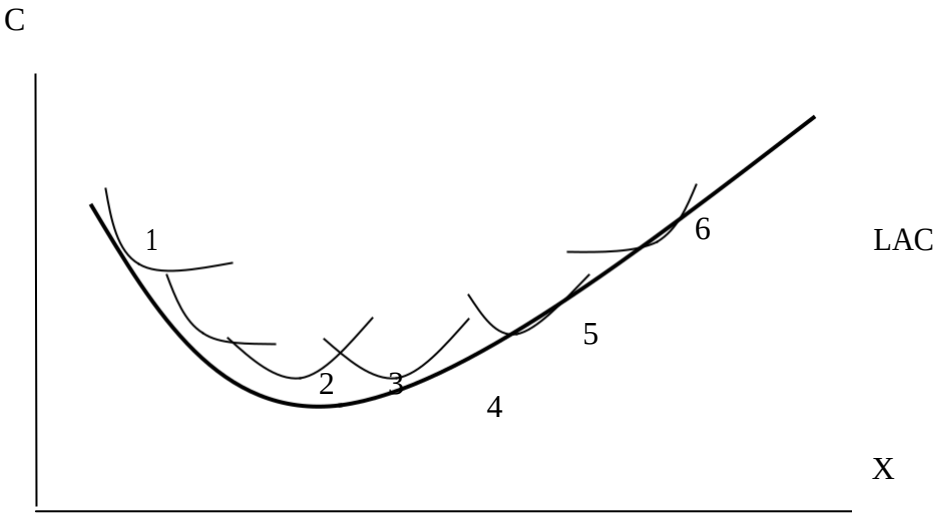


Figure 5.10: Derivation of LAC from short run cost

Assuming that there is infinite number of plant sizes, the LAC curve is a smooth curve tangent to each and every SAC curves corresponding to different plant sizes. See the following figure.

Figure 5.11: the long run average cost curve,
assuming that there are large number of plant sizes.



In summary, the LAC curve shows the minimum per-unit cost of producing any level of output when the firm can build any desired scale of plant in the sense that the firm chooses the short –run plant which allows it to produce the anticipated (in the long run)output at the least possible cost.

Why is the LAC U-shaped?

Dear learner, similar to the SAC curve, the LAC curve of a firm is also U-shaped, but the reason for the U-shapness of LAC curve is different from that of the SAC curve.

The LAC curve is U-shaped due to the laws of returns to scale(i.e increasing and decreasing returns to scale).that is, as output expands from a very low levels increasing returns to scale prevails (i.e., output rises proportionally more than inputs), and so the cost per-unit of output falls(assuming that input prices remain constant).As output continues expand, the forces of decreasing returns to scale eventually begin to overtake the forces of increasing returns to scale and the LAC begins to rise.

In other words, the per unit costs of production decreases initially as the plant size increases, due to the economies of scale which larger plant size makes possible.

Economies of scale are the cost dimension of increasing returns to scale and thus, they are like the two sides of a coin. If a firm has increasing returns to scale in production (i.e., if it requires the firm less than double inputs to produce double output) the firm will have economies of scale in costs (it will require the firm less than double cost to produce double output). Thus, the reason for the decreasing part LAC curve is increasing returns to scale or economies of scale. Economies of scale may prevail for various reasons such as specialization of skills, lower prices for bulk-buying of raw materials, decentralization of management system and etc.

The traditional theory of the firm assumes that economies of scale exists only up to a certain size of plant, which is known as optimal plant size, because with this plant size all possible economies of scale are fully exploited. If the plant size increases further than this optimal size diseconomies of scale will start to prevent, arising from managerial in efficiencies, the price advantage from bulk-buying may also stop beyond a certain limit etc. These diseconomies of scale will lead to increasing LAC curve. Thus, the increasing portion of the LAC curve shows the existence of diseconomies of scale or decreasing returns to scale.

In general, the reason for the U-shaped of the LAC curve are the existence of increasing returns to scale at initial stage of expansion decreasing returns to scale at a later stage of expansion.

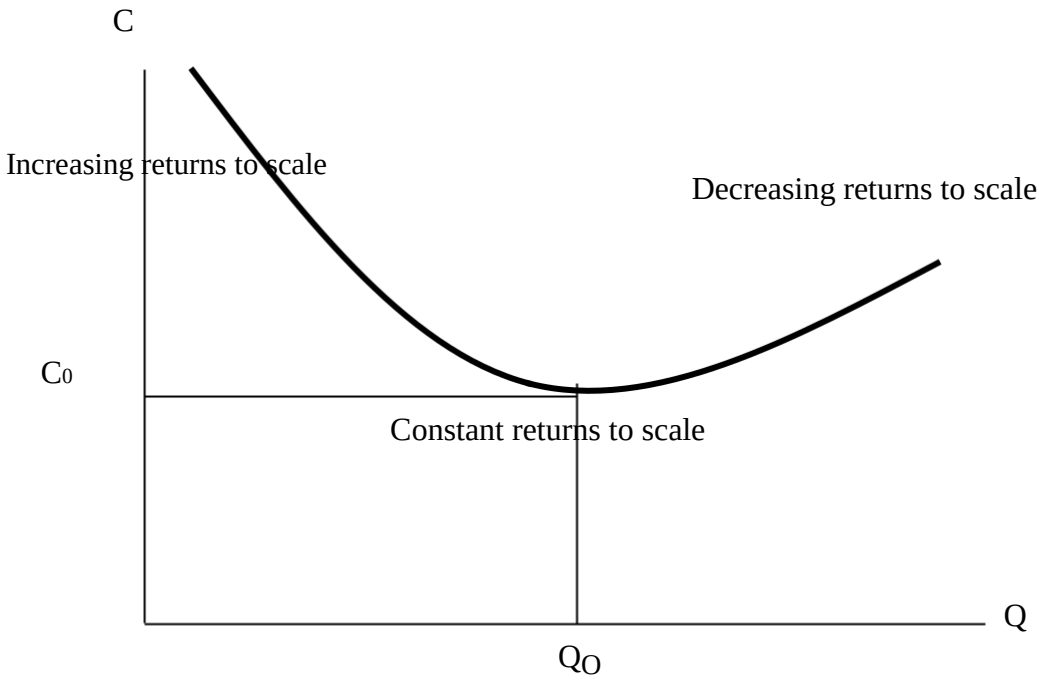


Figure 5.12: The LAC curve is u shaped due to the combined effects of increasing, constant and decreasing returns to scale.

5.5.2. *The Long-Run Marginal Cost Curve*

The long-run marginal cost curve (LMC) is derived from the short run MC curve but does not envelope them. The LMC is formed from points of intersection of the SMC curves with the vertical lines (to the x-axis) drawn from the points of tangency of corresponding SAC curves and the LAC curve.

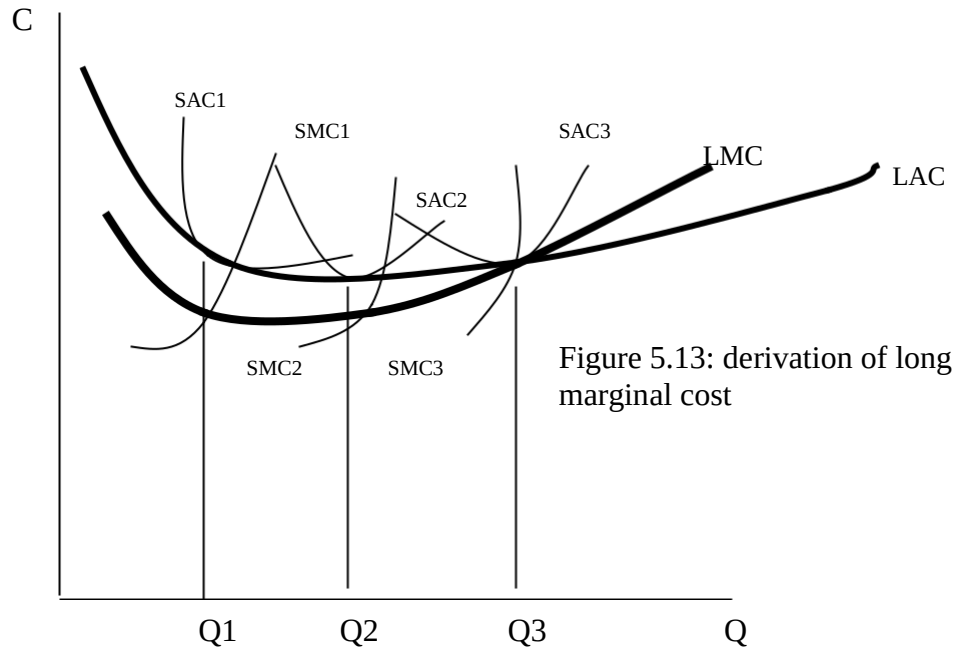


Figure 5.13: derivation of long run marginal cost

If we repeat this procedure for all points of tangency of SRAC and LAC curves to the left of the minimum point of the LAC, we obtain points of the section of the LMC which lies below the LAC. At the minimum point the LMC intersects the LAC. To the right of the minimum point of LAC curve the LMC lies above the LAC curve. At point of a minimum of LAC we have

$SAC_3 = SMC_3 = LAC = LMC$

There are various mathematical forms which give rise to U-shaped unit cost curves. The simplest total cost function which would incorporate the law of variable proportions is the cubic polynomial

$$C = \underbrace{b_0}_{} + \underbrace{b_1X - b_1X^2 + b_3X^3}$$

TC = TFC + TVC

The AVC is

$$AVC = \frac{TVC}{X} = b_1 - b_2 X + b_3 X^2$$

The MC is

$$MC = \frac{\partial C}{\partial X} = b_1 - 2b_2 X + 3b_3 X^2$$

The ATC is

$$\frac{C}{X} = \frac{b}{X}^{0} + b_1 - b_2 X + b_3 X^2$$

The TC curve is roughly S-shaped, while the ATC, the AVC and the MC are all U-shaped; the MC curve intersects the other two curves at their minimum points.

Note that, the LMC curve passes through the minimum of the LAC curve.

♥ Check Your Progress 4

1).Why is the LAC curve U- Shaped?

2).What is the point of difference between short-run and long-run costs?

Summary

Costs are the monetary value of inputs used for production purpose. Costs of production may involve explicit costs (costs of purchased in puts) and implicit cost (estimated costs of inputs owned by the producers themselves).

Managers, investors and economists must take into account the opportunity cost associated with the use of a firm‟s resources the cost associated with the opportunities forgone when the firm uses its resources in its next best alternative.

Costs of production depend on several factors such as the quantity of production, the level of technology and input prices. Thus cot functions are a multivariate function.

In the short-run, one or more of a firm‟s inputs are fixed. Thus, total cost of production can be divided to fixes cost and variable costs. Fixed costs are constant irrespective of the level output. A firm cannot avoid fixed cost even by producing zero level of output. Variable costs, on the other hand, vary with the level of output directly.

By dividing the total cost and total variable costs for the quantity of production, we obtain average cost (AC) respectively. In the short run, when not all inputs are variable, the AC and AVC curves assume a U- shape due to the law of variable proportions.

Marginal costs of production are additional costs incurred to produce one more unit of a commodity. The MC curve has a U- shape due to the law of variable proportions.

Short run marginal and average variable cost curves are a mirror reflection of the marginal product and average product of the variable input respectively.

In the long run, all inputs to the production process are variable. As a result, the choice of inputs depends both on the relative costs of a factor of production and on the extent to which the firm can substitute among inputs in its production process.

Self-check Exercise

Give a wide explanation for the following questions.

1) As a matter of cumulative experience with production the firm‟s marginal and average costs of producing a given output decreases because of certain reasons. Identify and give description of four reasons that contributes for the above mentioned idea.
2) Explain the scenarios behind the "U" shaped curves of the traditional short-run curves of cost.
3) Consider a barber in your locality. What are the explicit and implicit costs that the barber incurs to provide the service?
4) Discuss how long run average cost change due to economic of scale and learning scale.

Part II: work-out item

Assume the total cost function is: $TC= 10 + 6Q – 0.9Q^2 + 0.05Q^3$, then find

A) The AFC & AVC function?
B) The Minimum AVC?
C) The Minimum AC?
D) The Minimum MC?

CHAPTER SIX

6. Price And Out Put Determination Under Perfect Competition

Introduction

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

Objectives

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

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

6.1 Perfect Competition
Definition and Assumptions

Perfect competition is a market structure characterized by a complete absence of rivalry among the individual firms. Thus, perfect competition in economic theory has a meaning diametrically opposite to the everyday use of this term.

Most of the time, we see business men using the word "Competition" as synonymous to "rivalry". However, in theory, perfect competition implies no rivalry among firms

Assumptions

The model of perfect competition was constructed based on the following assumptions or imaginations.

a) ***Large number of sellers and buyers***.

The perfect competitive market includes a large number of buyers and sellers. How large should the number of buyers and sellers is large to the extent that the market share of each firm (and buyer) is too small to have a perceptible effect on the price of the commodity. That is the action of a single seller or buyer cannot influence the market price of the commodity, since the firm or (the buyer) is too small in relation to the market.

b) Products of the firms are homogeneous.

This means the products supplied by all the firms in the market have uniform physical characteristics (are uniform in terms of quantity, quality etc) and the services associated with sales and delivery are identical. Thus buyers can not differentiate the product of one firm from the product of the other firm.

The assumptions of large number of sellers and of product homogeneity imply that the individual firm in pure competition is a price taker: its demand curve is infinitely elastic, indicating that the firm can sell any amount of output at the prevailing market price. Since the share of the firm from the market supply is too small to affect the market price, the only thing that the firm can do is to sell any quantity demand at the ongoing market price. Thus, the demand curve that an individual firm faces is a horizontal line.

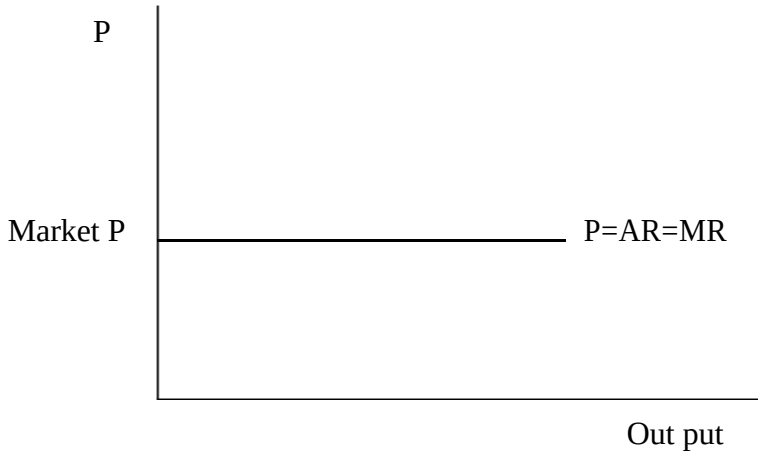


Fig 6*.1 the demand curve indicates a single market price at which the firm can sell any amount of the commodity demanded. The demand curve also indicates the average revenue and marginal revenue of the firm.*

3. Free entry and exit of firms

There is no barrier to entry and exit from the industry. Entry or exit may take time, but firms have freedom of movement in and out of the industry. If barriers exist the number of firms in the industry may be reduced so that one of them may acquire power to affect the market price.

4. The goal of all firms is profit maximization.

Of course, firms can have different objectives. Some firms may have the aim of making their product wise, others may want to maximize their sales even by cutting price, etc. But, in this model, it is assumed that the goal of all firms is to maximize their profit and no other goal is pursued.

5. ***No government regulation***

By assumption, there is no government intervention in the market. That is there is no tax, subsidy etc. A market structure in which all the above assumptions are fulfilled is called pure competition. It is different from perfect competition which requires the fulfillment of the following additional assumptions.

6. Perfect mobility of factors of production

Factors of production (including workers) are free to move from one firm to another throughout the economy. Alternatively, there is also perfect competition in the market of factors of production.

7. Perfect knowledge

It is assumed that all sellers and buyers have a complete knowledge of the conditions of the prevailing and future market. That is all buyers and sellers have complete information about.

- The price of the product
- Quality of the product etc

Thus, a perfectly competitive market is a market which satisfies all the above conditions (assumptions). In reality, perfectly competitive markets are scarce if not none. But since the theory of perfectly competitive market helps as a bench mark to analyze the more realistic markets, it is very important to study it.

Given the above assumptions (based which the model of perfect competition was built), we will now examine how the firm operating in such a market determines the profit maximizing out put both in the short run and in the long run. But to determine the profit maximizing output, first we have to see what the revenue and cost functions of the firms operating in perfectly competitive market looks like.

Costs under perfect competition

In the previous chapter, we have said that the per unit cost (AVC &AC) have U –shape due to the law of variable proportions (in the short run) and the law of returns to scale (in the long

run). There is no exception for firms operating under perfect competition i.e., their cost functions have the behavior mentioned in the last chapter.

6.2. Demand and Revenue Functions under Perfect Competition

Due to the existence of large number of sellers selling homogenous products, each seller is a price taker in perfectly competitive market. That is, a single seller cannot influence the market by supplying more or less of a commodity.

If, for example, the seller charges higher price than the market price to get larger revenue, no buyers will buy the product of this (the price raising) firm since the same product is being sold in the market at lower price by other sellers. Obviously, the firm will not also attempt to reduce the price. Thus firms operating in a perfectly competitive market are price takers and sell any quantity demanded at the ongoing market price.

Hence, the demand function that an individual seller faces is perfectly elastic (or horizontal line).

Graphically,

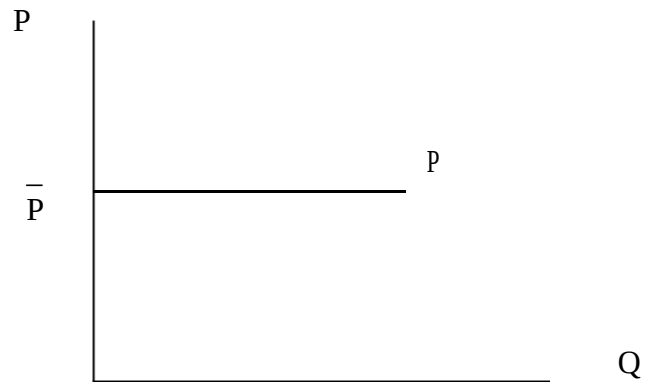


Fig 6.2 *the demand curve that a perfectly competitive firm faces is horizontal line with intercept at the market price. This indicates that sellers sell any quantity demanded at the ongoing market price and buyers buy any amount they want at the ongoing market price.*

From the buyers‟ side too, since there is large number of buyers in the market, a single buyer cannot influence the market price.

Thus, in perfectly competitive market, both buyers and sellers are price takers. They take the price determined by the forces of market demand and market supply.

Given the horizontal demand function at the ongoing market price, the total revenue of a firm operating under perfect competition is given by the product of the market price and the quantity of sales, i.e.,

TR = P*Q

Since the market price is constant at P*, the total revenue function is linear and the amount of total revenue depends on the quantity of sales. To increase his total revenue, the firm should sell large quantity.

Graphically, the TR curve is as shown below.

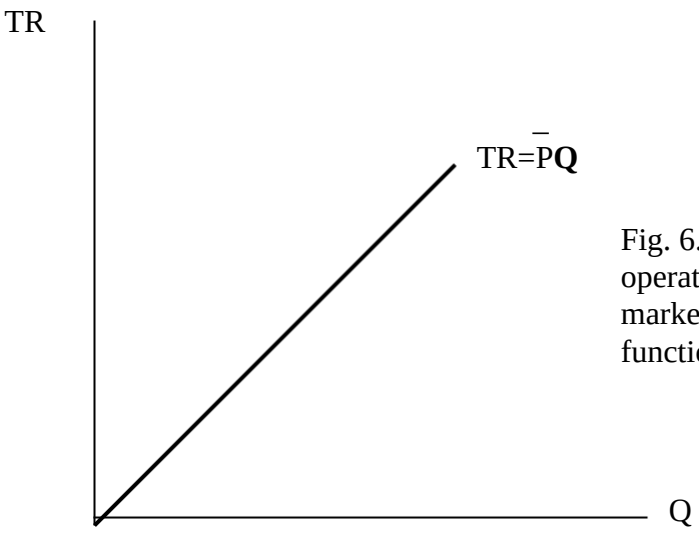


Fig. 6.3 the total revenue of firm operating in perfectly competitive market is linear (and increasing function) of the quantity of sales.

The marginal revenue (MR) and average revenue (AR) of a firm operating under perfect competition are equal to the market price. To see this, let‟s find the MR and AR functions from TR functions.

TR= PQ

By definition, MR is the change in total revenue that occurs when one more unit of the output is sold, i.e. $MR = \frac{dTR}{dQ} = P$ .Hence MR=P

Average revenue is the TR divided by the quantity of sales. i.e. $AR = \frac{TR}{Q} = \frac{P.Q}{Q} = P$

Hence, AR = P.

Graphically, the demand curve represents the MR and AR of the firm

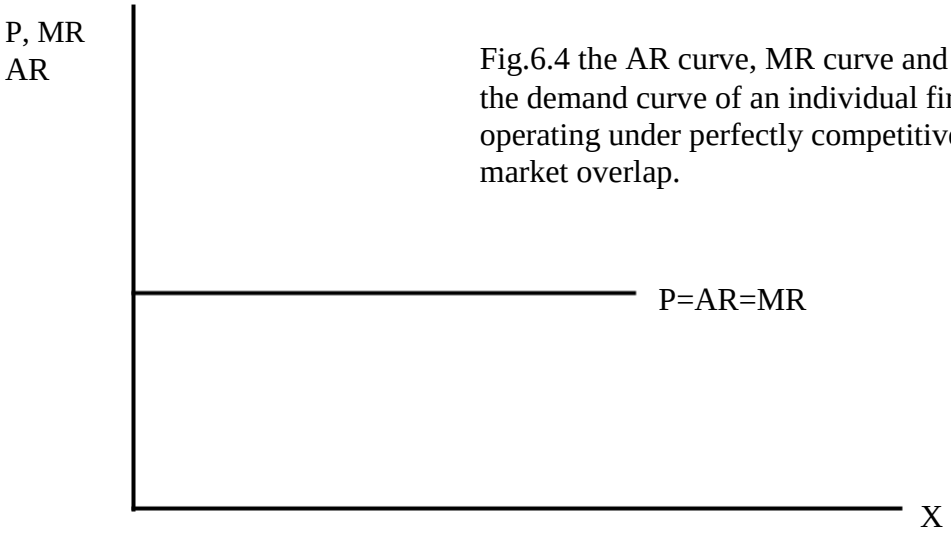


Fig.6.4 the AR curve, MR curve and the demand curve of an individual firm operating under perfectly competitive market overlap.

♥ Check your progress 1

1. How do you define a perfectly competitive market? Is there a real competition among firms operating in such markets?
2. Is promotion activity (such as advertising the product) necessary for a firm operating under perfect competition? Why or why not?
3. What are the assumptions used to construct the model of perfect competition?
4. Explain why the demand curve of an individual firm operating in a perfectly competitive market is perfectly elastic. What will happen to the quantity of sales of an individual firm if he raises the price above the market price?

6.3. Short-Run Equilibrium

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

6.3.1. Short Run Equilibrium of the Firm

Dear learner! What do we mean when we say the firm is in equilibrium? (Use the space left below to write your response)

_____

_____

If you don‟t know the answer, don‟t worry, just read what follows;

A firm is said to be in equilibrium when it maximizes its profit (∏). Profit is defined as the difference between total cost and total revenue of the firm:

∏= TR-TC

Under perfect competition, the firm is said to be in equilibrium when it produces that level of output which maximizes its profit, given the market price. Thus, determination of equilibrium of the firm operating in a perfectly competitive market means determination of the profit maximizing output since the firm is a price taker.

The level of output which maximizes the profit of the firm can be obtained in two ways:

- Total approach
- Marginal approach

Total Approach (Total Revenue-Total cost Approach)

The firm is in equilibrium when it maximizes its profits (Π), defined as the difference between total cost and total revenue:

Π =TR–TC

Given that the normal rate of profit is included in the cost items of the firm, Π is the profit above the normal rate of return on capital and the remuneration for the risk bearing function of the entrepreneur. The firm is in equilibrium when it produces the output that maximizes the difference between total receipts and total costs. The equilibrium of the firm may be shown graphically in two ways. Either by using the TR and TC curves, or the MR and MC curves. In fig.6.5 we show the total revenue and total cost curves of a firm in a perfectly competitive market.

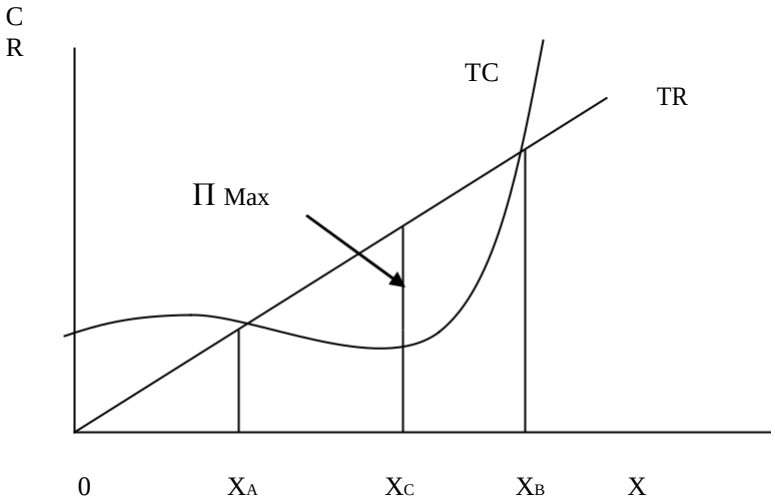


Fig. 6.5

The total revenue curve is a straight line through the origin, showing that the price is constant at all levels of output. The firm is a price-taker and can sell any amount of output at the going market price, with its TR increasing proportionately with its sales. The slope of the TR curve is the marginal revenue. It is constant and equal to the prevailing market price, since all units are sold at the same price. Thus in pure competition MR = AR = P.

The shape of the total-cost curve reflects the U shape of the average-cost curve, that is, the law of variable proportions. The firm maximizes its profit at the output X_C, where the distance between the TR and TC curves is the greatest. At lower and higher levels of output total profit is not maximized: at levels smaller than X_A and larger than X_B the firm has losses.

Marginal Approach

The total-revenue-total-cost approach is awkward to use when firms are combined together in the study of the industry. The alternative approach, which is based on marginal cost and marginal revenue, uses price as an explicit variable, and shows clearly the behavioral rule that leads to profit maximization.

In fig.2 we show the average and marginal cost curves of the firm together with its demand curve.

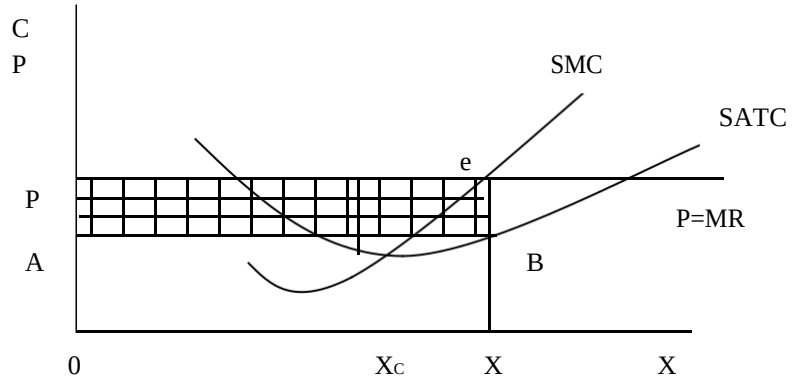


Fig. 6.6

The demand curve is also the average revenue curve and the marginal revenue curve of the firm in a perfectly competitive market. The marginal cost cuts the SATC at its minimum point. Both curves are U-shaped, reflecting the law of variable proportions which is operative in the short run during which the plant is constant. The firm is in equilibrium (maximizes its profit) at the level of output defined by the intersection of the MC and the MR curves (point e in fig. 6.6). To the left of e profit has not reached its maximum level because each unit of output to the left of X_e brings to the firm revenue which is greater than its marginal cost. To the right of X_e each additional unit of output costs more than the revenue earned by its sale, so that a loss is made and total profit is reduced. In summary:

(a) If MC>MR the level of total profit is being reduced and it pays the firm to expand its output.

(b) If MC = MR short-run profits are maximized.

Thus the first condition for the equilibrium of the firm is that marginal cost be equal to marginal revenue. However, this condition is not sufficient, since it may be fulfilled and yet the firm may not be in equilibrium. In fig. 6.6 we observe that the condition MC = MR is satisfied at point e|, yet clearly the firm is not in equilibrium, hence profit is maximized at $X_e^{|} > X_e$.

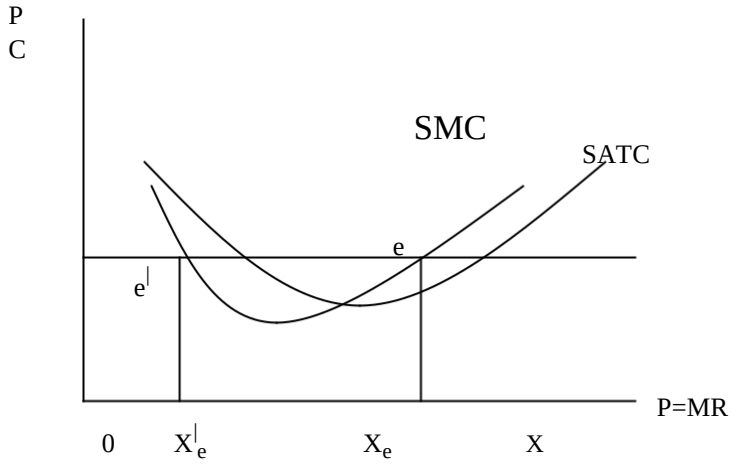


Fig. 6.7

The second condition for equilibrium requires that the MC must cut the MR curve from below, i.e., the slope of the MC must be steeper than the slope of the MR curve. In the fig. 5.7 the slope of MC is positive at e, while the slope of the MR curve is zero at all levels of output. Thus at e both conditions for equilibrium are satisfied

i. MC = MR and

ii. (slope of MC) > (slope of MR).

It should be noted that the MC is always positive, because the firm must spend some money in order to produce an additional unit of output. Thus at equilibrium the MR is also positive.

The fact that a firm is in short run equilibrium does not necessarily mean that it makes excess profits. Whether the firm makes excess profits or losses depends on the level of the ATC at the short-run equilibrium. If the ATC is below the price at equilibrium (fig. 6.8) the firm earns excess profits (equal to the area PABe). If, however, the ATC is above the price (fig. 6.9) the firm makes a loss (equal to the area FPeC). In the latter case the firm will continue to produce only if it covers its variable costs. Otherwise it will close down, since by discontinuing its operations the firm is better off: it minimizes its losses. The point at which the firm covers its variable costs is called the closing down point. In fig. 6.10 the closing-down point of the firm is denoted by point w. If price falls below P_W the firm does not cover its variable costs and is better off it closes down.

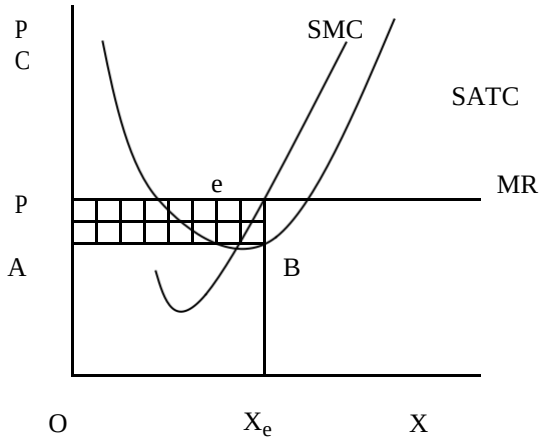


Fig. 6.8

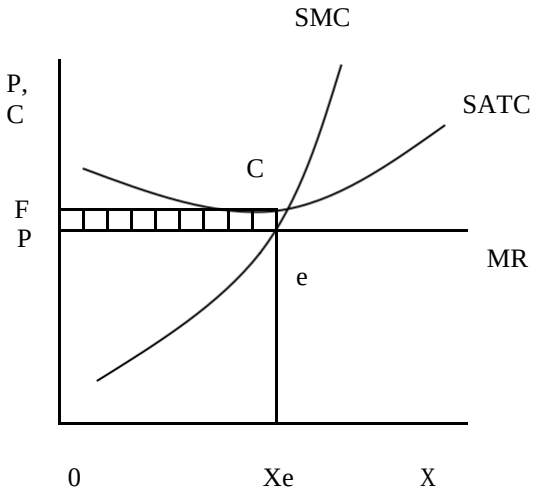


Fig. 6.9

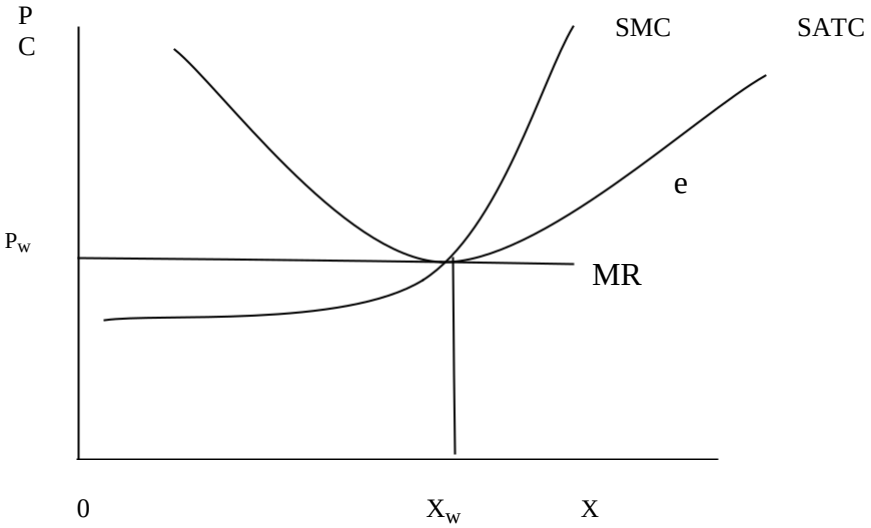


Fig. 6.10

Shutdown point

The shutdown point in perfectly competitive firm is the price, which just equals AVC, below which it is more profitable for the perfectly competitive firm to shutdown than to continue to produce. We can analyze the shutdown decision graphically. In fig. 6.11 the firm will run a loss whether the price is P_1, P_2, or P_3, because none of these prices is high enough to reach the minimum level of average cost (AC). We can show the lowest price that keeps the firm from shutting down by introducing one more short-run cost curve: the average variable cost (AVC) curve. Why is this curve relevant? Because as we have just seen, it pays the firm to remain in operation if its total revenue (TR) exceeds its total short-run total variable cost (TVC). If we divide both total revenue and total variable cost by quantity, we get TR/Q=P and

TVC/Q=AVC. So, we can state the condition for continued operation equivalently as the requirement that price must exceed AVC. The conclusion is:

"The firm will produce nothing unless price lies above the minimum point on the AVC curve."

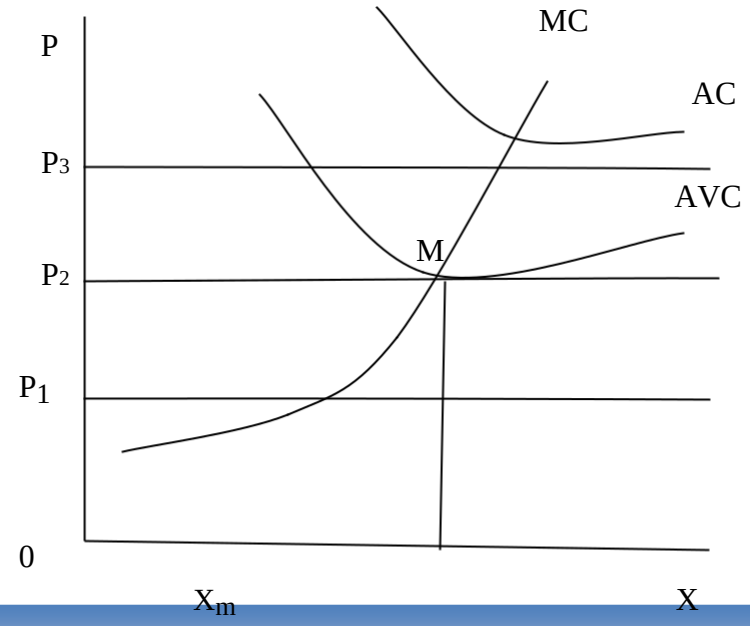


Fig.6.11 Shutdown point of a firm in perfect competition

In fig. 6.11 price P_1, below the minimum average variable cost. With this price, the firm cannot even cover its variable costs and is better off shutting down (producing zero output).
Price P_3 is higher. Although the firm still runs a loss if it sets MC=P at point A (because AC exceeds P_3) it allows the firm to at least cover its short-run variable costs, so it pays to keep operating the short-run. Price P_2 is borderline case. If the price is P_2, the firm is indifferent between shutting down and staying in the business and producing at level where MC= P (point B). P_2 is thus the lowest price at which the firm will produce anything. As we see from the graph, P_2 corresponds to the minimum point the AVC curve.

Mathematical Derivation of the equilibrium of the Firm

The firm aims at the maximization of its profit

$$\prod = R - C$$

Where $\prod$ = Profit

R = Total Revenue

C = Total Cost

Clearly R = $f_1(X)$ and C = $f_2(X)$, given the price P.

(a) The first-order condition for the maximization of a function is that its first derivative be equal to zero. Differentiating the total-profit function and equating to zero we obtain

$$\frac{\partial \prod}{\partial X} = \frac{\partial R}{\partial X} - \frac{\partial C}{\partial X} = 0 \quad \text{or} \quad \frac{\partial R}{\partial X} = \frac{\partial C}{\partial X}$$

The term $\partial R / \partial X$ is the slope of the total revenue curve, that is, the marginal revenue. The term $\partial C / \partial X$ is the slope of the total cost curve, or the marginal cost. Thus the first-order condition for profit maximization is MR = MC.

Given that MC>0, MR must also be positive at equilibrium. Since MR = P the first order condition may be written as MC = P.

(b) The second – order condition for a maximum requires that the second derivative of function be negative (implying that after its highest point the curve turns downwards). The second order derivative of the total-profit function is

$$\frac{\partial^2 \prod}{\partial X^2} = \frac{\partial^2 R}{\partial X^2} - \frac{\partial^2 C}{\partial X^2}$$

This must be negative if the function has been maximized, that is $\frac{\partial^2 R}{\partial X^2} - \frac{\partial^2 C}{\partial X^2} < 0$

This yields the condition $\frac{\partial^2 R}{\partial X^2} < \frac{\partial^2 C}{\partial X^2}$

But $\partial^2 R / \partial X^2$ is the slope of the MR curve and $\partial^2 C / \partial X^2$ is the slope of the MC must cut the MR curve from below. In pure competition the slope of the MR curve is zero, hence the second-order condition is simplified as follows $0 < \frac{\partial_2 C}{\partial X^2}$

Which reads: the MC curve must have a positive slope, or the MC must be rising.

Numerical example

Dear learner now let us sees how to determine the short run equilibrium of a firm operating in a perfectly competitive market by using a hypothetical example.

Suppose that the firm operates in a perfectly competitive market. The market price of his product is$10. The firm estimates its cost of production with the following cost function:

$TC=10q-4q^2+q^3$

A) What level of output should the firm produce to maximize its profit?

B) Determine the level of profit at equilibrium.

C) What minimum price is required by the firm to stay in the market?

Solution

Given: p=$10

$TC= 10q - 4q^2+q^3$

A) The profit maximizing output is that level of output which satisfies the following condition

- MR in a perfectly competitive market is equal to the market price. Hence, MR=10

Alternatively, $MR = \frac{dTR}{dq}$ where TR= P.q = 10q

Thus, $MR = \frac{d(10q)}{dq} = 10$

$MC=\frac{dTC}{dq} = \frac{d(10q - dq^2 + q^3)}{dq} = 10 - 8q + 3q^2$

- To determine equilibrium output just equate MC& MR And then solve for q.

$10 – 8q + 3q^2 = 10$

$- 8q + 3q^2 = 0$

$q (-8 + 3q) = 0$

$q = 0$ or $q = 8/3$

Now we have obtained two different output levels which satisfy the first order (necessary) condition of profit maximization i.e. 0 & 8/3

- To determine which level of output maximizes profit we have to use the second order test at the two output levels i.e. we have to see which output level satisfies the second order condition of increasing MC.
- To see this first we determine the slope of MC

Slope of MC = $\frac{dMC}{dq}$ = -8 + 6q

- At q = 0, slope of MC is -8 + 6 (0) = -8 which implies that marginal lost is decreasing at q = 0. Thus, q = 0 is not equilibrium output because it doesn‟t satisfy the second order condition.
- At q = 8/3, slope of MC is -8 + 6 (8/3) = 8, which is positive, implying that MC is increasing at q = 8/3

Thus, the equilibrium output level is q = 8/3

B) Above, we have said that the firm maximizes its profit by reducing 8/3 units. To determine the firm‟s equilibrium profit we have calculate the total revenue that the firm obtains at this level of output and the total cost of producing the equilibrium level of output.

TR = Price * Equilibrium out put

= $ 10 * 8/3= $ 80/3

TC at q = 8/3 can be obtained by substituting 8/3 for q in the TC function, i.e.

$TC = 10 (8/3) – 4 (8/3)^2 + (8/3)^3 \approx 23.12$

Thus the equilibrium (maximum) profit is

$\prod$ =TR–TC

= 26.67 – 23.12 = $ 3.55

c) To stay in operation the firm needs the price which equals at least the minimum AVC. Thus to determine the minimum price required to stay in business, we have to determine the minimum AVC.

AVC is minimal when derivative of AVC is equal to zero

$$\text{That is: } \frac{dAVC}{} = 0$$

Given the TC function: $TC = 10q - 4q^2 + q^3$, there is no fixed cost i.e. TC is equal to the TVC. Hence, $TVC = 10q - 4q^2 + q^3$

$$AVC = \frac{TVC}{q} = \frac{10q - 4q^2 + q^3}{q} = 10 - 4q^2 + q^2$$

$$\frac{dAVC}{dq} = 0 \rightarrow \frac{d(10 - 4q + q^2)}{dq} = 0$$

$$= -4 + 2q = 0$$

$\rightarrow$ q = 2 i.e. AVC is minimum when output is equal to 2 units.

The minimum AVC is obtained by substituting 2 for q in the AVC function i.e., Min AVC = $10–4(2)+2^2=6$

Thus, to stay in the market the firm should get a minimum price of $ 6.

♥ Check Your Progress 2

1. How can firms operating in a perfectly competitive market decide the profit maximizing output?
2. What do we mean by shut down point? What minimum price is required by a firm to stay in the business?
3. Suppose a given firm operating in a perfectly competitively market. TFC = $ 600, TVC = $ 500 and TR = $ 700. Should the firm stay in the business? What will be your answer if the TR changes to $ 450?
4. Suppose a firm has a cost structure given by

    a) Determine the profit maximizing output
    b) Determine the breakeven price
    c) What minimum market price the firm needs to continue production?

6.3.2. The Short Run Supply Curve of the Firm and the Industry

a) The Short Run Supply Curve of the Firm

In the previous section, we have demonstrated how a competitive firm determines the level of output which maximizes its profit for a given market price. The profit maximizing level of output is defined by the point of equality of MC and market price (because market price is equal to MR in the perfectly competitive market). By repeating this analysis at different possible market prices, we observe how the equilibrium quantity supply of the firm varies with the market price.

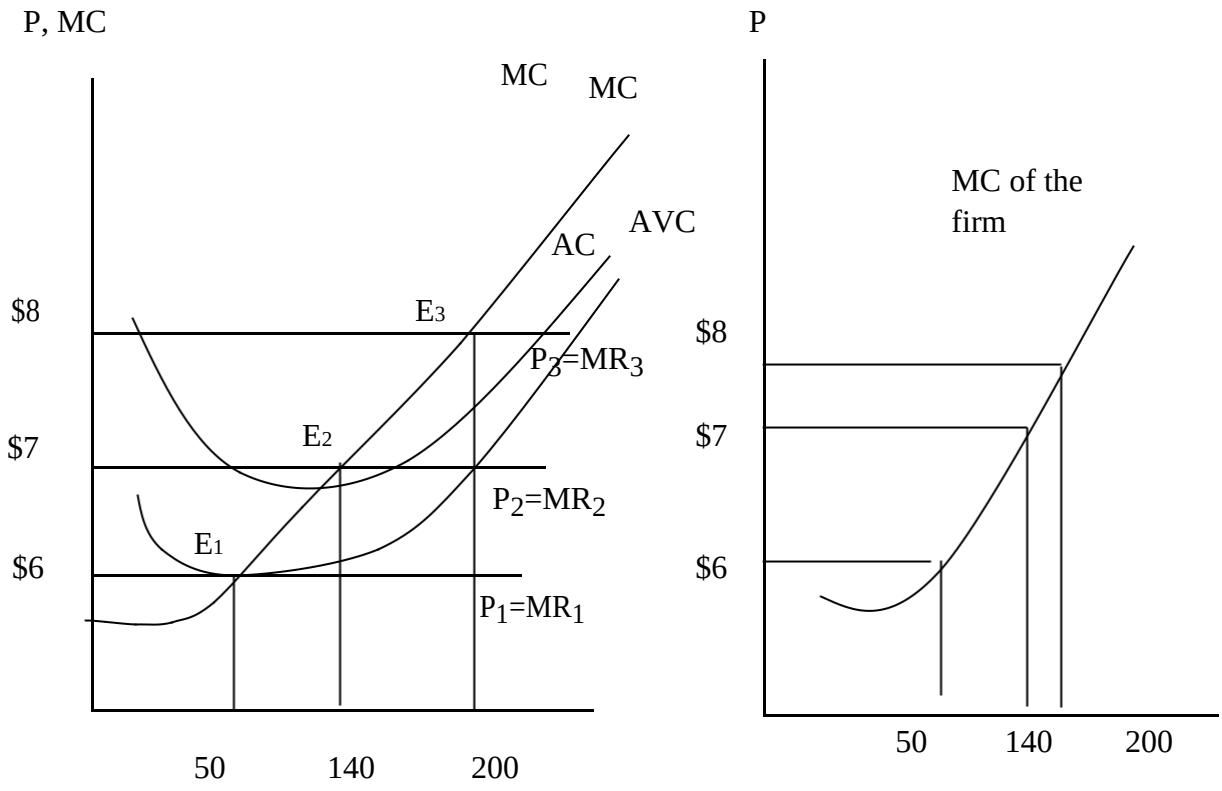
Now consider the figure 6.9 to understand how to derive the short run supply curve of a perfectly competitive firm.

Suppose that initially the market price and MR is $6 and the demand curve is shown by line P1. Given the MC curve, the level of output which maximizes the firm‟s profit is defined by the point of intersection of the MC curve and the demand line (P1), which is equal to 50 units.

Now assume that the market price increases to $7. This is shown by an upward shift of the demand curve (MR) to P2. Given the positive slope of MC, this higher demand (MR) curve cuts the MC curve at higher output level, 140. That is, when the market price increases from $6 to $7, the equilibrium quantity supplied by the firm increases from 50 units to 140 units. As the price increases further (say to $8), the equilibrium output increases to 200 units.

This implies that the quantity supplied by the firm increases as the market price increases. The firm, given its cost structure, will not supply any quantity (will shut down) if the price falls below $6, because at a lower price than $6, the firm cannot cover its variable costs. Thus, supply is zero for all price levels below $6 (minimum AVC)

If we plot the successive equilibrium points on a separate graph we observe that the supply curve of the individual firm over laps with (is identical to) to part of its MC curve to the right of the shutdown point.



Fig, 6.12 the short run supply curve of a perfectly competitive firm is obtained by connecting different equilibrium points E1, E2, E3 that occurs at successive price levels p1, p2 and p3 respectively. When the market price is $6, the firm supplies 50 units to maximize its profit. As the price increases to $7, the equilibrium quantity supplied increases to 140 units and so on.

Thus, the short run supply curve of a perfectly competitive firm is that part of MC curve which lies above the minimum average variable cost (Shut down point)

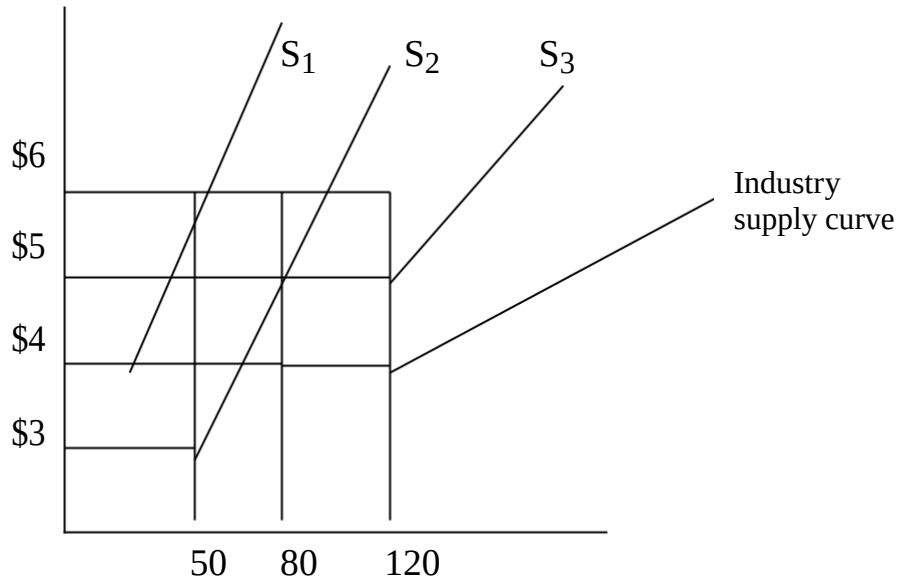
b) **Short Run Supply Curve Of The Industry**

Dear learner, before we discuss the derivation of short run supply curve of the industry, let us see what the word „***industry***" refers to in this unit. The word "industry" is defined as group of firms producing homogeneous products. Thus the industry supply is the total supply or market supply.

The industry –supply curve is the horizontal summation of the supply curves of the individual firms. That is, the total quantity supplied in the market at each price is the sum of the

quantities supplied by all firms at that price. This is based 0n the assumption that the factor prices and the technology are given.

For detailed information as to how to derive the short run industry supply curve from the supply of individual firms, consider the following figure. S_1, S_2 and S_3 denote the supply curves of firms existing in a given industry. The industry supply curve is obtained by adding the quantities supplied by all the firms at each price. For example, at price which equals $ 6, firm 1 supplies 50 units, firm 2 supplies 80 units & firm 3 supplies 120 units. The market supply at $ 6 price is thus 250 units (50+80+120 units). The short run industry- supply is derived by repeating the above process at each price levels.



Fig, 6.13 the industry- supply curve is the horizontal summation (at each price) of the supply curves of all firms in the industry.

When the market price falls below $ 4, only firm2 exists in the market. Thus, for prices below$ 4, the industry supply curve is identical with the supply curve is identical with the supply curve of firm 2. Similarly, for price levels ranging from $4 to $5, only firm1 and firm2 are producing and searching in the market. Thus, the industry- supply curve for this range of price is the sum of the quantities supplied by firm 1 and firm 2, and so on.

♥ Check your progress 3

1. Derive the short run supply curve an individual firm operating in the perfectly competitive market. Which part of the MC curve represents the firm‟s supply curve?
2. What is the industry-supply curve? How can we obtain it?

6.3.3. Short Run Equilibrium of the Industry

Dear learner, what is the necessary condition for a market to be equilibrium?

In our previous discussions, we have seen the short run equilibrium of the individual firm. At that time, we have said that the short run equilibrium of the firm is defined by the point of intersection of the horizontal MR curve (or the demand curve that the individual firm faces) and MC curve (or the supply curve of the firm). In other words, the short run equilibrium of an individual firm is defined by equality of MC of firm and the market price.

Short run equilibrium of the industry is defined by the intersection of the market demand and market supply. The intersection of market demand and market supply of a given commodity determines the equilibrium price and quantity of the commodity in the market.

While discussing the short run equilibrium of an individual firm we have said that the demand curve that an individual firm faces is horizontal line (perfectly elastic). This is due to the fact that; since there are large numbers of sellers in the market, an individual firm is too small to influence the market price. Rather, the firm sells any amount demanded at the prevailing market price.

Unlike the individual demand curve, the market demand curve (the total demand curve that the industry faces) is down-ward sloping, indicating that as the market price of the commodity increases, the total quantity demanded for the product decreases and vice versa. In fig.6.14 the industry is in equilibrium at price P_e, at which the quantity demanded and supplied is Q_e. At this equilibrium market price, individual firms can earn a positive profit, zero profit (normal profit) or even can incur a loss depending on their cost structures.

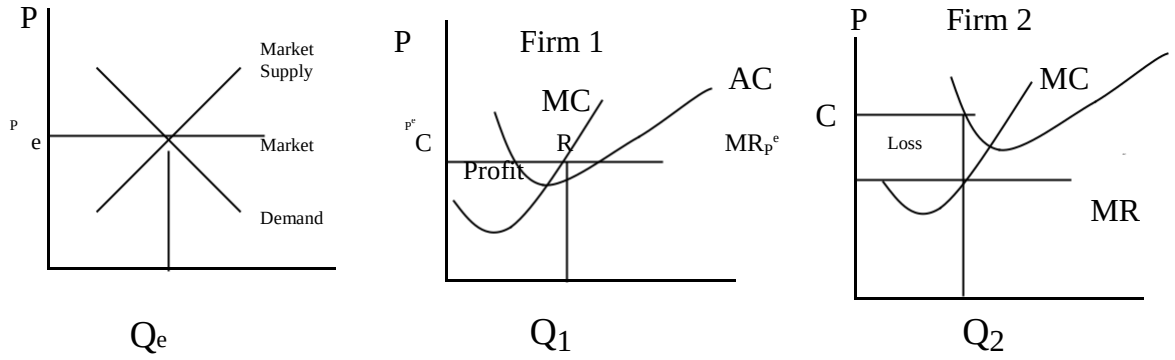


Fig 6.14:- short run equilibrium of the industry. Short run equilibrium of the industry is defined by the intersection of the market demand and the industry supply Curve. At equilibrium price, P_e firm 1 gets a positive profit because the average cost of the firm at equilibrium is less than the market Price, p_e. On the other hand, firm 2 is incurring a loss as its average cost is higher than the market price.

6.4. **Long-Run Equilibrium of the Firm and the Industry**

6.4.1. Equilibrium of the Firm In the Long Run

In the long run firms are in equilibrium when they have adjusted their plant so as to produce at the minimum point of their long-run AC curve, which is tangent (at this point) to the demand curve defined by the market price. In the long run the firms will be earning just normal profits, which are included in the LAC. If they are making excess profits new firms will be attracted in the industry; this will lead to a fall in price (a downward shift in the individual demand curves) and an upward shift of the cost curves due to the increase of the prices of factors as the industry expands. These changes will continue until the LAC is tangent to the demand curve defined by the market price. If the firms make losses in the long run they will leave the industry, price will rise and costs inclusive of the normal rate of profit.

In fig. 6.15 we show how firms adjust to their long-run equilibrium position. If the price is P, the firm is making excess profits working with the plant whose cost is denoted by SAC_1.

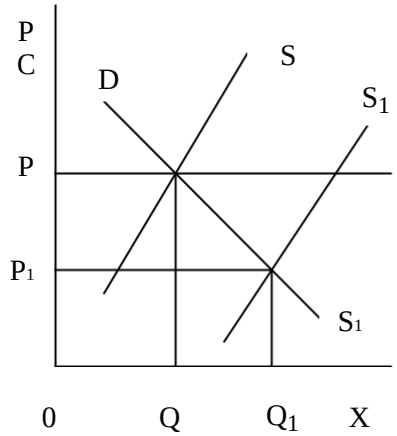


Fig.6.15

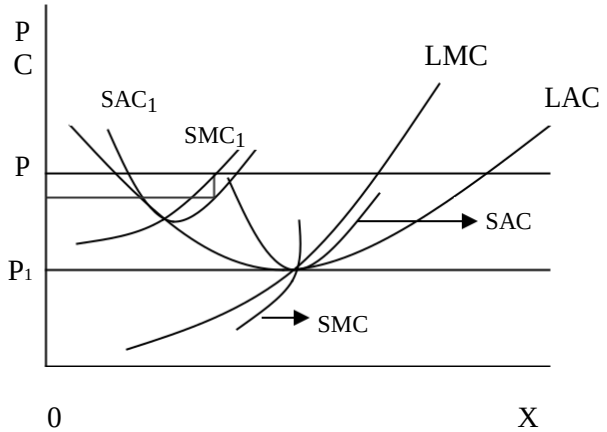


Fig.6.16

It will therefore have an incentive to build new capacity and it will move along its LAC. At the same time new firms will be entering the industry attracted by the excess profits. As the quantity supplied in the market increases (by the increased production of expanding old firms and by the newly established ones) supply curve in the market will shift to the right and price will fall until it reaches the level of P1 (in fig.6.16) at which the firm and the industry are in the long-run equilibrium. The LAC in fig.6.16 is the final-cost curve including any increase in the prices of factors that may have taken place as the industry expanded.

The condition for the long-run equilibrium of the firm is that the marginal cost be equal to the price and to the long-run average cost

LMC=LAC=P

The firm adjusts its plant size so as to produce that level of output at which the LAC is the minimum possible, given the technology and the prices of factors of production. At equilibrium the short-run marginal cost equal to the long-run marginal cost and the short-run average cost is equal to the long-run average cost. Thus given the above equilibrium condition, we have

SMC=LMC=LAC=LMC=P=MR

This implies that at the minimum point of the LAC the corresponding (short-run) plant is worked at its optimal capacity, so that the minima of the LAC and SAC coincide. On the other hand, the LMC cuts the LAC at its minimum point of the LAC the above equality between short-run and long-run costs is satisfied.

6.4.2. Equilibrium of the Industry in the Long-Run

The industry is in long-run equilibrium when a price is reached at which all firms are in equilibrium (proceeding at the minimum point of their LAC curve and making just normal profits). Under these conditions there is no further entry or exit of firms in the industry, given the technology and factor prices. The long-run equilibrium of the industry is shown in fig. 6.17. At the market price, P, the firms produce at their minimum cost, earning just normal profits. The firm is in equilibrium because at the level of output X.

LMC = SMC = P = MR. This equality ensures that the firm maximizes its profits.

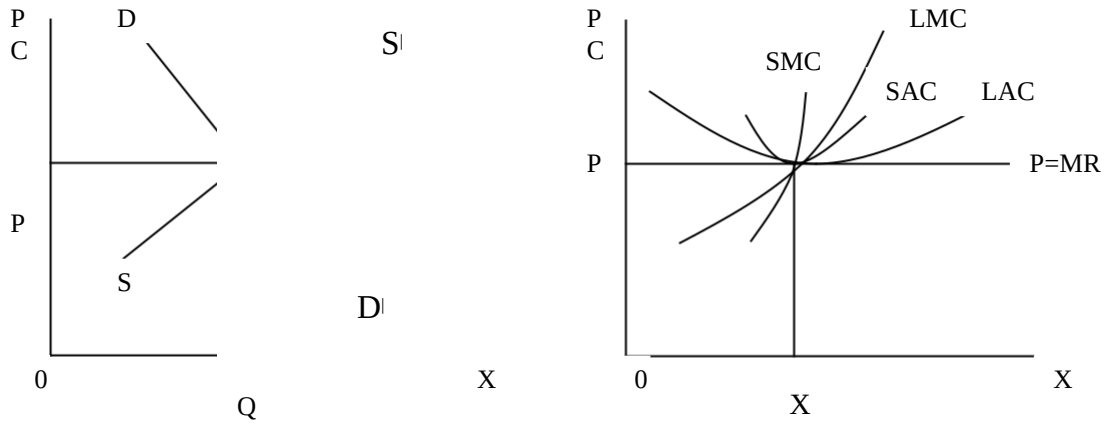


Figure 6.17

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

This is observed at the minimum point of the LAC curve. With all firms in the industry being in equilibrium and with no entry or exit, the industry supply remains stable, and, given the market demand (DD$^{|}$) in fig.6.17, the price P is a long run equilibrium price.

Since the price in the market is unique, this however, does not mean that all firms in the industry have the same minimum long-run average cost. This, however, does not mean that all firms are of the same size or have the same efficiency, despite the fact that their LAC is the same in equilibrium. The more efficient firms employ more productive factors of production and/or more able managers. These more efficient factors must be remunerated for their higher productivity; otherwise they will be bid off by the new entrants in the industry. In other words, as the price rises in the market the more efficient firms earn a rent which they must pay to their superior resources. Thus rents of more efficient factors become costs for the individual firm, and hence the LAC of the more efficient firm‟s shifts upwards as the market price rises, even if the factor prices for the industry as a whole remain constant as the industry expands. In this situation the LAC of the old, more efficient, firms must be redrawn so as to be tangent at the higher market price. The LMC of the old firms is not affected by

the rents accruing to its more productive factors. (It will be shifted only if the prices of factors for the industry in general increase.)

Thus the more efficient firms will be in equilibrium, producing that output at which the redrawn LAC is at its minimum (at which point the LAC is cut by the initial LMC given that factor prices remain constant). Under these conditions, with the superior, more productive resources properly cost at their opportunity cost, all firms have the same unit cost in their long-run equilibrium. This is shown in fig. 5.18.

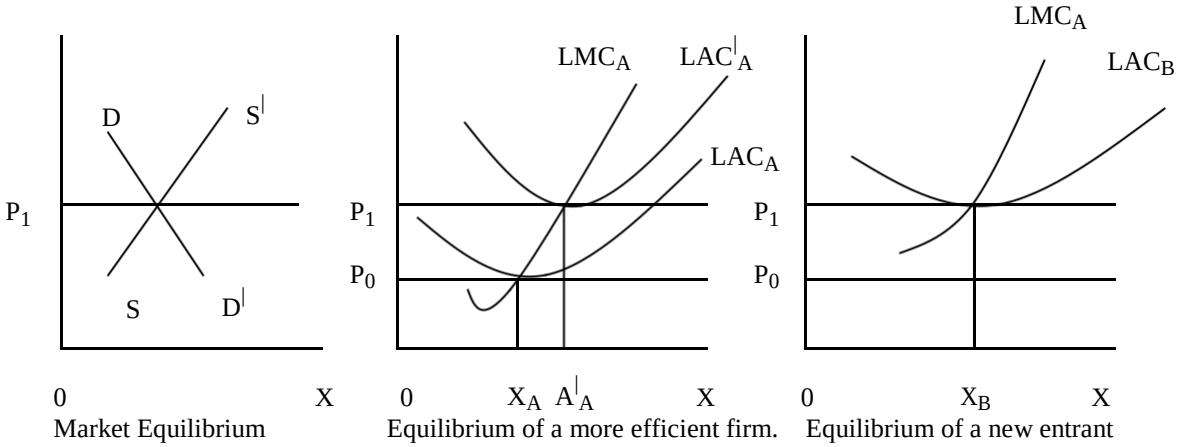


Fig. 6.18

At the initial price P_0 the second firm as not in the industry as it could not cover its costs at that price. However, at the new price, P_1, firm B enters the industry, making just normal profits. The established firm A earns rents which are imputed costs, so that its LAC shifts upwards and it reaches a new long-run equilibrium producing a higher level of output ($X^{|}_A$).

Long Run Shut Down Decision

Dear learner, do you remember the short run shut down point of a firm? If you don‟t remember, please revise section-.for the time being the time being the following paragraph may remind you. (About the short-run shut down point)

In the short-run the firm should continue production as far as the market price is greater than the minimum AVC, If the market price falls below the minimum AVC, the firm is well advised to shut down because if it shut down it well loose only the fixed costs but if it continues production the loss is greater than the fixed cost.

The long-run shut down decision (point) is different from that of the short run. The firm shuts down if its revenue is less than its or a variable cost. In the long run all costs are variable

because the firm can change the quantity of all inputs. Thus, in the long run the firm shuts down when its revenue falls below the long run total cost. In other words, in the long run shut down decision occurs if the market price falls below the minimum LAC of the firm.

6.4.3. Industry's Long Run Supply Curve

In our analysis of short run supply, we first derived the firm‟s supply curve and then showed how the horizontal summation of individual firms‟ supply curves generated and market supply curve. We cannot analyze long run in the same way, however, because in the long run firms enter and exit the market as the market price changes. This makes it impossible to sum-up curves- we don‟t know which firms‟ supplies to add.

To determine the long run supply curves, we assume all firms are access to the available production technology. Output is increased by using more inputs, not by invention. We also assume the prices of inputs for the production are constant while the industry is contracting and expanding.

The shape of the long run supply curve depends on the extent to which increases and decreases of industry output affect the prices those firms must pay for inputs in the production process. Therefore, it is important to distinguish among three types of industries: constant cost, decreasing cost and increasing cost industries.

Perfect competition and optimal resource allocation

In the perfect competition, the market mechanism leads to an optimal allocation of resources. The optimality is shown by the following conditions all of which prevail in the long run equilibrium of the industry;

a) The output is produced at the minimum feasible cost. That is all firms produce at the minimum of their LAC.

b) Consumers pay the minimum possible price which just covers the marginal cost of production, that is, price equals just opportunity cost so that the consumers are not exploited.

c) Plants are used at full capacity in the long- run so that there is no waste of resources. That is, at the long run equilibrium the short run average cost is also minimum.

d) Firms earn only normal profits.

These conditions justify the fact that perfect competition results in optimal resource allocation.

Summary

- A perfectly competitive market is a market structure characterized by large number of buyers and sellers, homogenous product, free entry and exit, no government regulation and perfect knowledge of the market conditions,. Each buyer and seller in this market structure is a price taker due to the large number of buyers and sellers and homogeneity of the product.
- Since an individual seller is a price taker, profit maximization in perfect competition involves determination that level of output which maximizes the firm‟s profit for the given market price. In the short run, the equilibrium (profit maximizing) level of output is that level of output which satisfies the condition: MC = MR and MC is rising.
- The fact that a perfectly competitive firm is in equilibrium doesn‟t necessarily mean that the firm enjoys a positive profit. Whether the firm gets positive or negative profit depends on the firms average cost (AC) production with respect to the market price (P). If AC>P, AC < P or AC = P at equilibrium the firm will get negative, positive or zero profit respectively. When the market price of the commodity lower than the minimum AVC, the firm should shut down to minimize its losses. Thus, the firm would supply a commodity to the market only if price of the commodity is at least sufficient to cover the average variable cost. Hence, a firm‟s short run supply curve is that portion of MC curve which lies above the minimum AVC.
- Short run equilibrium of the industry is defined by the intersection of market demand and industry supply curves.
- In the long run, profit maximizing completive firms chooses the output at which price is equal to long- run marginal cost and long –run average cost. In the long run, a firm can get only a normal profit.
- Perfect competition results in efficient allocation of resources.

Self-check Exercise

1. Is any loss a sufficient condition for the firm to shut down? Explain!

2. In the long run, all firms under perfectly competitive conditions earn only normal profit. Why is this true?
3. Suppose that you are given the following information about a particular perfectly competitive industry.

Market Demand: QD = 6500 – 100P

Market Supply: Qs = 1200P

Firm‟s total cost function: $C(q) = 722 + \frac{q_2}{200}$

Assume that all firms are identical and that the market is characterized by perfect competition.

   a. Find the market equilibrium price and quantity supplied by each firm.
   b. Determine the profit of a firm
   c. Would you expect entry into or exit from the industry in the long –run? Explain
   d. What is the lowest price at which each firm would sell in the long run?

4. Suppose that a competitive firm‟s marginal cost of producing output q is given by MC (q) = 3+2q

   Assume that the market price for the firm‟s product is $9.

   a. What level of output will the firm produce?
   b. Suppose the firm‟s fixed cost is known to be $3. Will the firm be earning positive, negative or zero profit?

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ARBAMINCH UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

ASSIGNMENT FOR MICROECONOMICS I FOR MANAGEMENT STUDENTS

Part I: choose the best answer for each question given below:

1. In order to find the market supply curve of the particular good, one would:
   A. Aggregate firms marginal revenue curves horizontally
   B. Add the firms supply curve vertically
   C. Aggregate the firms marginal cost curves vertically
   D. Aggregate firms marginal revenue curves vertically
   E. Add the firm supply curve horizontally
2. A competitive firm facing the demand and cost curves in the figure above should:
   A. Shutdown immediately
   B. Produce where marginal cost equals marginal revenue
   C. Stay open in the short run and long run
   D. Produce where marginal cost equals average revenue
   E. Stay open in the short run but not in the long run
3. Unlike perfectly competitive firm, a monopoly firm
   A. Can charge any price it wants
   B. Has a horizontal marginal revenue curve
   C. Has an upward sloping total revenue curve
   D. Faces downward sloping demand curve
   E. Faces a horizontal demand curve
4. If the government wants to establish a socially optimal price of for a natural monopoly, it should select the price at which:
   A. Average revenue equals zero
   B. Marginal revenue equals zero
   C. The marginal cost curve intersects the demand curve
   D. The average total cost curve intersects the demand curve

E. Marginal revenue equals marginal cost

5. A production possibility frontier will be a straight line when
   A. Efficiency is achieved.
   B. The goods on the axis are perfect substitutes in consumption.
   C. Utility is maximized.
   D. Resources are not specialized.
   E. The marginal product functions for all inputs are straight lines.
6. Which one of the following is characteristic of perfectly competitive firm's demand curve?
   A. Average revenue is less than price at all levels of output
   B. Marginal revenue is equal to marginal cost at all levels of outputs
   C. Price and marginal revenue are equal at all levels of output
   D. It is the same as the market demand curve
   E. Demand is inelastic at all levels of output
7. Suppose two goods X and Y. If the income of the consumer raised by 8 %, the prices of good X increased by 12 % and the price of Y decreased by 6. Which of the following is true?
   A. The budget line shifts outward
   B. The budget line rotates inward on the horizontal axis
   C. The same slope of the budget line
   D. The budget line rotates inward on the horizontal axis and rotates outward on the vertical axis
   E. All
8. Given two commodities X and Y and level of income M, then if price of one of the Commodities or price of X commodity increases which of the following is not true?
   A. The budget line shifts to the right.
   B. The budget line shifts to the left.
   C. The slope of the budget line changes.
   D. The X and Y intercept changes together.
   E. None

9. Suppose Abebe has a job that pays him birr 25,000 per year after tax. He is considering leaving his job and going to university full time for four years. Tuition fees and books will cost him birr 12,000 per year. Living expenses will cost birr 10,000 per year. What is the opportunity cost of Abebe's four year university degree?

    A. Birr 88,000
    B. Birr 100,000
    C. Birr 120,000
    D. Birr 148,000
    E. Birr188,000

10. In a mixed economies, economic behavior is

    A. Directly only on self interest
    B. Affected by elements of traditional, government command and market incentives.
    C. Random and unpredictable
    D. Based primarily on custom and habit
    E. Largely determined by central authority

11. An economic system that relies primarily upon custom and habit in economic decision making is a:

    A. Mixed system
    B. Communist system
    C. Market system
    D. Command system
    E. Traditional system

12. Economics is best defined as the study of how people, businesses, governments, and societies:

    A. Make choices to cope with scarcity.
    B. Attain wealth.
    C. Choose abundance over scarcity.
    D. Use their infinite resources.
    E. Make choices to cope with shortage.

13. Which of the following is a microeconomic topic?

    A. the reasons for a decline in average prices
    B. the reasons why Abebe buys less orange juice
    C. the cause of why total employment may decrease
    D. the effect of the government budget deficit on inflation
    E. the reasons for a decline in average prices

14. The opportunity cost of something you decide to get is
    A. The amount of money you pay to get it.
    B. The highest valued alternative you give up to get it.
    C. The lowest valued alternative you give up to get it.
    D. All possible alternatives that you give up to get it.
    E. Possibility of losing first best alternative.
15. Which of the following is an example of a normative statement?
    A. Government spending rose in the 1990s.
    B. Household consumption is the largest component of spending.
    C. Households should save more.
    D. The business sector is the primary source of jobs.
    E. None of the above

Part II: Discuss the Following Questions:

1. Mr. Dana's utility of certain income is less than average utility he earns from uncertain income. How do you explain Mr. Dana's attitudes toward risk?
2. Explain the properties of an smooth isoquant
3. State verbally the law of diminishing marginal return.
4. As a matter of cumulative experience with production the firm's marginal and average costs of producing a given output decreases because of certain reasons. Identify and give description of four reasons that contributes for the above mentioned idea.

Part III: work-out item: compute the following and show your steps clearly.

1. Assume the total cost function is: $TC= 20 + 4Q – 0.5Q^2 + 0.5Q^3$, then find
    A. The AFC & AVC function?
    B. The Minimum AC?
    C. The Minimum AVC?
    D. The Minimum MC?

2. Take a case of a given firm operating in a perfectly competitively market and its TFC = birr 500, TVC = birr 400 and TR = birr 600. Should the firm stay in the business? What will be your answer if the TR changes to birr 350?
3. Suppose a firm has a cost structure given by

   TC = $5q - 0.5q^2 + 2q^3$ and the market price of the commodity is birr 20

   A. Determine the profit maximizing output

   B. Determine the breakeven price

   C. What minimum market price the firm needs to continue production?