

## **ANNEXURE 1**

# **BASIC MICRO AND MACROECONOMICS**

**AN INTRODUCTION FOR NON-ECONOMISTS**

## ANNEXURE 1 – BASIC ECONOMIC THEORY AND LINKS TO ENVIRONMENTAL ECONOMICS

### 1.0 INTRODUCTION TO ECONOMICS

#### 1.1 DEFINITION OF ECONOMICS

There are as many definitions of economics as there are authors:

- Economics is the study of how people and society choose to employ scarce resources that could have alternative uses in order to produce various commodities and to distribute them for consumption, now or in the future, among various persons and groups in society;
- Economics is concerned with the efficient utilisation or management of limited productive resources for the purpose of maximising human satisfaction of needs; and
- Economics is a social science, which studies the principles controlling the alternative applications of limited means in satisfying unlimited wants.

The list can be endless! However, the above definitions touch on several different themes of economics including:

- a) Scarcity;
- b) Choice;
- c) Opportunity cost;
- d) Specialisation;
- e) Exchange;
- f) Equity or income distribution; and
- g) Economic Systems.

#### a) Scarcity

Scarcity occurs when commodities used to satisfy people's material wants are not available in adequate amounts. Scarce commodities are called **economic goods**. Commodities that are not scarce are called **free goods**. The problem of scarcity is commonly known as the **Economic Problem**. It has two aspects:

- Society's material wants: the material wants of its citizens and institutions, are virtually unlimited or insatiable; and
- Economic resources: the means for producing goods and services are limited or scarce.

An important question is: "why are commodities scarce?" They are scarce because the resources used to produce them are also scarce. These economic resources are land, labour and capital. They are also called the factors of production or inputs. Of particular note, the environment is limited in its capacity to provide non-renewable resources and absorb waste products.

### **Land**

Land refers to natural resources such as soil, water, minerals, climate, natural grasslands and woodlands. To the economist, therefore, the meaning of 'land' is broader than its usual meaning.

Below are some of the characteristics of land.

- limited in supply;
- no costs of production;
- varies in quality;
- has a wide range of alternative uses; and
- more productive land is in greater demand.

### **Labour**

Labour is the supply of human resources both physical and mental, available for the production of goods and services. The supply of labour is the number of hours which people are willing to work for a given wage-rate over a period - say a year. The supply of labour will, therefore, depend on the number of workers found multiplied by the average number of hours worked by each worker. Ability and willingness to work do not, in themselves, guarantee employment. Job creation depends on the expansion of the economy. The supply of labour must also consider the quality of labour and how efficiently the workers do the tasks given to them. The **efficiency of labour** depends on education and knowledge of the work force, motivation, working conditions and social welfare.

### **Capital**

Unlike land, capital is a man-made resource. The term capital in economics is all man-made aids to further production. Examples of capital are buildings, machines and other equipment, which

are used in making the goods we consume. On the other hand, money required for the production process is known as **liquid capital**.

Capital may be considered under various categories:

- fixed capital;
- working or circulating capital;
- social capital;
- human capital; and
- natural capital including renewable and non-renewable natural resources.

### **b) Choice**

If all things are scarce in comparison to the desire for them, and if people have a lot of unsatisfied wants, obviously they cannot satisfy all of their wants. People therefore have to make choices. In this case the economic problem is how best to use resources available to satisfy human wants.

### **c) Opportunity Cost**

Opportunity cost is a direct result of having to make a choice. It is therefore an indirect result of the problem of scarcity. In making a choice, people have to sacrifice - "having (a) means going without (b)". This sacrifice is called opportunity cost or the cost of something given up in terms of alternatives forgone when a choice is made. In environmental economics the concept of option value is quite relevant. Society may proceed with a development that precludes other options in the future. People value keeping their options open for using the environment.

### **d) Specialisation**

Specialisation results from division of labour. It is again a result of the problem of scarcity. Its aim is to increase the productivity of labour to produce more goods and services with a given level of capital. This will in turn increase the ability of people to satisfy their material wants.

### **e) Exchange**

Exchange complements specialisation. Any commodities produced must be bought and sold to help economic growth. There must be a ready market for those commodities produced otherwise specialisation would be of no benefit. The principle on which exchange is based is called the **Law of Comparative Advantage**. It states that it is beneficial if one specialises in the

production of the commodity in which he/she is more efficient. International trade is based on this very simple principle.

#### **f) Equity or Income Distribution**

The distribution of income in society and suggesting how poor and disadvantaged people can be helped without harming the economy. Evaluating income distribution is a fundamental element of modern economics.

#### **g) Economic Systems**

Another way to combat the problem of scarcity is to organise production and exchange into an economic system. An economic system has two elements:

- the forces of production; and
- the relations of production.

The forces of production include tools, factories, equipment, production skills, the level of knowledge of the labour force, natural resources, and the general level of technology. The relations of production are the social relationships between humans, particularly the relationship of each class of humans to the means of production.

The basic types of economic systems or organisations are usually described as:

#### **a) Traditional economies**

Custom and habit forms the cornerstone of the system of solving the economic problem. It is reinforced by superstition and religious beliefs and is common in some developing countries.

#### **b) Market economies**

There is predominantly private ownership of economic resources. The allocation and distribution of economic resources is determined by production, sales and purchase decisions taken mainly by firms and households through the market forces of demand and supply.

#### **c) Command economies**

This is a centrally planned economy where most decisions about the ownership, allocation and distribution of resources are taken by the central authorities. Firms and households produce

according to a “plan” drawn up by government bureaucrats. Competitive markets are not usually allowed to function.

#### **d) Mixed economies**

This is where the economic system is a combination of some or all of the other three systems. It may include some level of a market economy with a strong central government. There might be shifts in balance between these two forces.

## **1.2 BRANCHES OF MODERN ECONOMICS**

Over the past few decades, modern economics has greatly expanded its can be generally divided into two main areas of study: macroeconomics and microeconomics.

#### **Microeconomics:**

Considers the behaviour of the individual on the farm or street, the individual firm, or even the individual industry. Common questions include; how are prices set by a company, how does supply and demand work, and how do people make decisions over their individual savings and spending patterns?

#### **Macroeconomics:**

Addresses the "big picture", looking at things like national and international production, income, employment, price levels and trade. Macro-economics looks at how a national economy is performing and may try to predict with the aid of various models, how the economy might perform in the future, or react to specific policy measures. The impact of macro-economic policies on the environment is becoming an important question.

Within these core elements, a wide range of specialised disciplines have emerged where economists focus on a particular sector or issue such as international trade, welfare (analysing what is right or wrong about an economic system), finance, labour, development, agriculture, natural resources and environment. Natural resource economics is the application of basic macro and microeconomic economic theory to the allocation and use of natural resources. Even within this discipline, more specialised areas such as forest economics and mining economics

have developed. More recently, **environmental economics** (also called “ecological economics”) has emerged as a new discipline combining economics with ecology, sociology, engineering, etc. It is helping us to better understand how we use the environment, where and why society has gone wrong in terms of overexploitation of resources and environmental pollution, and more important, how rational solutions can be developed.

Economics cannot and should not be used solely for making decisions about natural resources and the environment. However, it can and should be used to provide information to society to help make better decisions about our future development path. Political decisions will still occur based on normative opinions of “what ought to happen”. Even the best economic studies cannot prevent this from occurring. However, environmental economics can help illustrate the cost to society from following certain courses of action.

## **2.0 INTRODUCTION TO MICROECONOMICS**

### **2.1 BACKGROUND**

Microeconomics helps us gain an understanding of the process by which, scarce resources are allocated among alternative uses in a modern economy, and of the role of prices and markets in this process. Concepts from microeconomics have been applied to assist rational decision-making in business through the development of operations research, management science and business economics.

### **2.2 ELEMENTS OF MICROECONOMICS**

The most basic elements considered in microeconomics are:

- a) commodities;
- b) prices;
- c) markets;
- d) economic agents; and
- e) rationality.

**a) Commodities**

These are the central objects of economic activity, since 'economic activity' consists of the production and exchange of commodities. We distinguish commodities from each other by one or more of three characteristics:

- Their physical nature and attributes;
- The location at which they are made available; and
- The date at which they are made available.

**b) Prices**

Prices are effectively commodity rates of exchange - they express the rate at which buyers and sellers agree to exchange either money for commodities (so many dollars for so many bags of fertiliser) or simply an exchange of commodities (so many pairs of shoes for so many bags of fertiliser). A major problem in environmental economics is that many natural resources and environmental services lack market prices. Assigning values to these goods and services is a major challenge of environmental economics.

**c) Markets**

A market exists whenever two or more individuals are prepared to enter an exchange transaction, regardless of time or place. The word 'market' denotes an exchange situation. The central problem of microeconomics is the analysis of how markets operate, since we view the process of resource allocation as a market process a resource allocation is brought about by the workings of markets.

**d) Economic Agents**

The basic units of analysis in microeconomics are the individual economic agents or decision-takers (hence the term microeconomics), who are actually classified either as consumers or firms. A consumer is regarded as an individual who may own initially certain stocks of commodities, his 'initial endowment' (counted as part of his wealth), and who has to choose an amount of each commodity (which may of course be zero) to consume.

A firm is also usually regarded as an individual decision-taker, undertaking the production of commodities by combining inputs in technological processes. These inputs will usually

themselves be commodities, some of which the firm may own as part of its initial endowment, and some of which it may buy on the relevant markets.

The crux of the distinction between consumers and firms is the nature of their economic activity: consumers buy and sell commodities to consume; firms buy inputs and produce commodities to sell.

### **e) Rationality**

In whatever way we break down the distinction between consumers and producers in microeconomic models, we assume that the individual decision-taker is the basic unit of analysis and the decision-taker is rational.

We say that rational decision-taking takes the following form:

- The decision-taker sets out all the feasible economic alternatives which are open to him;
- The consequences of choosing each of the alternatives is assessed, using the best information available;
- Alternatives are ranked in order of preference; and
- Alternatives highest in this ordering are chosen first.

The requirements of rationality are not always consistent with reality. People do behave irrationally. In taking a decision, they may:

- Ignore known alternatives;
- Be influenced by infeasible alternatives;
- Not bother to collect information on the consequences of their decisions;
- Contradict themselves in ranking of alternatives; and
- Choose an alternative whose consequences are known to be less attractive than those of another alternative.

Clearly, the assumption of rationality is a hypothesis; we can quite well conceive of its being false for a particular decision-taker.

## 3.0 DEMAND, SUPPLY AND PRICE

### 3.1 DEMAND

Demand refers to the amount of a commodity (good or service) that consumers are willing and able to purchase at a given price and over a specified period of time. In economics, we focus on effective demand. Effective demand refers to the demand from people who have income to allow them to make actual purchasing decisions. The demand for a commodity shows a relationship between prices and quantities consumers are willing to purchase.

#### 3.1.1 Determinants of Demand

The determinants of demand are the factors that affect the demand for a commodity. The factors can be grouped into two categories:

- Price of the commodity and effect on demand
- Conditions of demand

A change in price does not affect the position of the demand curve whereas a change in the conditions of demand results in shift of the whole demand curve. We now discuss the effects of these determinants on demand.

##### a) Demand and Price

The relationship between price and quantity demanded is an inverse one, ie, more of a commodity is demanded at a lower price than at a higher price. This is the **First Law of Demand and Supply (or Law of Demand)**.

##### Demand Schedule

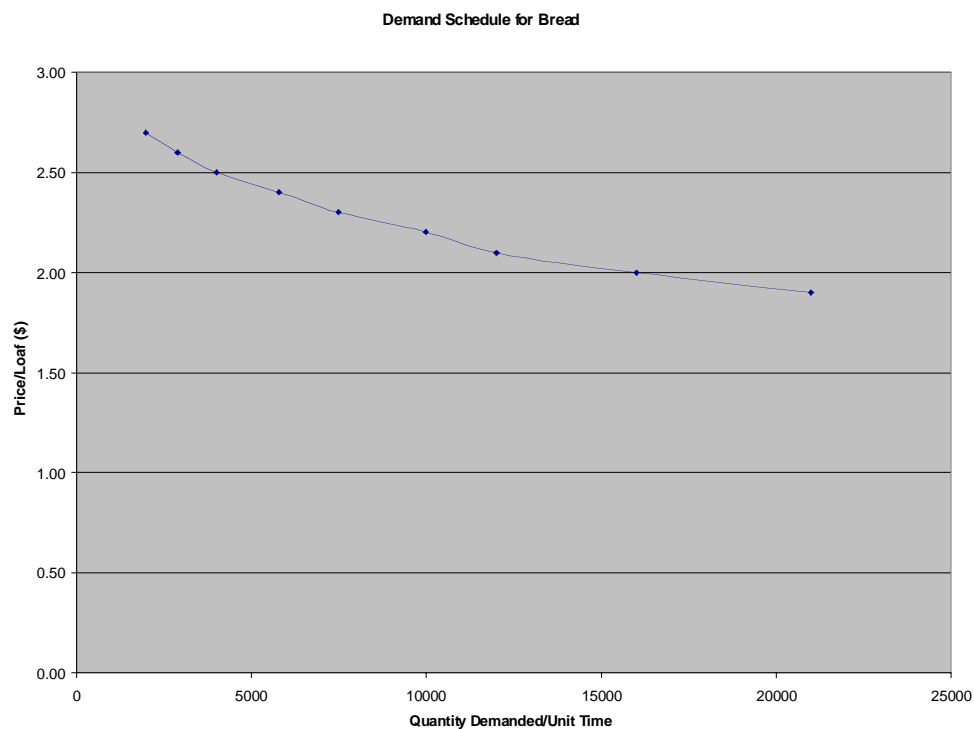
A demand schedule is a numerical way of showing the relationship between the quantity demanded and price (Table 1).

**Table 1: Loaves of white bread demanded during a single month**

PRICE PER LOAF (\$)	QUANTITY DEMANDED
1.90	21,000
2.00	16,000
2.10	12,000
2.20	10,000
2.30	7,500
2.40	5,800
2.50	4,000
2.60	2,900
2.70	2,000

### Demand Curve

If we plot the data in Table 1 with the price on the vertical axis and quantity demanded on the horizontal axis we get what is called a demand curve (Figure 1).

**Figure 1: Demand schedule for bread**

### **The Demand Curve Slopes Downwards**

The demand curve shows the quantity of a commodity (bread) that the people would like to buy at every possible price; the negative slope indicates that the quantity demanded increases as the price falls and vice versa. A single point on the demand curve indicates a single price-quantity relation. It is important to note that when the price of a commodity changes quantity demanded, rather than demand, changes. A change in price does not alter the position of the demand curve. Instead, it results in a **movement along the demand curve**.

### **b) Demand and Conditions of Demand**

Conditions of demand refer to all the factors that affect demand for a commodity except price. When these factors change demand also changes. Note that when the price of a commodity changes quantity demanded, rather than demand, changes. Conditions of demand include any of the following factors:

- Price of other commodities;
- Size and distribution of household income;
- Size and distribution of population;
- Tastes and preferences;
- Expectations of future changes in prices; and
- Sociological factors like place of residence, religion, number of children, etc.

### **3.1.2 Types of Demand**

#### **a) Joint/Complementary Demand**

Demand for two or more goods that are needed together at the same time, one being not very useful without the other. Examples include:

- Cars and petrol;
- Bread and butter;
- Computers and computer paper;
- Grain and milling services; and
- Fish and fishing boats.

### **b) Derived Demand**

Demand for a good or service that is needed as a result of the demand for another good or service. Examples include:

- Demand for cotton based on the demand for clothing;
- Demand for pulpwood based on the demand for newspapers;
- Demand for lumber based on the demand for housing;
- Demand for specialised consulting services based on the demand for environmental assessment studies; and
- Demand for unleaded petrol based on demand for new vehicles with emission control equipment.

### **c) Competitive Demand**

Close substitutes where an increase in the demand for one will lead to a decrease in the demand for the other. Examples include:

- High demand for cotton reduced the demand for synthetic fibres;
- High demand for maize-meal reduces the demand for bread;
- High demand for opaque beer reduces the demand for clear beer;
- High demand for charcoal reduces the demand for kerosene (and also increase timber cutting); and
- High demand for cars (as average incomes increase) reduces the demand for public transport.

## **3.2 SUPPLY**

Supply refers to the amount of a commodity (good or service) that producers are willing and able to offer for sale at a given price and over a specified period of time. Economists focus on effective supply. Effective supply refers to the supply from firms who have the commodity in stock, ie, supply backed by performance. The supply of a commodity shows a relationship between prices and quantities producers are willing to offer for sale.

### 3.2.1 Determinants of supply

The determinants of supply are the factors that affect the quantity supplied of a commodity. The factors can be grouped into two categories:

- Price of the commodity, and
- Conditions of supply (or shift factors).

A change in price does not affect the position of the supply curve whereas a change in the conditions of supply results in shift of the whole supply curve. We now discuss the effects of these determinants on supply.

#### a) Supply and Price

The relationship between price and quantity supplied is a direct one, ie, more of a commodity is supplied at a higher price than at a lower price. This is the **Second Law of Demand and Supply (or Law of Supply)**.

More of a commodity is offered for supply by firms at higher prices because it is profitable than when the selling price is lower. Firms aim to maximise their profits.

#### Supply Schedule

A supply schedule is a numerical tabulation showing the quantity that is supplied at selected prices, as shown below (Table 2).

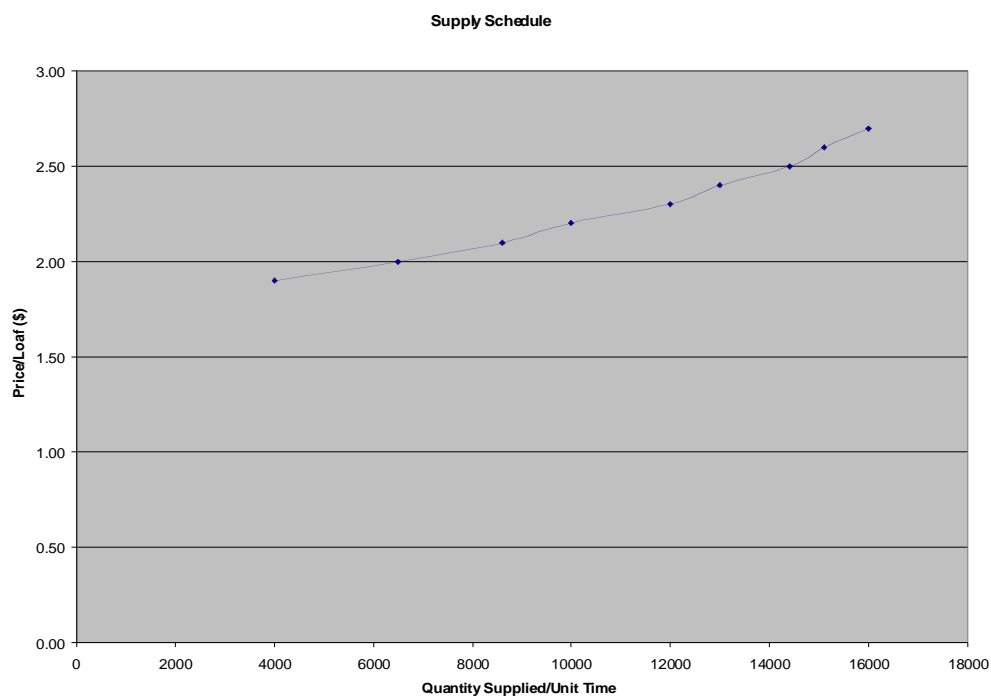
**Table 2: Loaves of white bread supplied during a single month**

PRICE PER LOAF (\$)	QUANTITY SUPPLIED
1.90	4,000
2.00	6,500
2.10	8,600
2.20	10,000
2.30	12,000
2.40	13,000
2.50	14,400
2.60	15,100
2.70	16,000

### Supply Curve

If we plot the data in Table 2 above with the price on the vertical axis and quantity supplied on the horizontal axis we get a supply curve (Figure 2).

Figure 2. Supply schedule for bread



The supply curve shows the quantity of a commodity (bread) that the firm would like to offer for sale at every possible price, and its positive slope indicates that the quantity supplied increases as the price rises. A single point on the supply curve indicates a single price-quantity relation. When the price of a commodity changes, the quantity supplied, rather than total available supply, changes. A change in price does not alter the position of the supply curve. Instead, it results in a **movement along the supply curve**.

### **The Supply Curve Slopes Upwards**

As prices rise or are expected to rise, firms are willing to supply increasing quantities of their product on the market because they will increase overall profits.

### **b) Conditions of Supply**

The other set of factors that effect supply are called the conditions of supply or shift factors. When these factors change, the supply also changes. Conditions of supply include any of the following factors:

- Price of factors of production, eg. wages, rent, interest rates, etc.;
- Government policy, eg. taxes, subsidies, pricing policies (agricultural sector), etc.;
- State of technology;
- Goals of the firm, ie, whether the firm aims to maximise profits (private firm) or sales (parastatal);
- Weather conditions - affects the agricultural sector directly and the other sectors indirectly;
- Discovery of new sources of raw materials and exhaustion of old ones; and
- Expectations about future changes in demand patterns, political climate, etc.

## **3.2.2 Types of Supply**

### **a) Joint supply**

These refer to goods and services that are produced together at the same factory. One example is an oil refinery producing aviation gas, LPG, Petrol, Illuminating Paraffin, diesel, and various other by-products. Another example is a pulp mill producing lignin and other chemical by-products as well as pulp and paper.

### **b) Competitive Supply**

At times, the expansion in the production of one commodity results in a decrease in production of another. This is called the **opportunity cost** in resources. Examples include:

- With limited arable land resources, expanding cotton production must obviously reduce maize production
- With the Zambezi river, major diversions for irrigation or to supply water to urban centres would reduce water levels at the dam and hence electricity generation
- For a given forest area, increasing timber supply by cutting more trees would mean the reduction of wildlife habitat and recreation benefits

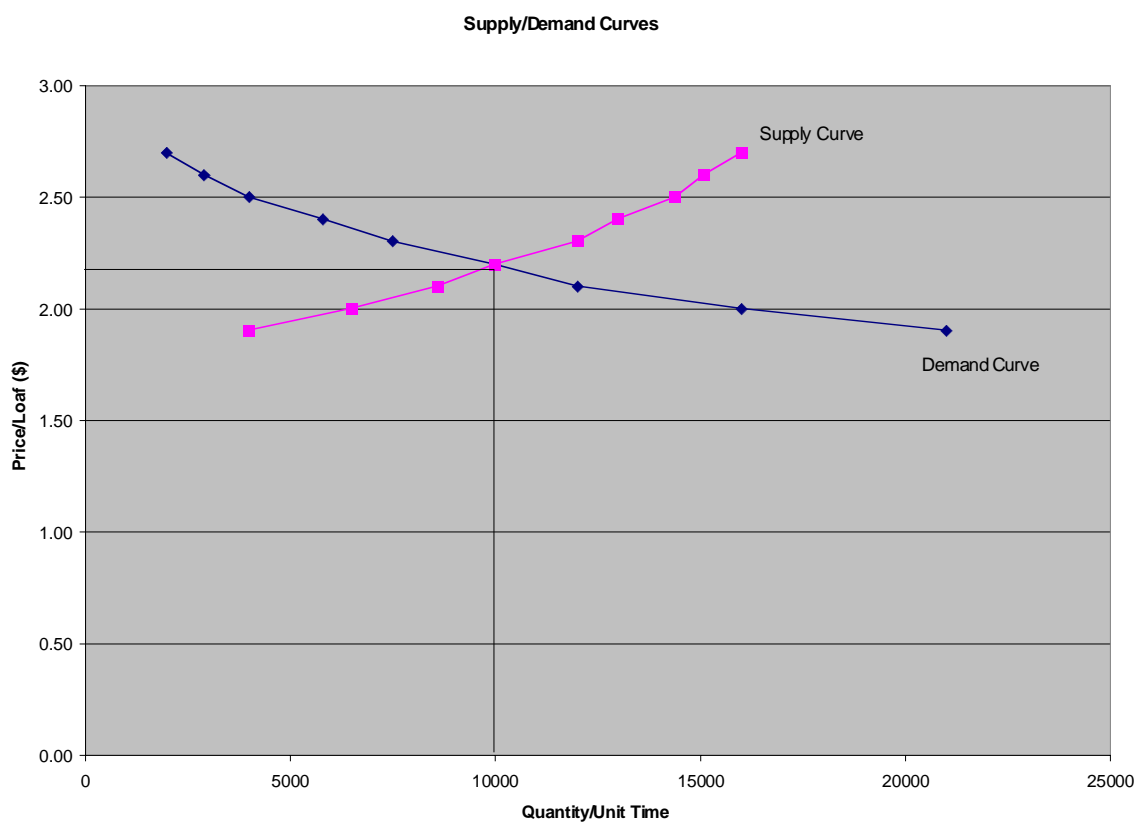
### 3.3 MARKET EQUILIBRIUM

The demand and supply schedules can be combined in a single table as shown below (Table 3). This table shows, among others, a single price where the quantity demanded and quantity supplied are equal. In this example, the price is \$2.20 and 10,000 loaves of bread are both demanded and supplied in a month. The price, which clears the market is called the **equilibrium price** and the quantity that is traded at that price is called the **equilibrium quantity**. The term equilibrium means a state of balance; it occurs when desired purchases equal desired sales. This is the **Third Law of Demand and Supply**, which states that equilibrium price equates demand and supply.

**Table 3: Demand and supply for white bread in one month**

PRICE PER LOAF (\$)	DEMAND	SUPPLY
1.90	21,000	4,000
2.00	16,000	6,500
2.10	12,000	8,600
2.20	10,000	10,000
2.30	7,500	12,000
2.40	5,800	13,000
2.50	4,000	14,400
2.60	2,900	15,100
2.70	2,000	16,000

The data in Table 3 above can be plotted to show the interaction of demand and supply curves (Figure 3).

**Figure 3: Demand and supply equilibrium**

### 3.4 CHANGES IN DEMAND AND SUPPLY

#### a) Demand changes while supply remains constant

The effects of a change in demand on price and quantity is contained in the **Fourth Law of Demand and Supply** which states that, other things being equal, an increase in demand will raise the price which in turn results in an increase quantity supplied. A decrease in demand will lower the price and result in a decrease in quantity supplied.

#### b) Supply changes while demand remains constant

The effects of a change in supply on price and quantity is contained in the **Fifth Law of Demand and Supply**. It states that, other things being equal, an increase in supply will lower the price which in turn results in an increase quantity demanded while a decrease in supply will raise the price and result in a decrease in quantity demanded.

## 4.0 ELASTICITY OF DEMAND AND SUPPLY

### 4.1 ELASTICITY OF DEMAND

Elasticity of demand refers to the responsiveness of quantity demanded to changes in any of the factors that affect the demand for a commodity. These determinants of demand were discussed in section 3.1.1.

Although there are many factors that determine the demand for a commodity only three of them are important for elasticity of demand purposes:

- Price of the commodity,
- Income of the household, and
- Price of other commodities.

From these three determinants of demand we get three important types of elasticity of demand which are:

- a) Price elasticity of demand,
- b) Income elasticity of demand, and

c) Cross elasticity of demand.

### a) Price Elasticity of Demand

Price elasticity of demand refers to the degree of responsiveness of the quantity demanded for a good or service to changes in its price. It is the relationship between a proportionate change in price and a proportionate change in quantity demanded.

The formula used to calculate price elasticity of demand is:

$$PED = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in price}}$$

### EXAMPLE OF ELASTICITY

If we know the price elasticity of demand for game drives in a National Park is -2.0, what does this mean? Well, if a tour operator plans to increase his price per game drive by 10%, we know that:

$$Ed = \frac{\% \text{ change in } Q}{\% \text{ change in } P} \quad \text{thus, } -2.0\% = \frac{\% \text{ change } Q}{10\%}$$

Solving for Q gives us -20%. Therefore, the tour operator can logically expect the quantity demanded for game drives to decrease by 20% if he increases his prices by 10%.

### Interpretation of price elasticity of demand

Ignoring the minus sign,

- If  $PED > 1.0$  demand is price elastic
- If  $PED < 1.0$  demand is price inelastic
- If  $PED = 1.0$  demand has unitary price elasticity; here the percentage change in price equals the percentage change in quantity demanded

**A high price elasticity of demand means that the change in price is less than the change in quantity demanded. The opposite is true for a good with low elasticity of demand.**

The minus sign on the numerical value of price elasticity of demand indicates the inverse relationship between price and quantity demanded. In other words it emphasises the Law of Demand and a downward sloping demand curve.

### **Different Price Elasticities of Demand**

#### i) Perfectly elastic demand

- Elasticity is infinite at all points on the demand curve.
- The demand "curve" is a straight horizontal line.

#### ii) Relatively elastic demand

- Change in price causes a larger percentage change in quantities demanded.
- Slope of the demand curve will usually be fairly shallow.

#### iii) Unitary elasticity

- Change in price causes the same proportionate change in quantity demanded.

#### iv) Relatively inelastic demand

- Change in price causes a smaller percentage change in the quantities demanded; and
- The demand curve usually has a fairly steep slope.

#### iv) Perfectly inelastic demand

- The same quantity is demanded whatever the price; and
- The demand "curve" is a straight vertical line.

### **Factors Affecting Price Elasticity of Demand**

- The availability of close substitutes;
- The nature of the commodity's substitutes;
- The proportion of the prices of the commodity relative to one's income;
- Whether the good is a basic necessity or a luxury ; and
- The relevant time period.

- The possibility of new purchasers
- Habits and impulse

### **b) Income Elasticity of Demand**

Income elasticity of demand refers to the degree of responsiveness of demand for a commodity, to changes in income. In other words it is the relationship between a proportionate change in income and a proportionate change in quantity demanded.

The formula used to calculate of income elasticity of demand is:

$$IED = \frac{\text{percentage change in quantity demanded}}{\text{percentage change in income}}$$

### **Interpretation of income elasticity of demand**

For most commodities, increases in income lead to increases in quantity demanded, and income elasticity is therefore positive. Commodities with positive income elasticities are called **normal goods**. For such commodities, we have some subdivisions of income elasticity as for price elasticity, ie,

- If  $IED > 1.0$  demand is income elastic
- If  $IED < 1.0$  demand is income inelastic
- If  $IED = 1.0$  demand has unitary elasticity; here the percentage change in income equals the percentage change in quantity demanded

### **c) Cross Elasticity of Demand**

Cross elasticity of demand is the degree of responsiveness of demand for one commodity, to changes in the price of another commodity. In other words it is the relationship between a proportionate change in price of one commodity and a proportionate change in the quantity demanded of another commodity.

The formula used in the calculation of cross elasticity of demand between two commodities X and Y is:

$$IED_{xy} = \frac{\text{percentage change in quantity demanded of } X}{\text{percentage change in price of } Y}$$

### **Interpretation of Cross Elasticity of Demand**

Complementary commodities have negative cross-elasticities of demand and substitutable commodities have positive cross elasticities of demand. An example is:

- Bread and margarine are complementary commodities: a fall in the price of margarine causes an increase in the consumption of both commodities. Thus changes in the price of margarine and changes in the quantity of bread have opposite signs.
- In contrast, butter and margarine are substitutable commodities: a fall in the price of butter increases the quantity demanded of butter, but reduces the quantity demanded of margarine.
- Changes in the price of butter and margarine demanded will, therefore, have the same sign.

## **4.2 ELASTICITY OF SUPPLY**

Elasticity of supply is the responsiveness of quantity supplied to changes in any of the factors that affect the demand for a commodity. Although there are many factors that determine the supply of a commodity only price is important for elasticity of supply.

### 4.2.1 Price Elasticity of Supply

Price elasticity of supply refers to the degree of responsiveness of the quantity supplied of a good or service to changes in its price. That is why it is also called own price elasticity of supply.

The formula used to calculate of own price elasticity of supply is:

$$PES = \frac{\text{percentage change in quantity supplied}}{\text{percentage change in price}}$$

#### Interpretation of Price Elasticity of Supply

- If  $PES > 1.0$  supply is price elastic
- If  $PES < 1.0$  supply is price inelastic
- If  $PES = 1.0$  supply has unitary price elasticity; here the percentage change in price equals the percentage change in quantity supplied

#### Different Elasticities of Supply

a) Perfectly inelastic supply:

- Supply is fixed and is a straight vertical line.

b) Unitary elasticity

- Change in price leads to an equal proportionate change in the quantity supplied.

c) Perfectly elastic supply

- Any quantity is supplied at a given price.
- Supply curve is a straight horizontal line.

### **Determinants of the price elasticity of supply**

Price elasticity of supply depends on the willingness and ability of the producer to respond to a change in prices. **Several factors affect supply elasticity:**

- The cost and economic feasibility of storage of the goods.
- Characteristics of the production process
- Cost and availability of resource inputs.
- The relevant time period

## **5.0 PRODUCTION, COSTS AND REVENUES**

### **5.1 PRODUCTION**

#### **5.1.1 What is Production?**

In economics, production refers to the provision of goods and services to satisfy human wants and needs. Production is concerned with changing the form of things such as raw materials of iron and steel into finished articles such as motor cars. It could also be the production of fish, trees and wildlife. The provision of services such as banking, education and distribution are also considered as production because they satisfy human wants.

#### **5.1.2 Types of production**

The production process is divided into three stages:

- a) primary production;
- b) secondary production; and
- c) tertiary production.

##### **a) Primary Production**

Primary production is the first stage of production. It involves the extraction of natural resources through industries such as mining, fishing, forestry and farming. The materials output from these industries are in a raw state, which cannot normally be consumed. At this stage of production,

serious environmental degradation can occur through wasteful or improper extraction practices. Most developing country economies in Africa, Latin America and Asia rely heavily on primary products such as minerals, fish and agricultural crops. Countries that rely mainly on primary products tend to be poorer than countries that produce more secondary products. This is because further processing of primary products adds value.

### **b) Secondary Production**

In secondary production, primary materials are transformed into goods, which can be more readily used by consumers. Examples of secondary manufacturing include food processing, producing lumber or pulp from raw timber, making aluminium from bauxite, etc.

### **c) Tertiary Production**

A vital part of the economic process is the transportation and distribution of finished goods to consumers. Secondary goods have to be taken to markets where they can be sold to the public. This is the tertiary stage of production. The tertiary stage involves the production of services, including transport, the wholesale trade, the retail trade, insurance and banking which all form part of the process of moving goods from the factory to the consumer. These services are also known as commerce. Thus workers in transport, finance, insurance, advertising, etc. are known as commercial workers.

## **5.2 PRODUCTION FUNCTION**

The production function describes the relationship between the above four inputs or factor services and the quantity of final product. A production function is written as:

$$Q = (f_1, \dots, f_m)$$

where:  $Q$  = quantity of output produced, and,  
 $f_1, \dots, f_m$  = quantities of inputs used in production

In production, firms as making three different types of decisions:

- How best to employ its existing plant and equipment;
- What new plant, equipment and production processes should be selected within the framework of the existing technology; and
- What to do about encouraging the development of new technology.

The first set of decisions is said to be made over the short-run, the second over the long-run, and the third over the very long-run.

#### **a) Short-run**

The short-run is defined as the period of time over which the inputs of some factors, called **fixed factors**, cannot be varied. As an example, you can't build a new factory overnight if you suddenly want to produce more shoes. In the short-run, production can be changed only by altering inputs that can be varied, in this case leather, thread, etc. These inputs are called **variable factors**.

#### **b) Long-run**

The long-run is defined as the period of time where inputs of all factors can be varied, but not so long enough that the basic plant and technology of production changes. The long-run is a planning period because it corresponds to the situation facing the firm when it is planning to go into business, or to expand or to scale of its operations.

#### **c) Very long-run**

The very long-run is defined as the period concerned with situations in which the technological possibilities open to the firm changes, leading to new and improved products and new methods of production. In other words the production function changes in the very long-run.

While we have three time horizons, which a firm can face, most economists concentrate on the short-run. Sorting out the clash between short and long-run decisions is a major component of environmental economics

### 5.3 SHORT-RUN CHANGES IN OUTPUT

The short-run is concerned with what happens to output (and costs) as increasing inputs of a variable factor are applied to a given quantity of other fixed factors. We might be interested in knowing how output changes when we add more workers (variable input) on a farm but hold constant the level of other inputs such as land and capital (fixed inputs). There are three ways to assess this change in output:

- a) Total product,
- b) Average product, and
- c) Marginal product.

#### a) Total product

Total product (TP) is the total number of units (output) produced with a given quantity of inputs (land, labour, capital, etc.) over a given period of time.

#### b) Average product

Average product (AP) refers to the number of units of output per unit of variable input.

$$\text{Average product} = \frac{\text{units of output}}{\text{units of variable input}}$$

#### c) Marginal product

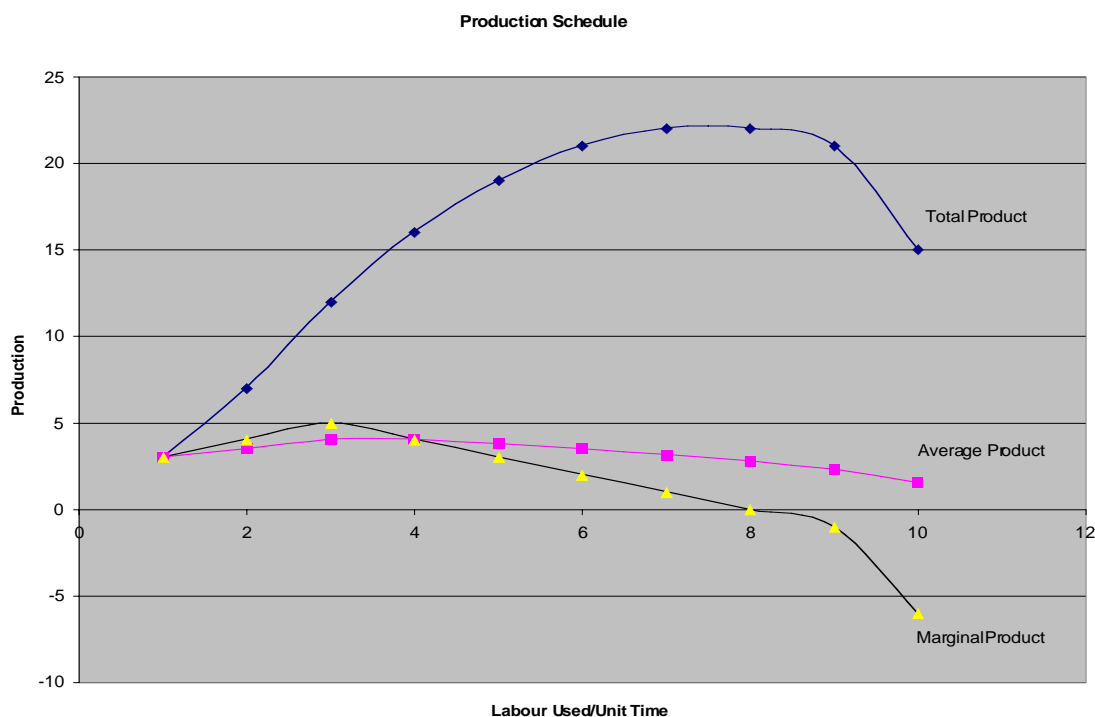
Marginal product (MP) is the change in total output resulting from changing one unit of the variable factor.

$$MP = \frac{\text{change in total product}}{\text{change in variable inputs}}$$

The relationship among TP, AP and MP are illustrated in Table 4 and Figure 4.

**Table 4: Production data for a small maize farm**

<b>LABOUR INPUT (workers)</b>	<b>TOTAL PRODUCT (tonnes)</b>	<b>AVERAGE PRODUCT (tonnes)</b>	<b>MARGINAL PRODUCT (tonnes)</b>
1	3	3.00	3
2	7	3.50	4
3	12	4.00	5
4	16	4.00	4
5	19	3.80	3
6	21	3.50	2
7	22	3.12	1
8	22	2.75	0
9	21	2.33	-1
10	15	1.50	-6

**Figure 4: Production schedule**

### 5.3.1 Changes in Total, Average and Marginal Product

- The total product (TP) increases with additional inputs of labour, first at an increasing rate (where the TP curve is rising steeply), then at a slower rate (where the TP curve begins to level off to the horizontal). The TP curve reaches a maximum point at about 7 units of labour input, and then begins to fall. It can fall because the factors of production begin to clash. For example, adding units of fertiliser will eventually poison the agricultural crop. Adding more and more workers to a factory will eventually lead to congestion;
- Average product is represented by a curve, which rises at first and then declines after 4 units of labour input;
- The marginal product curve rises sharply at first, reaches a maximum at around 3 units of labour input, and then declines, at one point becoming negative as it crosses the x-axis; and
- The Law of Diminishing Returns says that beyond a certain point, additional variable inputs added (in this case, labour) to a fixed quantity of other inputs (land, water, and fertiliser) will

result in smaller and smaller increases in output. This law gives the various curves their shape.

### 5.3.2 Combining the Factors of Production

In a business it is the task of management to combine the factors of production to produce goods and services. For example, management might decide to replace an expensive factor such as capital machinery by a cheaper one such as labour. In mines, production can take place using little labour and large amounts of capital (automatic drills, caterpillars, tractors, trucks, etc) or by combining large amounts of labour with very little capital. Some industries are capital intensive (high capital to labour ratio) while others are labour intensive (low capital to labour ratio) per unit of production.

## 5.4 SHORT-RUN VARIATIONS IN COST

During production, most inputs are not free but must be purchased. Thus, cost functions are derived from production functions. A cost function derived from a production function will be written as:

$$C = f(Q, T, P_i);$$

where     $C$  = total cost  
           $Q$  = total product  
           $T$  = technology  
           $P_i$  = prices of inputs

There are three different ways of looking at how cost varies with the level of production:

- a) Total cost;
- b) Average total cost; and
- c) Marginal cost.

It is important to note that one of the major impediments to environmental sustainability is that most production decisions ignore the costs of environmental impacts. One of the challenges of environmental economics is to identify and quantify these costs so producers can make decisions based on full costs.

### a) Total Cost

Total cost (TC) refers to the total cost of producing any given rate of output. It is divided into two components:

- Total fixed cost (TFC); and
- Total variable cost (TVC).

Fixed costs do not vary with the level of output whereas variable costs do vary with the level of output. Examples of fixed costs include rent, maintenance and depreciation. Examples of variable costs include labour, raw materials and energy. The relationship between total, fixed and variable cost can be shown as follows:

$$TC = TFC + TVC;$$

where: TC = total cost,  
TFC = total fixed costs,  
TVC = total variable cost.

### b) Average Total Cost

Average total cost (ATC) refers to the total cost per unit of output.

$$ATC = \frac{TC}{Q}$$

where: ATC = average total cost,  
Q = output.

### c) Average Fixed and Variable Costs

Average cost may be divided into average fixed cost (AFC) and average variable cost (AVC).

$$AFC = \frac{TFC}{Q} \quad AVC = \frac{TVC}{Q}$$

$Q$  $Q$ 

where: AFC = average total cost  
 TFC = total fixed cost  
 AVC = average variable cost  
 TVC = total variable cost

#### d) Marginal Cost

Marginal cost (MC) refers to change in total cost resulting from the production of one more or less unit of output.

$$MC = \frac{\text{change in total cost}}{\text{change in units of output}}$$

## 5.5 SHAPE OF THE SHORT-RUN COST CURVES

### 5.5.1 Total Cost Curves

- a) The **total cost curve** is **S-shaped** due to the **Law of Diminishing Returns**. At a lower level of output the firm will be under-utilising its plant and equipment. This causes total costs to increase at an increasing rate as output increases. As output keeps increasing, total costs begin to increase at a decreasing rate indicating more efficient utilisation of the plant. At a given level of output, the optimal level, total costs will increase at a constant rate. This is the maximum level of output that must be produced by that firm in the short-run. However, if the firm becomes greedy and produces more output over and above this optimal level, the basic plant and equipment becomes overburdened and total costs will start rising at an increasing rate. In other words the plant will be over-utilised.
- b) The **total variable cost curve** is also S-shaped for the same reason. However, it starts from the origin since it varies with the level of output. When output is zero it will also be zero and only increases as output increases.

- c) The **total fixed cost curve** is a horizontal straight line. This is because fixed costs do not vary with the level of output. They will remain the same whether output is zero or one million. The level of fixed cost is the starting point or intercept for the total cost curve.

The relationship between the total cost curves is shown in Table 5 and Figure 5.

### 5.5.2 Average Cost Curves

All short-run cost curves are characteristically U-shaped due to the Law of Diminishing Returns. The following points can be noted about these curves:

- a) As output increases, the AFC curve falls continuously. This is because fixed costs are being divided by the growing output. As AFC falls when output increases, the firm is said to be **spreading its overheads**.
- b) As output increases the AVC curve tends to approach the ATC curve although not quite touching it. This is because of the spreading of overheads, or the declining nature of AFC as output increases.
- c) The marginal cost curve decreases up to the point when diminishing returns to the factors of production begin to set in. A company will increase production levels until marginal costs equal marginal revenue. The marginal cost curve always cuts the average cost curve at its lowest point. Here MC and AC are equal.

The relationship between the average cost curves is shown in Table 5 and Figure 6.

## 5.6 SHORT-RUN VARIATIONS IN REVENUE

Firms aim to make profits. This goal is realised through sale of the output produced to get **revenue**. Net revenue is, therefore, strongly related to production and cost functions. There three ways of looking at how revenue varies with production and sales:

- a) Total revenue
- b) Average revenue
- c) Marginal revenue

### a) Total Revenue

Total revenue (TR) refers to the total amount of money that the firm receives from the sale of its output. TR is the product of the amount produced and the selling price of the commodity.

$$TR = P \times Q$$

where: TR = total revenue  
P = selling price  
Q = quantity produced

### b) Average Revenue

Average revenue (AR) refers to the total revenue received per given amount of output produced. It is calculated by dividing TR by Q. In a perfectly competitive market, the AR curve is a horizontal straight line equal to the market price per unit.

$$AR = \frac{TR}{Q}$$