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BUS 802

Economic Theory

Module 2

BUS 802 Economic Theory Module 2

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Module 2

Unit 1 Consumer Choice and Maximisation of Utility

1.0 Introduction

Because economic systems are made up of a collection of individuals involved in choosing among different alternatives, it will be wise to begin our analysis of consumer behaviour in terms of individual choice patterns. Individuals attempt to choose among different alternatives with the aim of maximising utility or satisfaction. To effectively address the choice and utility maximisation issues, we shall look at the roles of individuals that of interest to economists, the axioms of rational choice, the economic definition of utility, the indifference curve, and the principle of utility maximisation.

2.0 Objectives

At the end of this unit, you should be able to:

- explain consumer choice
- define the concept of utility
- explain the principle of utility maximisation.

3.0 Main Content

3.1 Role of Individuals

Every rational individual operates in at least three roles that are of interest to economists. The roles include:

(i) ***The individual as a consumer***. Individuals demand a variety of goods and services, because they presumably derive some welfare from them.

(ii) ***The individual provides productive services***. The most important resource provided by the individual is labour. The individual must decide how much labour to trade in exchange for goods and services in the market. Individuals also provide capital as a productive resource through savings. An individual may also decide to invest in his/her own education or health thereby investing in human capital.

(iii) The individual participates in the political process. By voting and being involved in other political activities, the individual expresses his/her preferences regarding a given political party and government's provision of goods and services like defense, policy, trash collection. The individual also expresses his/her willingness to pay for these services by paying taxes.

It is important to note that these roles cannot be separated from one another. Any decision an individual makes as a consumer will have an effect on decisions as a provider of resources, and on decisions as a voter in the political process.

Economic textbooks often refer to an individual as "economic man" (or *homo economicus*) and concentrate attention on the individual's role as a consumer only. Other roles are never discussed explicitly. Nevertheless, we discuss, in general, ***individual preferences*** and the ***concept of utility***

3.2 Axioms or Postulates of Rational Choice

Economists often begin the analysis of individual's choices by specifying a basic set of postulates (or axioms) that characterise *rational* behaviour. They begin with the concept of "preferences": when an individual prefers choice A to choice B, it is taken to mean that, all things being equal, he/she feels better off with choice A than with choice B. Such preference relation is assumed to have two basic properties:

(i) ***Completeness***: If A and B are two choice situations, the individual can always specify exactly one of the following three possibilities:

(a) A is preferred to B

(b) B is preferred to A

(c) A and B are equally attractive

Individuals are assumed to completely understand and can always make up their minds on the desirability of any two alternatives.

(ii) ***Transitivity***: If an individual feel that choice A is preferred to choice B and that B is preferred to choice C, then he/she must always feel that A is preferred to C. It follows that individuals do not articulate preferences that are self-contradictory.

Economists refer to this ranking of relative desirability as ***utility***, following the terminology introduced by a political theorist, Jeremy Bentham in 1848. The term utility assumes that more desirable alternatives offer more utility than do less desirable ones. Let us examine in detail the concept of utility.

3.3 The Concept of Utility

Economists are of the opinion that individuals make those choices that are most favourable to them, so that from among available alternatives, individuals are assumed to select the one that maximises their utility. The utility-maximisation hypothesis recognises the facts that individuals seldom take actions that are against their best interests.

Because the term utility is used to refer to overall satisfaction which can be affected by a variety of factors, a common practice has been to devote attention exclusively to choices among quantifiable alternatives such as, relative quantities of goods and shelter, number of hours worked per day, or votes among specific tax formulas, while holding other things that affect choice behaviours constant. This ***ceteris paribus*** (other things being equal) assumption is invoked so as to make analysis of choices manageable within a specified setting.

An important example of the ***ceteris paribus*** assumption is as follows:

Consider an individual's problem of choosing, at a given point in time, among n consumption goods: X1, X2, X3, …, Xn. Assuming the individual seeks to maximise utility *function* of the form:

Utility = U(X1, X2, X3, …, Xn; other things), (3.3.1)

where the X's are quantities of the goods chosen and the "other things" is to remind us that many aspects of the individual's welfare is being held constant in the analysis.

The utility function is often used to indicate how an individual ranks certain bundles of goods available at a given period.

It is important to note that the measurability of utility in terms of units of measurement has been a problem in economic theory. It is also problematic to compare utilities. To say that the utility of a bundle of goods A, U (A), is greater than that of another bundle of goods B, U(B), only means that the bundle of goods A is preferred to the bundle of goods B. You cannot answer the question by "how much?" bundle A is preferred to bundle B.

3.3.1 Assumptions on the Utility Function

The following are few basic assumptions guiding the use of utility functions in the analysis of consumer behaviours. These assumptions must be taken serious as they help in drawing inferences about an individual consumer's behaviour.

Assumption 1: The More the Better

An obvious assumption you can make about an individual's preference is that "more of a good or service is preferred to less". This assumption can be simply illustrated in figure 3.3.1 below.

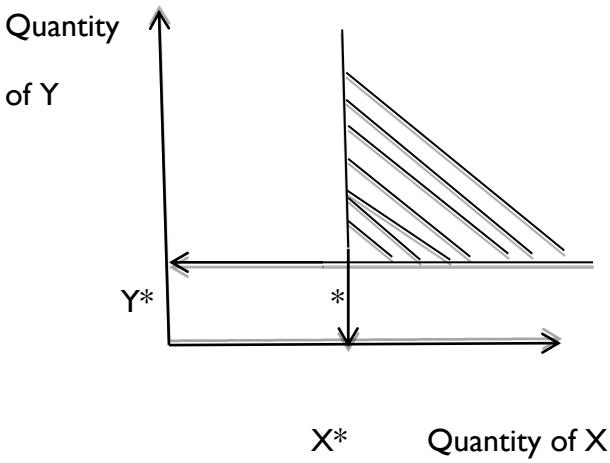

Figure 3.3.1: More of a Good is Preferred to Less

All points in the shaded area of figure 3.3.1 are preferred to the quantities X* of good X and Y* of good Y. We assume here that the individual consumer is not satiated. Movements from point X*, Y* to any point in the shaded area is an unambiguous improvement, since

the individual would obtain more of one good without being forced to accept less of any other.

Assumption 2: Trades and Substitution

This assumption states that individuals give up more of a good to get more of the other good. Given up units of one commodity to get back some other commodity is what trade and markets in economics is all about.

Assumption 3: Diminishing Marginal Rate of Substitution

The curve representing the trade-off between two goods, say X and Y, is referred to as indifference curve, because, while moving along the curve, the individual is indifferent about where he/she is on it. The slope of this curve is negative indicating that if the individual is forced to give up some units of good Y, he/she must be compensated by additional units of good X to remain indifferent between the two bundles of goods. As indicated by figure 3.3.2 below, the indifference curve is drawn so that the slope increases as units of X increases. Figure 3.3.2 is a graphical representation of the assumption of a diminishing marginal rate of substitution.

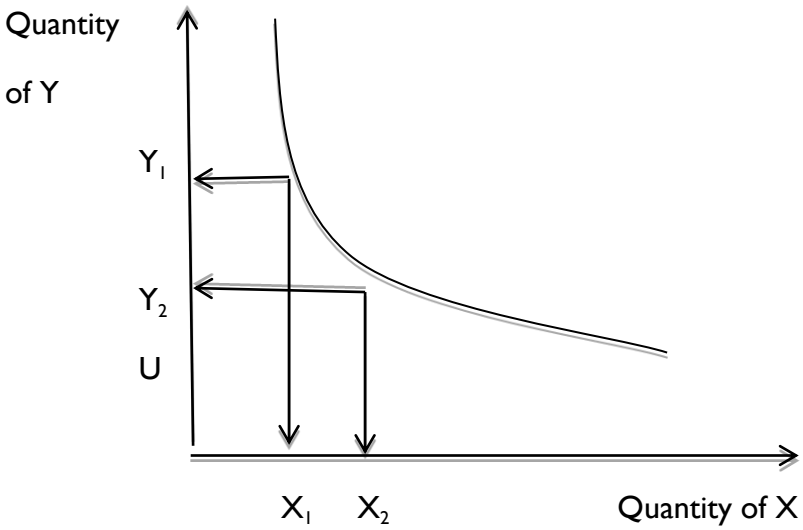

Figure 3.3.2: The Indifference Curve

The marginal rate of substitution of good X for good Y, MRSx,y is defined as the negative of the slope of the indifference curve. Thus,

MRSx,y = -(dY/dX), U is constant. (3.3.2)

It follows that the value of MRSx,y diminishes as the quantity of X increases, indicating that for very low quantities of an individual is willing to give up a large amount of Y to get one more unit of good X.

The assumption of diminishing marginal rate of substitution is both analytically important and tallies with an intuitive notion that people tend to be progressively less willing to consume more of a commodity as they acquire more of it. An individual's psychic rate of tradeoff between commodities depends on how much of those commodities he/she is currently consuming.

Assumption 4: Convexity of the Indifference Curve

The assumption of diminishing marginal rate of substitution, MRS, is equivalent to the assumption that all combinations of X and Y, which are preferred to or indifferent to a particular combination, X*, Y*, form a convex set or quasi-concave. The convexity assumption rules out the possibility of an indifference curve being straight over any portion of its length.

3.3.2 The Concept of Marginal Utility

The marginal utility from the consumption of good X, for example, is defined as the extra utility obtained from consuming extra units of X while holding the quantity consumed of other goods constant. The value of the marginal utility depends on how much the commodity the individual is currently consuming.

Considering two goods, X and Y, the marginal rate of substitution of X for Y, MRSx,y, is defined as equal to the ratio of the marginal utility of X to the marginal utility of Y. These definitions can be illustrated by the following derivations.

Suppose an individual ranks goods by a utility function:

$$\text{Utility} = U(X_1, X_2, X_3, \ldots, Xn), \qquad (3.3.3)$$

where Xi (i = 1, 2, 3, …, n) are the amounts of each of the n different goods are consumed. By the marginal utility of good X_1, for example, we mean the function:

$$\text{marginal utility of } X_1 = MU_{X1} = \partial U/\partial X1$$

We can derive the total derivative of equation (3.3.3) as:

$$dU = (\partial U/\partial X_1)dX_1 + (\partial U/\partial X_2)dX_2 + \ldots + (\partial U/\partial Xn)dXn$$

$$= (MUx_1)dX_1 + (MUx_2)dX_2 + \ldots + (MUx_n)dXn \qquad (3.3.4)$$

Equation (3.3.4) reveals that extra utility obtained from an additional unit of X_1, X_2, X_3, …, Xn, is simply the sum of additional utility provided by each of these increments.

The concept of MRS can be developed by considering changing the level of two goods, X and Y, so as to keep an individual indifferent (that is, dU = 0). By equation (3.3.4), we get:

$$dU = 0 = MUxdX + MUydY \qquad (3.3.5)$$

Holding other goods constant therefore, dU is only affected by changing the quantities of the two goods, X and Y,

Dividing equation (3.3.5) by dX and rearranging terms, you get:

$$-(dY/dX)|dU = 0 = MUx/MUy = \frac{\partial U/\partial X}{\partial U/\partial Y} = MRSx,y \qquad (3.3.6)$$

Thus, the marginal rate of substitution of X for Y is equal to the ratio of the marginal utility of X to the marginal utility of Y, MRSx,y.

3.3.3 Maximisation of Utility

To maximise utility, given a fixed amount of expenditure, an individual will buy those quantities of goods for which the psychic rate of trade-off between any two goods (the MRS) is equal the rate at which the goods can be traded one for the other in the market place. We will illustrate this point use the two goods, X and Y.

Assume that an individual has I naira to allocate between good X and good Y. If Px represents the unit price of good X and Py the unit price of good Y, then the individual's budget constraint would be:

$$PxX + PyY \leq I \qquad (3.3.7)$$

Implying that no more than the income, I, can be spent on goods X and Y. This budget/income constraint is shown graphically in figure 3.3.3 below.

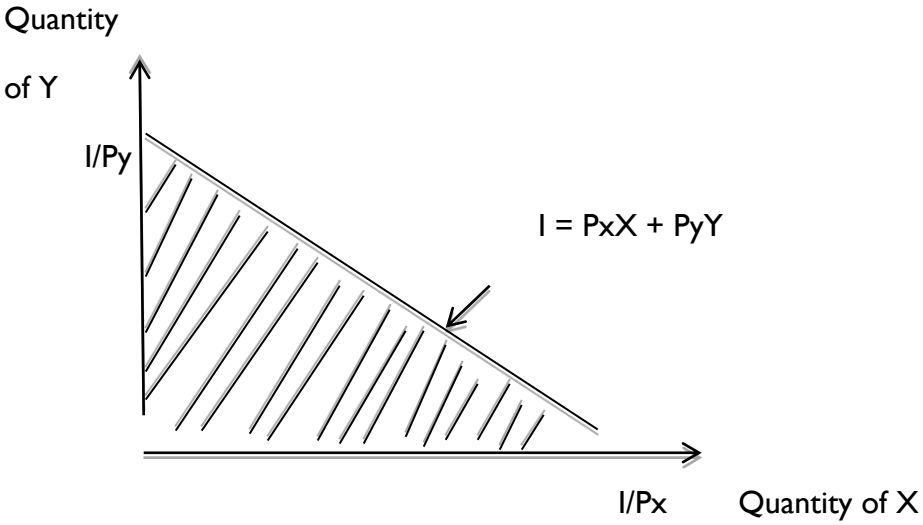

Figure 3.3.3: Individual's Budget Constraint for Goods X and Y

Figure 3.3.3 indicates that the individual can only choose combinations X and Y bounded by the shaded triangle. If all the income, I, is spent on good X, the individual will buy I/Px units of X, and if all is spent on good Y, the individual will buy I/Py units of Y. The slope of the constraint (or the budget line) can be shown to be –Px/Py.

As shown in figure 3.3.4, you can impose the budget constraint in figure 3.3.3 to the indifference curve in figure 3.3.2 to illustrate the utility maximising process for an individual consumer.

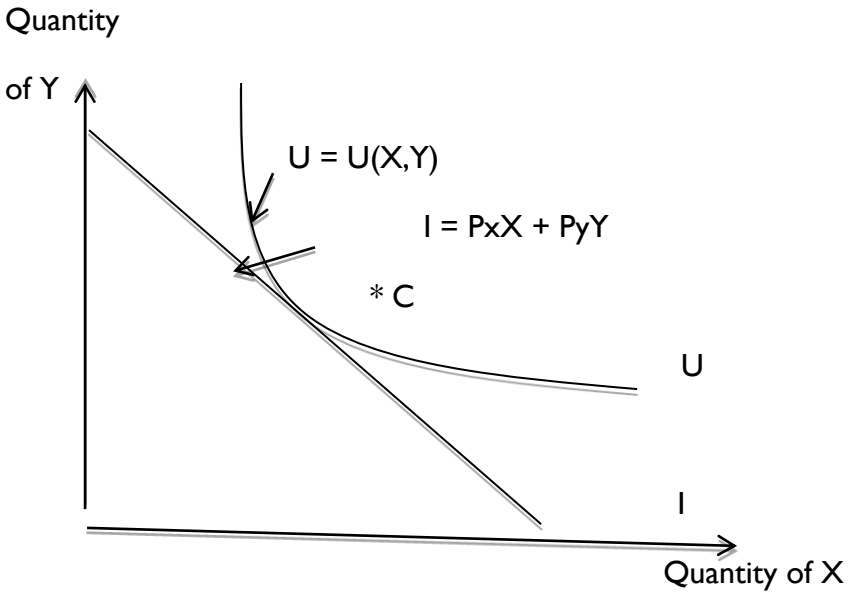

Figure 3.3.4: Graphic Illustration of the Utility Maximisation Process

The utility maximising point is indicated by point C on figure 3.3.4. This is the point for which the slope of the budget line, I equals the slope of the indifference curve, U. At this point, the optimal combination of goods X and Y consumed are X* units and Y* units, respectively. Point C is therefore referred to as the utility maximising point for the individual. Observe also that at point C, -Px/PY (slope of the budget line) equals –(Mux/MUy), slope of the indifference curve or the marginal rate of substitution, MRS. It can be said, in general, that to solve for the optimal combinations of goods X and Y that will maximise the individual's utility, you just need to equate the slope of the relevant budget constraint to the marginal rate of substitution as derived from the given utility function. But to solve for the specific optimum values of individual goods consumed given the budget constraint, you need to use a function referred to as the lagrange function, λ , and the associated first-order condition. An example follows.

Example

Assume that an individual's utility function is given by: $U = X_1X_2$; that $P_1 = 2$ naira, $P_2 = 5$ naira; and, that the individual consumer's income for the period of analysis is N10,000. What are the units of goods X_1 and X_2 that the consumer must purchase and consume in order that he/she maximises his/her utility?

Solution

You can first formulate the budget constraint using the unit prices of the goods X_1 and X_2 as follows:

Budget constraint: $10{,}000 = 2X_1 + 5X_2$.

We want to maximise $U = X_1X_2$, subject to $10{,}000 = 2X_1 + 5X_2$.

Formulating the lagrange function, Z, and setting its partial derivatives equal to zero, we get:

$Z = X_1X_2 + \lambda(10{,}000 – 2X_1 – 5X_2)$, and setting the partial derivatives equal to zero:

$\partial U/\partial X_1 = X_2 - 2\lambda = 0$ (3.3.8)

$\partial U/\partial X_2 = X_1 - 5\lambda = 0$ (3.3.9)

$\partial Z/\partial \lambda = 10{,}000 - 2X_1 - 5X_2 = 0$ (3.3.10)

Solving the three linear equations for the unknowns, X_1, X_2, and λ, using the above equations, we get:

$\underline{X_2} = \underline{2}$

$X_1 \quad 5$

$X_1 = (5/2)X_2$ (3.3.11)

Substituting the expression for X_1 in equation (3.3.10), you get:

$10000 - 2(5/2)X_2 - 5X_2 = 0$

$10X_2 = 10000$

$X_2 = 1000$

$X_1 = 250$ (by equation 3.3.11)

Using equations (3.3.8) to solve for λ, you get:

$X_2 - 2\lambda = 0$

$X_2 = 2\lambda$

$2\lambda = 10$

$\lambda = 5$

The values for X_1, X_2, and λ are therefore, 250 units, 1000 units, and 5 respectively. By implication, to maximise his/her utility, the individual consumer should purchase for consumption 250 units of good X_1 and 1000 units of product X_2.

Self-Assessment Exercise

List and discuss the axioms of a rational choice. Think of and discuss about two life examples of how these axioms can be applied.

4.0 Conclusion

This unit has expanded our knowledge on the theory of consumer choice with specific emphasis on the utility concept and how utility can be maximised by an individual consumer. The axioms of rational choice were also presented for guidance on choice of the best among different choice alternatives.

5.0 Summary

An important aspect of economic theories is its analysis of the role of individuals in economic activities. Assuming rationality in consumption behaviours and participation in economic activities, this unit began with the discussion of individuals as economic agents. The unit enumerated the role of individuals both as consumers and as providers of factors of production.

The unit also outlined the important axioms or postulates of rational choices, including the axiom of completeness and the axiom of transitivity. These axioms serve as guides in choosing among desirable economic choice alternatives.

Another important principle in the study of individual consumer behaviour is the concept of utility. This unit has outlined the important issues in utility analysis, including: the utility function; basic assumptions on utility functions; and, the concept of marginal utility. The unit introduced the basic application of utility analysis by examining the principle of utility maximisation under budget constraints. It ended with a simply mathematical application to demonstrate the practice of optimum consumer choice.

6.0 Self-Assessment Exercise

Find the optimum commodity purchases for a consumer whose utility function and budget constraint are given as: $U = U(q_1, q_2) = q_1^2 q_2$; and, $3q_1 + 4q_2 = 100$, respectively.

7.0 Reference/Further Reading

Henderson, J. M. & Quandt, R. E. (1980). *Microeconomic Theory: A Mathematical Approach* USA: McGraw-Hill, Inc.

Unit 2 Analysis of Individual and Market Demand

1.0 Introduction

This unit is aimed at expanding your knowledge of what market demand is all about. To achieve this aim, it provides for you the definition of market demand, complemented with discussions on the types of market demand and demand functions. The unit is an essential requirement for businesses. It provides a good background for demand planning and production forecasting. This is in recognition of the fact that the analysis of market demand for a business firm's product plays an important role in business decision making. In addition, for a firm to succeed in its operations, it must plan for future production, the inventories of raw materials, advertisements, and sales outlets. The knowledge of the magnitude of the current and future demand is therefore, indispensable.

The analysis of market demand enables business executives know:

1. the factors determining the size of consumer demand for their products;
2. the degree of responsiveness of demand to changes in its determinants;
3. the possibility of sales promotion through manipulation of prices;
4. the responsiveness of demand to advertisement expenditures; and,
5. the optimum levels of sales, inventories, and advertisement expenditures.

2.0 Objectives

At the end of this unit, you should be able to:

- define individual and market demands
- explain demand schedules
- explain demand functions.

3.0 Main Content

3.1 Definition of Market Demand

The market demand of any product is the sum of individual demands for the product at a given market price in a given time period. Note that the individual demand for the product per unit of time at a given price is the quantity demanded by an individual.

A horizontal summation of individual demand schedule gives rise to the ***market demand schedule.*** For example, assume three consumers, X, Y, and Z of a given commodity, say commodity A. Let the individual demands by the consumers, X, Y, and Z be represented as in table 3.1 below, the market demand schedule, that is, the aggregate of individual demands by the three consumers at different prices, as indicated, is shown by the last column of the table.

Price of A	Quantity of A Demanded by: X	Y	Z	Market Demand
10	5	1	0	6
8	7	2	0	9
6	10	4	1	15
4	14	6	2	22
2	20	10	4	34
0	27	15	8	50

Table 3.1: The Market Demand Schedule

3.2 Types of Demand

The major types of demand encountered in business decisions are outlined below.

1. ***Individual and Market Demand.*** The quantity of a commodity an individual is willing and able to purchase at a particular price, during a specific time period, given his/her money income, his/her taste, and prices of other commodities, such as substitutes and complements, is referred to as the ***individual demand*** for the commodity. As illustrated in table 3.1 above, the total quantity which all the consumers of the commodity are willing and able to purchase at a given price per time unit, given their money incomes, their tastes, and prices of other commodities, is referred to as the ***market demand*** for the commodity.

2. ***Demand for Firm's and Industry's Product.*** The quantity of a firm's product that can be sold at a given price over time is known as the demand for the firm's product. The sum of demand for the products of all firms in the industry is referred to as the market demand or industry demand for the product.

3. ***Autonomous and Derived Demand.*** An *autonomous demand* or direct demand for a commodity is one that arises on its own out of a natural desire to consume or possess a commodity. This type of demand is independent of the demand for other commodities. Autonomous demand may also arise due to *demonstration effect* of a rise in income, increase in population, and advertisement of new products.

The demand for a commodity which arises from the demand for other commodities, called '*parent products*' is called *derived demand.* Demand for land, fertilizers and agricultural tools, is a derived demand because these commodities are demanded due to demand for food. In addition, demand for bricks, cement, and the like are derived demand from the demand for house and other types of buildings. In general, demand for producer goods or an industrial input is a derived demand.

4. ***Demand for Durable and Non-Durable Goods.*** Durable goods are those goods for which the total utility or usefulness is not exhaustible in the short-run use. Such goods can be used repeatedly over a period of time. Durable consumer goods include houses, clothing, shoes, furniture, refrigerator, and the like. Durable producer goods include

mainly the items under 'fixed assets', such as building, plant, machinery, and office furniture.

The demand for durable goods changes over a relatively longer period than that of the non-durable goods. The demand for non-durable goods depends largely on their current prices, consumers' income, and fashion. It is also subject to frequent changes.

Durable goods create replacement demand, while non-durable goods do not. In addition, the demand for non-durable goods change linearly, while the demand the demand for durable goods change exponentially as the stock of durable goods changes.

5. ***Short-Term and Long-Term Demand.*** Short-term demand refers to the demand for goods over a short period. The type of goods involved in the short-term demand are most fashion consumer goods, goods used seasonally, inferior substitutes for superior goods during scarcities. Short-term demand depends mainly on the commodity price, price of their substitutes, current disposable income of the consumers, the consumers' ability to adjust their consumption pattern, and their susceptibility to advertisement of new products.

The ***long-term demand*** refers to the demand which exists over a long period of time. Changes in long-term demand occur only after a long period. Most generic goods have long-term demand. The long-term demand depends on the long-term income trends, availability of better substitutes, sales promotion, consumer credit facility, and the like.

3.3 Demand Functions

Mathematically, we can define a function as a symbolic representation of relationship between dependent and independent variables. A demand function states the relationship between the demand for a product (the dependent variable in this case) and its determinants (the independent variables).

It is the nature of demand-price relationship that determines the form of a demand function. The three most common forms of demand functions are the ***linear demand function***, ***non-linear demand function*** and the ***multi-variant or dynamic demand function***. Each of these forms will be presented briefly in the following discussions.

3.3.1 Linear Demand Function

A demand function is said to be linear when its graph results in a straight line. The general form of a linear demand function is presented in equation (3.3.1) below:

$$D_x = a - bP_x \qquad (3.3.1)$$

Where a = the demand intercept or the quantity demanded at a zero price,

b = the slope of the demand function or the rate at which quantity demanded of product X changes with respect to the price (P_x). This slope is defined

by $\Delta D_x/\Delta P_x$

The graphical form of this demand function is illustrated in figure 3.3.1 below.

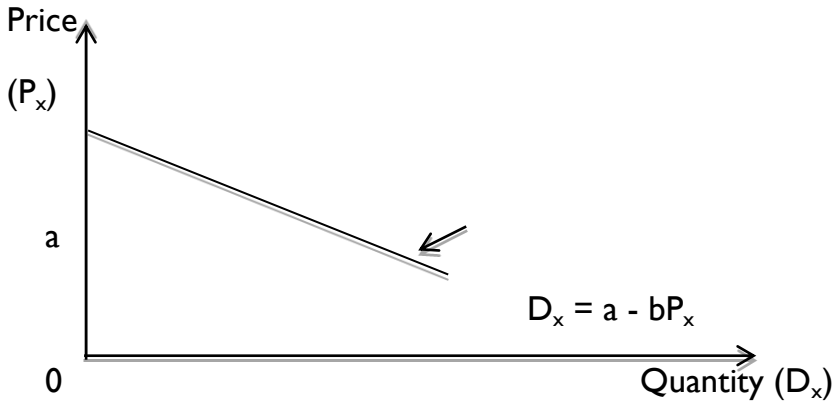

Figure 3.3.1: Linear Demand Function

The price function can easily be obtained from the demand function (equation 3.3.1) in the following way:

$D_x = a - bP_x$

$bP_x = a - D_x$

$P_x = \frac{a - D_x}{b} = \frac{a}{b} - \frac{1}{b}D_x$ (3.3.2)

3.3.2 Nonlinear Demand Function

A demand function is said to be nonlinear or curvilinear when the slope of the demand function, $\Delta P/\Delta D$, changes along the demand curve. A nonlinear demand function yields a demand curve unlike the demand line yielded by a linear demand function as in figure 3.4 above. A nonlinear demand function is of the form of a power function as given in equation (3.3.3) below.

$D_x = aP_x^{-b}$ (3.3.3)

You should note that the exponent of the Price variable P_x, that is, -b, in the nonlinear demand function (equation (3.3.3) is referred to as the price-elasticity of demand. The nonlinear demand function can be sketched as in figure 3.3.2 below.

Price

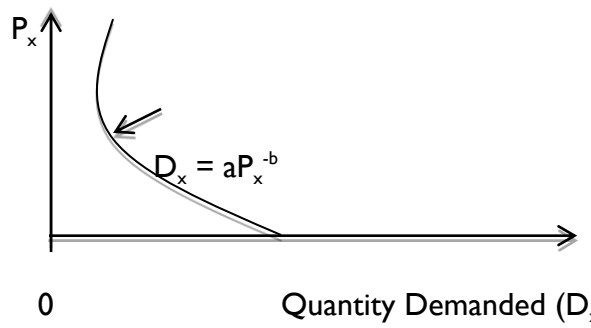

Figure 3.3.2: Nonlinear Demand Function

3.3.3 Multi-Variate or Dynamic Demand Function

The demand functions discussed above are classified as single-variable demand functions, and, as such, referred to as short-term demand functions. In the long run, neither the individual nor the market demand for a given product is determined by anyone of its determinants alone, because other determinants do not remain constant. The long-run demand for a product depends on the composite impact of all its determinants operating simultaneously. It follows that in order to estimate the long-term demand for a product, all the relevant determinants must be taken into account.

The long-run demand functions describe the relationship between a demand for a product (the dependent variable) and its determinants (the independent variables). Demand functions of this type are referred to as *multi-variate* or *dynamic* demand functions. Consider the demand for product X, (D_x), which depends on such variables as its own price (P_x), consumer's income (Y), price of its substitutes (P_s), price of the complementary goods (P_c), consumer's taste (T), and advertisement expenditure (A), the functional form can be written as:

$$D_x = f(P_x, Y, P_s, P_c, T, A) \qquad (3.3.4)$$

If the relationship between the demand (D_x) and the quantifiable independent variables, P_x, Y, P_s, P_c, and A, is of a linear form, then the estimable form of the demand function is formulated as:

$$D_x = a + bP_x + cY + dP_s + eP_c + gA \qquad (3.3.5)$$

where 'a' is a constant and parameters b, c, d, e. and g are the coefficients of relationship between the demand for product X (D_x) and the respective independent variables.

For the market demand function for a product, other independent variables such as size of the population (N), and a measure of income distribution, the Gini-coefficient (G) may be included in equation (3.3.5).

Self-Assessment Exercise

Briefly distinguish between market demand and individual demand for a particular product.

4.0 Conclusion

This unit has been devoted to the analysis of market demand. You were informed that the market demand for a product is the horizontal sum of individual demands for the product. Other important discussions were made on types of demand and the different demand functions. The principles learned from the unit are important in decisions involving product marketing, forecasting, and production.

5.0 Summary

The analysis of market demand enables business executives know: (i) the factors determining the size of consumer demand for their products; (ii) the degree of responsiveness of demand to changes in its determinants; (iii) the possibility of sales

promotion through manipulation of prices; (iv) the responsiveness of demand to advertisement expenditures; and, (v) the optimum levels of sales, inventories, and advertisement expenditures.

The market demand of any product is the sum of individual demands for the product at a given market price in a given time period. Few types of demand were outlined, including: the individual demand; demand for firm's and industry's product; autonomous and derived demand; demand for durable and non-durable goods; short- and long-term demand. The demand functions include: linear demand functions; non-linear demand functions; multivariate and dynamic demand functions.

6.0 Self-Assessment Exercise

As a business manager, how would the knowledge of the different types of demand help in product decisions?

7.0 Reference/Further Reading

Dwivedi, D. N. (2007). *Managerial Economic.* (6th ed.). Delhi: Gajendra Printing Press.

Unit 3 Determinants of Market Demand

1.0 Introduction

Among the important decision variables in the production process is individual consumption decisions which are the determinants of demand in the commodity market. Unit two informed you of the derivation of market demand from individual demands. To complete our analysis of market demand, this unit examines the essential factors that are responsible for market demand.

2.0 Objectives

At the end of this unit, you should be able to:

- list and explain the factors that affect the market demand for given products
- explain the law of demand
- describe and apply strategic production decisions.

3.0 Main Content

3.1 Determinants of Market Demand

For corporate managers at large and specifically, the marketing managers, it is highly important to understand the factors affecting the market demand for their products. This understanding is required for analysing and estimating demand for the products. Though there are several factors affecting market demand for a product, the most important are:

3.1.1 Price of the product or the own price (Po)

This is the most important determinant of demand for a product. The own price of a product and the quantity demanded of it are inversely-related so that,

$$\frac{\Delta Qo}{\Delta Po} > 0$$

3.1.2 Price of the related goods, such as substitutes and complements (Ps and Pc)

When two goods are *substitutes* for each other, the change in price of one affects the demand for the other in the same direction. If goods X and Y are substitute goods, then an increase in the price of X will give rise to an increase in the demand for Y. Note that changes in the price of related goods cause shifts in the demand for the goods. Changes in demand are illustrated graphically as rightward shifts (for increase) and leftward shifts (for decrease) in the demand for the products. As shown in figure 3.1 below, an increase in the price of good X will shift the demand for good Y to the right and shift that of good X to the left.

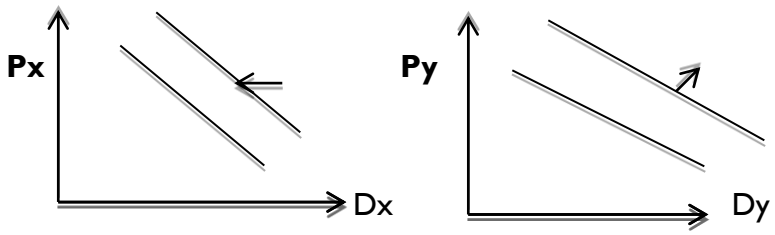

Figure 3.1: Shifts in Demand

Symbolically, $Dx = f(Py)$; $\Delta Dx/\Delta Py > 0$

$Dy = f(Px)$; $\Delta Dy/\Delta Px > 0$

When two goods are complements for each other, one complements the use of another. Petrol and car complement goods. If an increase in the price of one good causes a decrease in demand for the other, the goods are said to be complements. Thus if the demand function for a car (Dc) in relation to petrol price (Pp) is specified by:

Dc f(Pp), $\Delta Dc/\Delta Pp < 0$.

3.1.3 Consumer's Income

This is the major determinant of demand for any product since the purchasing power of the consumer is determined by the disposable income. Managers need to know that income-demand relationship is of a more varied nature than those between demand and its other determinants.

The relationship between demands for commodity X, for example, and the consumer's income, say Y, keeping other factors constant, can be expressed by a demand function:

$Dx = f(Y)$, and $\Delta Dx/\Delta Y > 0$.

You should note that consumer goods of different nature have different relationships with income of different categories of consumers. The manager needs, therefore, to be completely aware of the goods they deal with and their relationship with consumer's income, particularly with respect to the assessment of both existing and prospective demand for a product.

Regarding income-demand analysis, consumer goods and services are grouped under *four* broad categories:

i. Essential ***Consumer Goods (ECG).*** Goods and services in this category are referred to as 'basic needs', and are consumed by all persons in a society. Such goods and services include food grains, salt, vegetable oil, cooking, fuel, housing, and minimum clothing. The demand for such goods and services increase with increases in consumer's income, but only up to a certain limit, even though the total expenditure may increase in accordance with the quality of goods consumed, all things being equal. The relationship between goods and services of this category and consumer's income is shown by the curve ECG in figure 3.2 below.

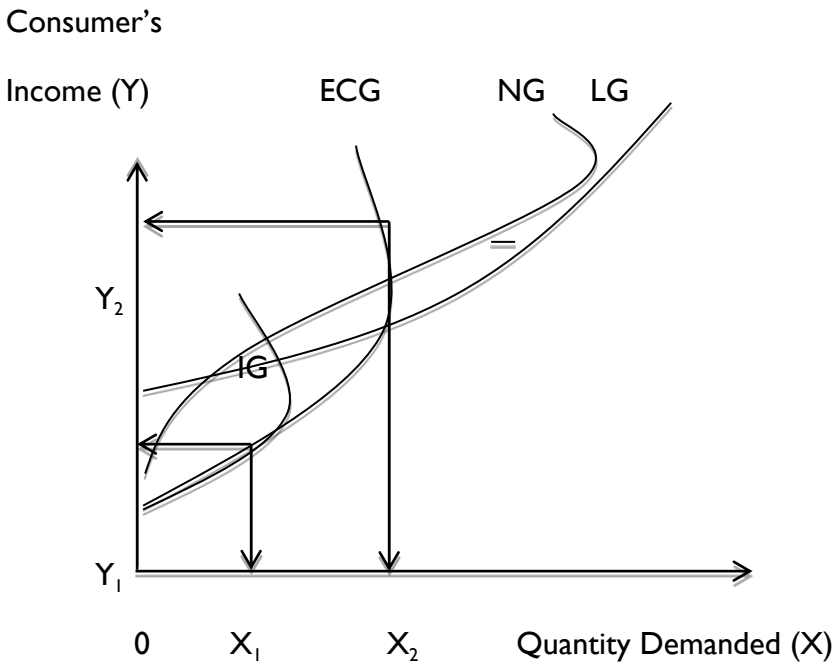

Figure 3.2: Income-Demand Relationships

ii. Inferior ***Goods (IG).*** Inferior and superior goods are widely known to both buyers and sellers. Economists define inferior goods as goods in which their demands decrease as consumer's income increases, beyond a certain level of income. The relationship between income and demand for an inferior good is illustrated by curve IG in figure 3.2 above. Demand for such goods rises only up to a certain level of income, say (OY_1), and declines as income increases beyond this level.

iii. ***Normal Goods (NG***). In economic terms, normal goods are goods demanded in increasing quantities as consumer's income rises. Examples of normal goods are clothing, furniture, and automobiles. The type of relationship between income and demand for normal goods is shown by curve NG in figure 3.2 above. Note in the figure that up to a certain level of income, say Y_1, the relationship between income and demand for all types of goods is similar. The difference is only in terms of the degree of relationship. The relationship becomes distinctively different beyond the income level (Y_1).

iv. ***Luxury and Prestige Goods***. All such goods that add to the pleasure and prestige of the consumer without enhancing his or her earning fall in the category of luxury goods. Prestige goods are special category of luxury goods, examples, rare paintings and antiques, prestigious schools, and the like. Demand for such goods arises beyond a certain level of consumer's income. Producers of such goods, while assessing the demand for their product, need to consider the income changes in the richer section of the society. The income-demand relationship for this category of goods is shown by curve LG in figure 3.2.

3.1.4 Consumers' Tastes and Preferences

Consumers' tastes and preferences play important role in the determination of the demand for a product. Tastes and preferences generally depend on life style, social customs,

religious values attached to a commodity, habit of the people, age and sex of the consumers, and the like. Changes in these factors tend to change consumers' tastes and preferences.

3.1.5 Advertisement Expenditures

Advertisement costs are incurred while attempting to promote sales. It helps in increasing product demands in at least four ways:

(a) by informing the potential consumers about the product's availability;

(b) by showing the product's superiority over the rival product;

(c) by influencing consumer's choice against the rival product; and,

(d) by setting new fashions and changing tastes. The impact of these causes upward shifts in the demand for the product. All things being equal, as expenditure on advertisement increases, it is expected that volume of sales will increase. The relationship between sales (S) and advertisement outlays (AD) can be expressed by the function:

$S = f(AD)$, and $\Delta S/\Delta AD > 0$. This relationship is indicated in figure 3.3 below:

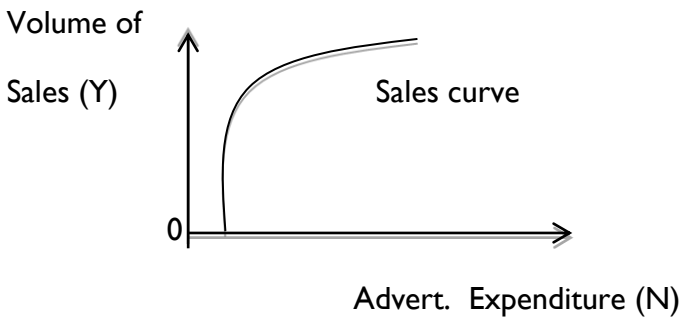

Figure 3.3: Advertisement and Sales

The relationship as shown by figure 3.3 is based on the following assumptions:

- Consumers are fairly sensitive and responsive to various modes of advertisement
- The rival firms do not react to the advertisement made by the firm,
- The level of demand has not reached the saturation point and advertisement makes only marginal impact on demand for a product,
- Adding of advertisement cost to the product price does not make the price prohibitive for consumers, compared to the price of substitutes.

3.1.6 Consumers' Expectations

The consumers' expectations about the future product prices, income, and supply position of goods play significant role in the determination of demand for goods and services in the short run. A rational consumer who expects a high rise in the price of a nonperishable commodity would buy more of it at the high current price with a view to avoiding the pinch of the high price rise in the future. This partly explains the high demand for fuel during

periods of expected increase of pump price of fuel in Nigeria. On the contrary, if a rational consumer expects a fall in the price of goods he/she purchases, he/she would postpone the purchase of such goods with a view to taking advantage of lower prices in the future. This is especially the case for non-essential goods. This behaviour tends to reduce the current demand for goods whose prices are expected to decrease in the future.

An expected increase in income would similarly increase current demand for goods and services. For instance, a corporate announcement of bonuses or upward revision of salary scales would induce increases in current demand for goods and services.

3.1.7 Demonstration Effect

Whenever new commodities or models of commodities are introduced in the market, many households buy them not because of their genuine need for them but because their neighbours have purchased them. This type of purchase arises out of such feelings jealousy, competition, and equality in the peer group, social inferiority, and the desire to raise once social status. Purchases based on these factors are the result of what economists refer to as 'demonstration effect' or the 'Band-Wagon effect'. These effects have positive impacts on commodity demand.

On the contrary, when a commodity becomes a thing of common use, some rich people decrease their consumption of such goods. This behaviour is referred to in economics as the 'snob effect'. This has negative impact on the demand for the commodity concerned.

Other determinants of demand for commodities include *Consumer-Credit facility*, the *population of consumers*, and *income distribution*.

Self-Assessment Exercise

How do the changes in the following factors affect the demand for a commodity: (a) Price; (b) Price of the substitute; (c) Income; (d) Advertisement

4.0 Conclusion

This unit has discussed extensively the determinants of market demand. In a nutshell, you learned that the followings are the major determinants of market demand for a given commodity:

(i) Own price of the commodity;

(ii) Price of related goods, such as the substitutes and complements;

(iii) Consumers' tastes and preferences;

(iv) Advertisement expenditures;

(v) Consumers' expectations; and,

(vi) Demonstration effects.

5.0 Summary

The very important information from our discussions in this unit is that: First, it is important for corporate managers to know the factors affecting the market demand for their products. Such factors were enumerated to include: the commodity's own price; price of related goods, such as substitutes and complements; consumers' tastes and preferences; advertisement expenditures; consumers' expectations; and, demonstration effects. Secondly, economists define inferior goods as goods in which their demands decrease as consumer's income increases, beyond a certain level of income. They also define normal goods as goods that are demanded in increasing quantities as consumer's income rises; and, Luxury goods as goods that add to the pleasure and prestige of the consumer without enhancing his or her earning;

6.0 Self-Assessment Exercise

Which of the following commodities has the most inelastic demand and why? (a) Salt; (b) Penicillin; (c) Cigarettes; (d) Soap

7.0 References/Further Reading

Dwivedi, D. N. (2007). *Managerial Economics.* (6th ed.). Delhi: Gajendra Printing Press.

Nicholson, W. (1978). *Microeconomic Theory: Basic Principles and Extensions.* (2nd ed.). Illinois: The Dryden Press.

Unit 4 Price-Elasticity of Demand, the Demand Function, Total Revenue, and Other Important Elasticities

1.0 Introduction

The price-elasticity of demand for a product can be measured directly from the demand function. We look at this from the perspective of the linear demand function, as well as the non-linear demand function. In this unit, we learn how demand elasticities can be derived from demand functions, the relationship between price-elasticity and total revenue, income-elasticity of demand, promotional elasticity of sales, and elasticity of price expectations. These are among the decision variables available to a marketing manager.

2.0 Objectives

At the end of this unit, you should be able to:

- describe the relationship between price elasticity and demand for a given commodity
- explain the importance of income-elasticity of demand, promotional elasticity of sales, and elasticity of price expectations
- explain the use of economic variables in pricing and marketing decisions.

3.0 Main Content

3.1 Price-Elasticity and Demand Functions

This section focuses on the derivation of price-elasticity from linear and non-linear demand functions. This enables you to compute price elasticities from given demand functions.

3.1.1 Measurement of Price-Elasticity from a Linear Demand Function

For a given linear demand function, you can measure the price-elasticity by first taking the first derivative with respect to the price variable, P, (dQ/dP), if price is the independent variable, or with respect to the quantity variable, Q, (dP/dQ), if quantity is the independent variable. The result will be multiplied by the price-quantity ratio (P/Q) for the first case, and the quantity-price ratio (Q/P) for the second case. Consider a linear demand function:

$$Q = 210 - 0.1P,$$

the point elasticity can be measured for any price by using:

$$\frac{dQ}{dP} \cdot \frac{P}{Q} \qquad (3.1.1)$$

For P = N5/unit, the price-elasticity would be:

$-0.1(P/Q)$, since $\frac{d(210 - 0.1P)}{dP} = -0.1$

Given that P = 5 (as specified above), we solve for Q in the demand function to get:

$Q = 210 - 0.1(5) = 210 - 0.5 = 209.5$

Therefore, the required price-elasticity of demand becomes,

$e_p = -0.1(5/209.5) = -0.002.$

3.1.2 Measurement of Price-Elasticity from a Non-Linear Demand Function

The computation of price-elasticity from a non-linear demand function follows the same process as that of the linear demand function. The only difference is in the nature of the demand function. If a non-linear demand function is given by:

$$Q = aP^{-b},$$

then, $e_p = \frac{dQ}{dP} \cdot \frac{P}{Q}$

where $\frac{dQ}{dP} = -baP^{-b-1}$

The price-elasticity of demand can therefore be expressed as:

$e_p = -baP^{-b-1}(P/Q)$

$= \frac{-baP^{-b}}{Q}$

Since $Q = aP^{-b}$, by substitution, you get:

$$ep = \frac{-baP^{-b}}{aP^{-b},} = -b \qquad (3.1.2)$$

According to equation (3.1.2), when a demand function is of a multiplicative or power form, the price-elasticity coefficient equals the power of the variable P. This implies that price-elasticity for multiplicative demand function remains constant, regardless of a change in the commodity price.

3.2 Price-Elasticity and Total Revenue

A revenue-maximising firm would be interested in knowing whether increasing or decreasing the commodity price would maximise revenue. The price-elasticity of demand for the firm's product at different price levels would provide the answer to this question.

The answer would come from the fact that if $e_p > 1$, then decreasing the price will increase the total revenue, and if $e_p < 1$, then increasing the price will increase the total revenue.

The relationship between price-elasticity (e_p) and total revenue (TR) is sumarised in table 3.1 below.

Elasticity Coefficient	**If Price:**	**Then Total Revenue Will:**
$e_p = 0$	Increases Decreases	Increase Decrease
$e_p < 1$	Increases Decreases	Increase Decrease
$e_p = 1$	Increase Decrease	No change No change
$e_p > 1$	Increase Decrease	Decrease Increase
$e_p = \infty$	Increase Decrease	Decrease to zero Infinite increase, depending on size of the market

Table 3.1: Price-Elasticity, Price-Change, and Change in Total Revenue

3.3 Price-Elasticity and Marginal Revenue

Note that Marginal Revenue (MR) is the first derivative of the total revenue (TR) function, and that TR = PQ (P = unit price; Q = quantity sold). The relationship between price-elasticity, MR, and TR is shown by the following derivations:

Since TR = P.Q,

$$MR = \frac{d(P.Q)}{} = P + Q\frac{dP}{} \quad \text{(the product rule of differentiation)}$$

$$= P\ 1 + \left[\frac{Q}{P} \cdot \frac{dQ}{dQ}\right] \qquad (3.3.1)$$

Note that in equation (3.2.1):

$$\frac{Q}{P} \cdot \frac{dQ}{dP} = -1/e_p$$

By substituting $-1/e_p$ into equation (3.3.1), you get:

$$MR = P[1 - 1/e_p] \qquad (3.3.2)$$

Given this relationship between Marginal Revenue (MR) and price-elasticity of demand (e_p), the deciding manager can easily know whether it will be beneficial to change the price.

From equation (3.3.2), you can deduce that if $e_p = 1$, $MR = 0$. It follows that change in price will not affect the total revenue (TR).

If $e_p < 1$, $MR < 0$, TR decreases when price decreases, and TR increases when price increases. And if $e_p > 1$, $MR > 0$, TR increases when price decreases, and *vice versa*.

3.4 Income-Elasticity of Demand

The income-elasticity of demand can be defined as the degree of responsiveness of demand to changes in the consumer's income. Note that unlike the price-elasticity of demand, which is always negative due to the negative slope of the demand function, the income-elasticity of demand is always positive. This is because of the positive relationship between demand and the consumer's income. This is the case however, for normal goods. In the case of inferior goods, the income-elasticity of demand is always negative. This is so because the demand for inferior goods decreases with increases in consumer's income, and vice versa.

The income-elasticity of demand for a commodity, say X can be computed by:

$$e_y = \frac{Y}{Q_x} \cdot \frac{\Delta Q_x}{\Delta Y} \qquad (3.4.1)$$

Where, e_y = income-elasticity of demand; Y = consumer's income; Qx = quantity demanded of commodity X.

As noted above, for all normal goods, the income-elasticity is positive. However, the degree or magnitude of elasticity varies in accordance with the nature and type of commodities. Consumer goods of the three categories: ***necessities, comforts***, and ***luxuries*** have different elastiticies. The general pattern of income-elasticities of different kinds of goods for increase in income and their effects on sales is given in table 3.2 below for managers to take note:

Consumer Goods	**Coefficient of Income-Elasticity**	**Effect on Sales**
Essential Goods	Less than 1 or unity ($e_y < 1$)	Less than proportionate change in sales
Comforts	Almost equal to unity ($e_y \equiv 1$)	Almost proportionate change in sales
Luxuries	Greater than unity ($e_y > 1$)	More than proportionate increase in sales

Table 3.2: Magnitude of Income-Elasticity for Different Categories of Goods

Own-price and cross-elasticities of demand are specifically significant in the pricing of products aimed at the maximisation of short-run revenues. Income-elasticity of products is highly significant in long-run planning and management of production, especially during the period of business cycles.

The concept of income-elasticity can be used in the estimation of future demand, provided that the rate of increase in income and income-elasticity of demand for the given product are known. This can be useful in forecasting demand for expected changes in consumers' personal incomes, other things remaining the same. Knowledge of income-elasticity of demand is also helpful in the avoidance of over- and under-production.

3.5 Advertisement- or Promotional-Elasticity of Sales

It is a known fact that expenditure on advertisements and on other sales promotion activities help in promoting sales, but not in the same magnitude or degree at all levels of sales. The concept of advertisement elasticity is found useful in the determination of optimum level of advertisement expenditure. This concept assumes a greater significance in deciding advertisement expenditure than other decision variables. This is so especially when the government imposes restriction on advertisement cost (as is the case in most developed economies), or there is competitive advertising by the rival firms.

By definition, advertisement-elasticity of sales is the degree of responsiveness of sales to changes in advertisement expenditures. It can be computed by the formula:

$$e_A = \frac{\Delta S}{\Delta A} \cdot \frac{A}{S} \qquad (3.5.1)$$

where S = sales; ΔS = change in sales; A = initial advertisement cost; and, ΔA = additional expenditure on advertisement

The advertisement-elasticity of sales varies between zero and infinity. Thus,

$0 \leq e_A \leq \infty$

Some values of the advertisement-elasticity of sales can be interpreted according to table 3.3 below:

Elasticity (e_A)	**Interpretation**
$e_A = 0$	Sales do not respond to advertisement expenditure
$0 < e_A < 1$	Increase in total Sales is less than proportionate to the increase in advertisement expenditure
$e_A = 1$	Sales increase in proportion to the increase in expenditure on advertisement
$e_A > 1$	Sales increase at a higher rate than the rate of increase in advertisement expenditure.

Table 3.3: Interpretation of Advertisement-Elasticity of Sales

Some of the ***important factors affecting the advertisement-elasticity*** of sales can be outlined as follows:

(i) ***The Level of Total Sales***. As sales increase, the advertisement-elasticity of sales decreases.

(ii) ***Advertisement by Rival Firms***. In a highly competitive market, the effectiveness of advertisement by a firm is determined by the relative effectiveness of advertisement by the rival firms

(iii) ***Cumulative Effect of Past Advertisements***. Additional doses of advertisement expenditures do have cumulative effect on the promotion of sales, and this may considerably increase the advertisement-elasticity of sales.

Other factors affecting the advertisement-elasticity of sales are those factors demand for the product, including *change in product's price; consumer's income; growth of substitute goods and their prices.*

3.6 Elasticity of Price-Expectations

During the period of price fluctuations, consumer's price expectations play a significant role in determining demand for a given commodity. The price-expectation-elasticity refers to the expected change in future price as a result of changes in current prices of a given product. The elasticity of price-expectation is defined and measured by the following formula:

$$e_x = \frac{\Delta P_f}{\Delta P_c} \cdot \frac{P_c}{P_f} \qquad (3.6.1)$$

where P_c and P_f are *current* and *future* prices, respectively.

The coefficient e_x is a measure of expected percentage change in future price due to a 1 percent change in current price. $e_x > 1$ implies that future change in price will be greater than the current change in price, and *vice versa*. $e_x = 1$ implies that the future change in price will be equal to the change in current price.

The concept of elasticity of price-expectation is very useful in future pricing policies. For instance, if $e_x > 1$, sellers will be able to sell more in the future at higher prices. Accordingly, businesspeople may determine their future pricing policies.

Self-Assessment Exercise

Which of the following statements is true, and why?

(a) If price elasticity = 1, MR = 0

(b) If price elasticity > 1, MR > 0

(c) If price elasticity < 1, MR < 0

4.0 Conclusion

The basic information obtained from this unit is that the price-elasticity of demand for a product can be measured directly from the demand function. We examined how price elasticity can be estimated both from a linear and a non-linear demand function. Other important discussions were on: the relationship between price elasticity and total revenue; income-elasticity of demand; promotional elasticity of sales; and, elasticity of price expectations.

5.0 Summary

We can summarise our discussions in this unit as follows:

For a given linear demand function, you can measure the price-elasticity by first taking the first derivative with respect to the price variable, P, (dQ/dP), if price is the independent variable, or with respect to the quantity variable, Q, (dP/dQ), if quantity is the independent variable. The result will be multiplied by the price-quantity ratio (P/Q) for the first case, and the quantity-price ratio (Q/P) for the second case.

A revenue-maximising firm would be interested in knowing whether increasing or decreasing the commodity price would maximise revenue. The price-elasticity of demand for the firm's product at different price levels would provide the answer to this question. The answer would come from the fact that if $e_p > 1$, then decreasing the price will increase the total revenue, and if $e_p < 1$, then increasing the price will increase the total revenue.

The income-elasticity of demand can be defined as the degree of responsiveness of demand to changes in the consumer's income.

The concept of advertisement elasticity is found useful in the determination of optimum level of advertisement expenditure. This concept assumes a greater significance in deciding advertisement expenditure than other decision variables.

The price-expectation-elasticity refers to the expected change in future price as a result of changes in current prices of a given product.

6.0 Self-Assessment Exercise

Explain your understanding of the term elasticity of price expectation (E_e). In the context of an environment of business recession, what are the implications of:

$E_e > 1$; (ii) $E_e = 1$; $E_e = 0$; $E_e < 0$

7.0 References/Further Reading

Dwivedi, D. N. (2007). *Managerial Economics*. (6th ed.). Delhi: Gajendra Printing Press.

Nicholson, W. (1978). *Microeconomic Theory: Basic Principles and Extensions*.(2nd ed.). Illinois: The Dryden Press.