NATIONAL OPEN UNIVERSITY OF NIGERIA

BUS 802

Economic Theory

Module 6

BUS 802 Economic Theory Module 6

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Module 6

Unit 1 Distribution of Income, Resource Allocation, and the Theory of Welfare Economics

1.0 Introduction

In any market economy, the distribution of income or goods is determined simultaneously with the allocation of resources. Governments often attempt to affect the way after-tax income is finally distributed, but the market acts as the principal distribution mechanism. In this unit, we will be interested in both how the market distributes income and resources and in the development of a framework for re-distributional policy in case of market failures.

Welfare economics is generally concerned with examination of all resources that are feasible in the production of goods and services needed by the society, as well as establishment of criteria for selecting among alternative resources. The basic question often raised by welfare economists is "What is the best allocation of resources from a social point of view?" Welfare economics is the most normative branch of microeconomics. The aim of this unit is to examine the intrinsic difficulties inherent in questions of social welfare and to demonstrate important conceptual issues.

2.0 Objectives

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

- explain the theory of income distribution
- enumerate the factors responsible for income inequality
- enumerate and explain alternative income re-distribution programmes available to governments
- define welfare economics and the welfare criteria in an exchange economy
- explain the social welfare function
- enumerate the methods of attaining social welfare in an economy.

3.0 Main Content

3.1 Theory of Income Distribution

A typical shape of the income distribution curve is presented in figure 3.1 below. The figure presents income levels on the horizontal axis and the number of households with such income levels on the vertical axis.

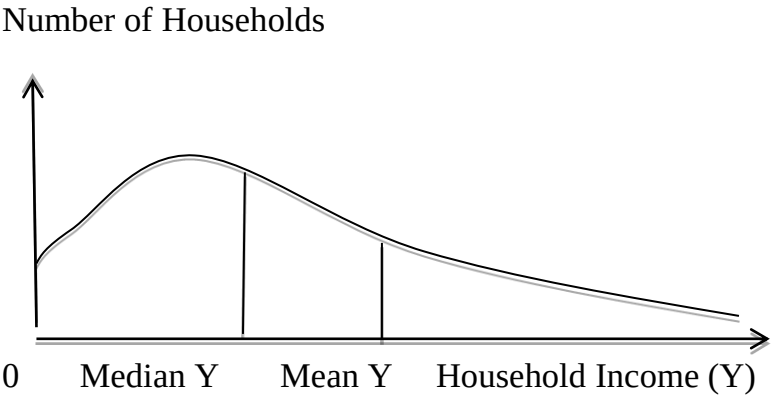

Figure 3.1: Typical Distribution of Income for a Developed Economy

Three general features of the above income distribution curve can be highlighted. First, there are large numbers of households in the middle income ranges. As many economists have pointed out, many developed economies are numerically dominated by the middle class. Another observation is that the income of households outside of the mid-range are not symmetrically distributed so that, the income distribution curve is skewed to the right. The implication is that there are some households with very high incomes (you may want to reflect on the income distribution of the Nigerian society). For such skewed distributions, the mean or average income will exceed median income that is, the income level that divides the population into two equal-size groups. This has been the case because the existence of very high incomes will affect the location of the mean but not of the median incomes. The last observation is that, for income levels above the mean income, the income distribution declines smoothly in an exponential form.

3.1.1 Measurement of Income Inequality

Figure 3.1 illustrates the hypothesis that most countries exhibit considerable inequality in the distribution of income. With an appropriate income distribution data, a country's income distribution can be presented in a graph through the use of ***Lorenz curve***, as illustrated in figure 3.2 below. The Lorenz curve is a plot of the cumulative percentages of the population (or households) along the horizontal axis, and cumulative percentages of total income received by households (starting with the lowest income) along the vertical axis. If income were perfectly equally distributed, the Lorenz curve would be a diagonal straight line showing that, for example, 10 percent of the population receives 10 percent of total income. Inequality in the actual income distribution is indicated by the curve being bowed below the diagonal. The more unequal the income distribution, the more extensive will be the bowed effect.

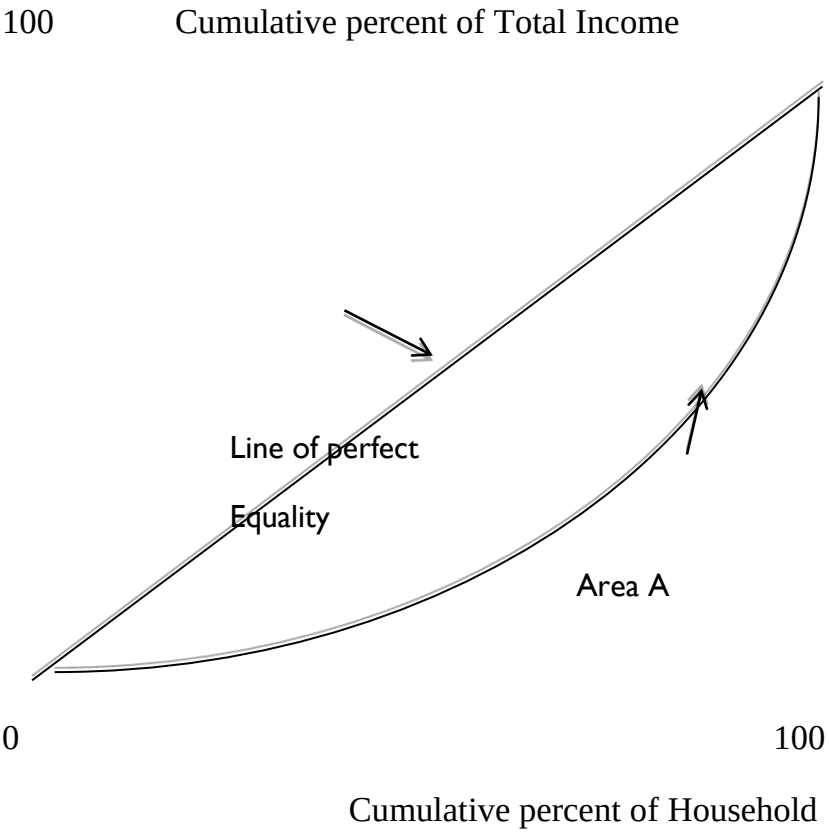

Figure 3.2: The Lorenz Curve of Cumulative Income Distribution

A measure of the inequality, derived from the Lorenz curve is the ***Gini Coefficient*** defined by:

$$\text{Gini Coefficient} = \frac{\text{Area A}}{\text{Area(A+B)}}$$

Hypothetically, the Gini coefficient ranges from 0 (perfect equality) to 1 (absolute inequality, that is, one person gets all income).

Though, modern income distribution theory continues to make a distinction between income from labour (earnings) and income from capital (interest, dividends, rents and the like). To summarise, sources of income are discussed below:

3.1.2 Sources of Income

A household's total income (Y) can be disaggregated as labour income (Y_L) and income from capital (Y_K):

$$Y = Y_L + Y_K \qquad (3.1)$$

Labour income is usually expressed as the product of wage rate (w) and the number of hours worked by the household member (L) so that,

$Y_L = wL$ (3.2)

Similarly, income from capital is expressed as the product of rental rate of capital (r) and the quantity of capital owned by the household (K) so that,

$Y_K = rK$ (3.3)

Each household's income can thus be written as:

$Y = wL + rK$ (3.4)

Observe intuitively that differences in incomes among households can arise from differences in any of the four variables, w, L, r, and K in equation 3.4, or from inequalities caused by the relationships among these variables. It is therefore important to examine the possible economic determinants of each of these principal variables.

1. ***Distribution of the Wage Rates (w):*** The wage dispersion existing in hourly wage rates or salaries, as the case may be, is probably the principal determinant of overall inequality in households income. If wage rates are determined according to the productivity of labour, note that productivities may differ among workers because of differences in formal education, training, on-the-job experience, or physical and mental ability.

2. ***Distribution of Hours Worked (L):*** Hours worked by households vary. This can be because of differences in the number of individuals in a given household and because of variability in hours worked by individual household members. In recent times, households have attempted to increase the number of hours worked in the family by increasing the labour force participation through either married women participating in the labour force or participation of children of adult age.

3. ***Distribution of Rent (r):*** It is probable that rental rates earned on capital investments differ relatively slightly among households. The differences can be explained by the following factors:

First, because capital market is mobile, the market tends to equalise rates of return as capital owners reallocate their resources form low- to high-yielding investments. A number of factors may prevent this, however. Some capital owners may be able to command a monopoly rent. Some investments may be available only to those with substantial assets. Secondly, differences in rental rates may arise because some individuals are more willing to take risks than are others.

4. ***Distribution of Capital Ownership (K):*** The distribution of the stock of capital owned by households has been noted as highly unequal among households. Because it appears there are only two ways in which capital stocks may be obtained (gifts and inheritance or accumulated savings), distribution of capital ownership may differ due to variations among individuals blessed with these methods of capital acquisition. Conventional opinion suggests that inheritance is a principal cause of differences in capital ownership among households.

Savings behaviour is also important in the determination of distribution of capital ownership. Households with high propensity to save are more likely to be rich in capital accumulation than those with low propensity to save.

3.2 Income Redistribution Programmes

To address the problem income inequality among households, governments often design some re-distributional programmes. The activities undertaken by governments with express purpose of improving the distribution of income has been classified into two different groupings: (i) market-oriented programmes; and, (ii) tax-subsidy programmes. This section examines these activities one at a time.

3.2.1 Market-Oriented Programmes

Government's activities aimed at promoting equal opportunity in hiring practices is one example of market-oriented programmes. Many regulatory functions of government, such as actions against monopolistic practices, also have important re-distributional effects. Additionally, government can adopt educational and work training programmes with the aim of equalizing wage rates. These traditional government programmes are aimed at getting the market to produce an equitable distribution of income.

3.2.2 Tax-Subsidy Programmes

In addition to impacting on the determinants of income, governments often change household's income directly through tax or subsidy programmes. To illustrate the effects of such programmes, you can rewrite total households income as:

$$Y = wL + rK - T(w, L, r, K, \ldots), \quad (3.5)$$

where the function T(w, L, r, K, …), expenditure on taxes, may depend on the absolute level of household income, the consumption expenditures, and size of the household. A positive value for T would indicate that the household pays taxes, whereas a negative value would indicate that the household receives subsidy.

3.2.3 Benefits and Costs of Re-distributional Programmes

The principal benefit of re-distributional programmes is, naturally, decreased inequality in income distribution. If the entire population desires equality, this benefit will be of a substantial value. Market-oriented re-distributional programmes do have the additional benefit of improving the operation of various labour markets and perhaps raising the productivity of some workers, especially the less privileged workers. Such programmes may therefore, not only ensure that output of the economy is distributed more equitably but also increase the total output and income to be distributed.

The costs of re-distributional programmes do not actually represent the naira costs of such programmes. The naira costs represent transfers from one member of the society to another and therefore not costs from the social point of view. This is not to say however, that re-distributional programmes are costless. Tax levies with which to finance transfer programmes can induce important distortions into the allocation process. If lump-sum taxes could be imposed so as to decrease the purchasing power of the individual that is

being taxed without biasing decisions, those distortions might be minimised. As income tax affects the wage rate or salary relevant to an individual's decision income taxes will cause a reaction in individual's labour-leisure choices. It may be the case that progressive income tax rates needed to carry out adequate re-distributional programmes will encourage the most highly paid, and possibly more productive workers, to prefer more leisure than work. The resulting reduction in output due to withdrawal from the labour force would be the true cost of any transfer programme. The following section examines specifically the work disincentive effect of government income transfer programmes.

3.2.4 Work Disincentive Effect of Government Income Transfer Programmes

The issue of whether or not individuals will reduce their work effort or even withdraw from the labour force when they receive an income guaranteed by the government has been a major issue of interest in labour economics. This section therefore discusses such issue, since this issue can illustrate many of the principles of individual behaviour. We shall begin by analysing the effect of a guaranteed income in a static context. This will be followed by simple dynamic view of individual behaviour that is capable of raising some doubts about the conclusions of the static theory in economics.

Basic Features of Transfer Programmes

All simple income transfer programmes can be characterised by two basic features: income guarantee (G); and, the reduction rate (t) (also referred to as the tax rate). The parameter, G, represents the amount the government undertakes to pay an individual with no other income. G is often referred to in advanced economies, such as the United States, as unemployment benefit.

The Total income or individual beneficiaries can never fall below G. The parameter, t, the reduction rate indicates how governmental payments are to be reduced as the individual's other incomes (from labour earnings) rises. For example, suppose the G is set at N10,000 per year and that the reduction rate is 50 percent. If an individual has no other income, he/she will therefore receive N10,000 from the government. If the individual earned the amount, say, N6,000 during the year, he/she will receive (N10,000 – 0.5 x N6,000) = N7,000. That is, the government grant is reduced by 50 percent of what the individual earned. Government grants will decline as earnings increase.

More formally, let E be the individual's earning during the year and suppose that income from capital is zero. Government payments or grant to the individual becomes:

$P^* = G - tE \qquad (3.6)$

Generally, P^* cannot be negative, so that $P^* = 0$ for $tE \geq G$

Total income earned by the individual now becomes:

$Y^* = P^* + E = G + (Y^* - t)E \quad (3.7)$

Equation (3.7) becomes the basic budget constraint we will be investigating while trying to determine the work disincentives brought about by the government transfer programme.

The Disincentive Effects of Transfer Programmes

In our discussions, the term "work disincentive" should be taken to mean a decrease in an individual's hours of work. We are interested in how an individual's hour of work will change when he/she faces the budget constraint given by equation (3.7) above.

Assume that the individual is able to earn a wage rate, w, per hour. Then earnings will be given by:

$E = wL$ (3.8)

where L = the number of hours worked.

In the theory of labour supply, economists formulate an individual's demand for hours of leisure per year (H) as follows:

$H = T - L,$ (3.9)

where T = total available time per year

L = hours of work per year

Consequently, from equation (3.8),

$E = w(T - H)$ (3.10)

Equation (3.10) implies that the individual earns income for those hours he/she works instead of taking leisure.

It can be shown that the result of implementation of a governmental transfer programme is to cause the individual to demand more leisure and reduce hours of work.

Let us compare the individual's budget constraint with and without a transfer programme.

Without the transfer programme, the individual's only source of income is earnings. Thus the budget constraint is given by:

$Y^* = E = w(T - H)$ (3.11)

Under the transfer programme and using equation (3.11), total income and hence the new budget constraint is given by:

$Y^* = P + E = G + (1 - t)E = G + (1 - t)w(T - H)$ (3.12)

Sketching the two budget constraints, equations (3.11) and (3.12), and using the utility maximising principle, you can illustrate the disincentive effects of a transfer programme as follows:

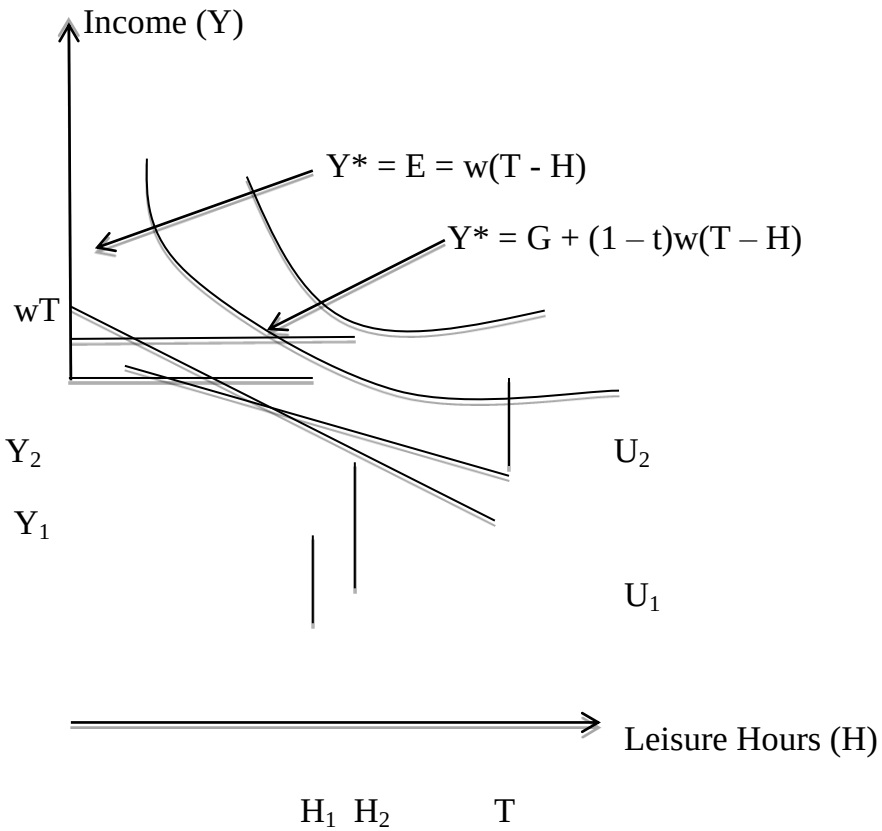

Figure 3.3: Disincentive Effects of a Transfer Programme

As indicated by figure 3.3, the result of implementation of a governmental transfer programme is to cause the individual to demand more leisure and reduce the number of hours put to work. In the absence of a transfer programme, the individual's utility-maximising choice between leisure (H) and income (Y) (working hours) is Y_1, H_1. The new budget constraint introduced by the programme will cause the utility-maximising point to shift to Y_2, H_2, where more leisure is demanded at the expense of working time.

3.3 The Theory of Welfare Economics

In a nutshell, we define welfare economics as a field that focuses on the optimal allocation of resources. In the sections that follow, we examine the basic tool for optimal allocation of resources.

3.3.1 Establishing the Welfare Criteria in an Exchange Model

Consider the Edge worth box in figure 3.1. The box illustrates the social welfare of two individuals, Obi and Adamu. Only those points on the curve 0a, Oo, referred to as the contract curve, are possible points for a social optimum. Points outside the contract curve are dominated by points on the curve because both Obi and Adamu can be made better off, and by so doing, social welfare could be improved. Along the contract curve, the utilities of the two individuals represented vary, and these utilities are directly competitive. Obi's utility can be increased only by decreasing that of Adamu.

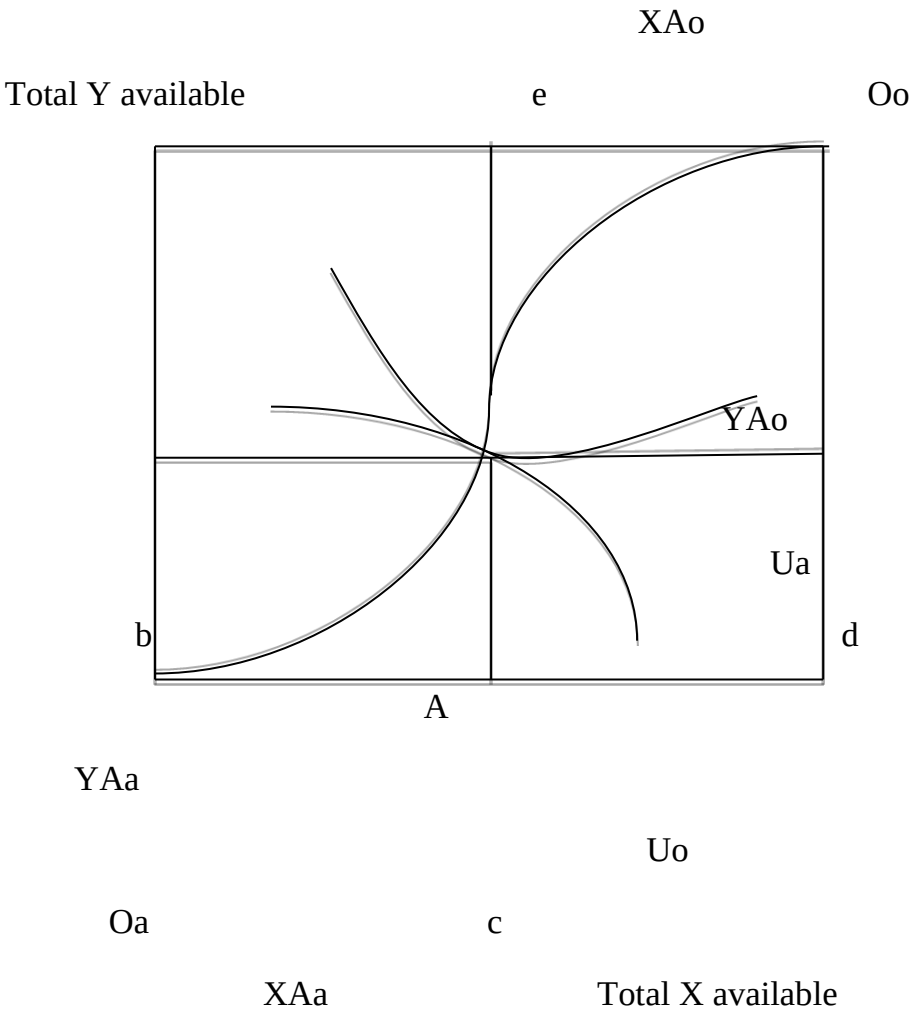

Figure 3.4: Edge worth Box Diagram of Exchange

Given this set of efficient allocations, we want to discuss the possible criteria for choosing among them. We assume that utilities are measurable and that they may be compared on a common scale. Making this assumption will permit us to conceptualise certain problems. From the assumption of measurability, it is possible to use utility combinations along the contract curve, Oa, Oo to construct the utility possibility frontier (UPF), shown in figure 3.2 below.

The utility curves Ua and Uo are those of Adamu and Obi, respectively. Point A, the point of intersection of the contract curve (Oa, Oo), Ua, and Uo is the utility maximizing point for Adamu and Obi. Two goods, X and Y are used in this illustration. As indicated, the total available quantity of Y is represented on the Y-axis, and that of X is represented on the X-axis. At point A XAo units of good X is available for Obi, and XAa units of X is available for Adamu. Similarly at point A, Yao units of Y is available for Obi and YAa units of Y is available for Adamu.

The curve Oa, Oo in figure 3.2 records those utility levels for Adamu and Obi that are obtainable from the fixed quantities of goods Y and X that are available. Any utility combination, such as point C, that lies inside the curve Oa, Oo is efficient in the sense that utilities could be unambiguously improved (for example by moving to any point on the arc C'C'); This is just a reflection of the way in which the contract curve is constructed.

Using the utility possibility frontier, economists can replace the problem of welfare economics as being the development of criteria for choosing a point on this frontier.

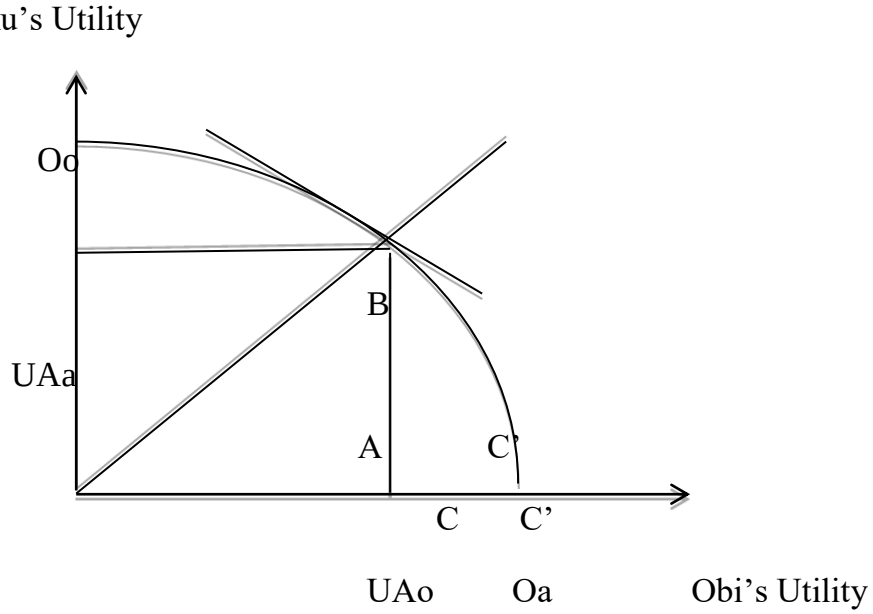

Figure 3.5: The Utility Possibility Frontier

The Welfare Criteria

Two simple criteria for choosing a point on the utility possibility frontier, Oa, Oo, can be shown on figure 3.2 above. The ***first criterion*** requires complete equality: Adamu and Obi should be able to enjoy the same level of welfare. This is a social welfare criterion that would necessitate choosing ***point A*** on the utility possibility frontier above. Since point A corresponds to a unique point on the contract curve, the social optimum allocation of goods X and Y has been determined by this choice. Observe that in figure 3.1 (the previous figure), this allocation requires that Adamu gets XAa units of good X and YAa units of Y. And Obi gets XAo units of X and YAo units of Y. Note that in this analysis, the goods X and Y are not necessarily distributed equally. We are concerned with the equality of utilities. If individuals have rather different tastes, as is usually the case, for two goods, the goods could be very unequally distributed at point A above.

The ***second criterion*** would be to choose that point on the utility possibility frontier for which the sum of the individual utilities is the greatest. This requires that the optimal point, **point B** on the utility possibility frontier be chosen to maximise (Ua and Uo), subject to the constraint implied by the utility possibility frontier.

Methods of Attaining the Social Optimum

The above two criteria are simple notations of social welfare. If the society had decided that it should operate by one of these principles, the criteria provide one method of findings the socially optimal allocation of goods. The question facing economists has been on the exact method of allocating the specific goods in the socially optimal way. ***One method*** of achieving the optimal allocation is to directly allocate all gods by the government. This would however, require perfect knowledge about individual tastes. The ***second method*** would be to allocate one of the goods "*correctly*" for instance, Give Adamu XAa and Obi

XAo and let them trade only in the other good, good Y, until they arrive at the contract curve. It has been noted that this approach will work even when more than two goods are involved. The ***third*** and more practical method of achieving the optimal and efficient allocation presented by point A on figure 3.2, it will be necessary to ensure that initial endowments are appropriate. If the government wishes to ensure equity, as well as efficiency, it would find it necessary to engage in some transfers of initial endowments before trading among individuals begins. That is, the government should transfer income among citizens in order to ensure that an equitable distribution of utilities is attained.

3.3.2 Social Welfare Functions

A more general and mathematical approach to social welfare is to use the concept of ***a social welfare function***. Continuing with the two individuals, Adamu and Obi, we can formulate a social welfare function of the form:

Social Welfare, W = W(Ua, Uo), (3.1)

assuming the individual's tastes are important.

The society's problem becomes that of allocating goods X and Y between Adamu and Obi, for example, so as to maximise the welfare, W. This process can be illustrated as in figure 3.3 below. The curves, W_1, W_2, and W_3, represent different ***social indifference curves.*** These assume that the society is indifferent about which utility combination on a particular curve is chosen.

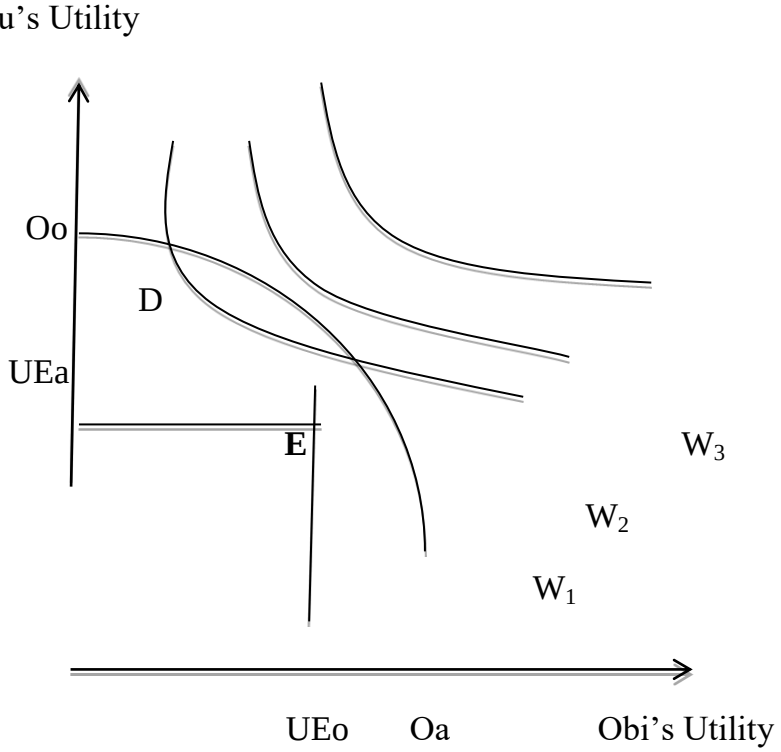

Figure 3.6: Determination of the Optimum Social Welfare

The indifference curves for the function, W, exhibits a diminishing rate of substitution of Obi's utility for that of Adamu. This assumption is made with the belief that the society is less willing to make Adamu better off at the expense of making Obi worse off. Point E is the optimal point of social welfare, because this is the highest level of welfare achievable with the given utility possibility frontier.

Enumerate and discuss in detail the factors responsible for differences in income distribution among households in Nigeria.

Self-Assessment Exercise

1. Enumerate and discuss, with simple examples, two methods of ensuring optimum societal welfare in Nigeria.

2. Assume an economy with just two individuals, A and B, explain the results of exchange in the following situations:

(a) Perfect competition in which individuals A and B accept prices as given by the "market".

(b) Individual A is a monopolist and can set any price he/she chooses.

(c) Does each of these situations lead to a pareto efficient solution? Use an Edge worth box Diagram to explain this.

4.0 Conclusion

This unit discusses in detail the theories of income distribution, resource allocation, and welfare economics. Specific emphasis were on the measurement of income inequality, using the Lorenz curve; composition of the household total income, labour income and income from capital; factors associated with differences in income distribution; and, income redistribution programmes and their disincentive effects.

We also have learned that welfare economics deal with all feasible resources in the production and distribution of goods and services. The discussions also outlined the following:

(1) The welfare criteria in an exchange model;

(2) The utility possibility frontier (UPF); and,

(3) The methods of attaining optimal social welfare.

5.0 Summary

The unit began with a brief presentation of the general income distribution curve. We noted that there are three general features of the income distribution curve which can be highlighted as follows: First, there are large numbers of households in the middle income ranges in most developed countries. As many economists have pointed out, many developed economies are numerically dominated by the middle class. Another feature is that the income of households outside of the mid-range are not symmetrically distributed so that, the income distribution curve is skewed to the right.

The unit also observes that, with an appropriate income distribution data, a country's income distribution can be presented in a graph through the use of ***Lorenz curve***, as illustrated in figure 3.2 below. The Lorenz curve is a plot of the cumulative percentages of the population (or households) along the horizontal axis, and cumulative percentages of total income received by households (starting with the lowest income) along the vertical axis. If income were perfectly equally distributed, the Lorenz curve would be a diagonal straight line.

A household's total income (Y) can be disaggregated as labour income (Y_L) and income from capital (Y_K):

$Y = Y_L + Y_K$ (3.1)

The major determinants of principal variables in the household income included distribution of the wage rate, distribution of hours of work, distribution of rent, and distribution of capital ownership. These determinants can affect the income distribution in a given economy.

Another important issue bordering on income distribution is the government programmes aimed at reducing the income inequality among household. There are two major income re-distribution programmes available to governments, including: market-oriented programmes and tax-subsidy programmes. Each of these programmes however, has disincentive effects. The most noticeable among these effects is the tendency of beneficiaries to demand more leisure.

Using the Edge worth diagram of exchange, and the utility possibility frontier (UPF), we outlined the welfare criteria in an exchange model as including:

1. Complete equality in social and economic welfare; and,

2. Choosing that point on the utility possibility frontier for which the sum of the individual utilities is the greatest.

The unit also enumerated the suggested methods of attaining social welfare as:

(1) Direct allocation of goods and services by the government;

(2) Allocation of one of the goods or services correctly to one among individuals in the society, and letting the other(s) trade only in the other goods or services; and,

(3) Transfer of income to citizens by the government.

We learned that one general and mathematical approach to social welfare is to use the concept of ***a social welfare function***, which can be defined as the sum of utilities of all citizens in the economy.

6.0 Self-Assessment Exercise

1. Suppose an individual seeks to maximise a utility function of the form:

$$U = U(Y, H) = Y1/3H2/3,$$

where Y = total income received, and H = hours of leisure.

(a) If the individual can earn a wage of N4 per hour and has no other source of income, how many hours will he/she choose to work out of a typical 24-hour day? What will total income and utility be in this situation?

(b) Suppose now that a negative income tax that provides a guarantee rate (G) of N200 per day is implemented, with an implicit tax rate (t) of 50 percent. Payments are thus given by:

P = (1 – t)wL + G = 0.5wL + 200, for G ≥ twL, P = 0 otherwise.

What will be the individual's utility maximizing Y and H in the given situation?

2. There are 200 kilograms of a food item in an Island that must be allocated between two marooned sailors. The utility function of the first sailor is given by:

$U1 = U_1(F) = \sqrt{F_1}$

where F_1 is the quantity of the food item consumed by the first sailor.

The utility function of the second sailor is given by:

$U_2 = U_2(F) = ½(\sqrt{F_2})$

where F_2 is the quantity of the food item consumed by the second sailor.

(a) If the food is to be allocated equally between the two sailors, how much utility would each receive?

(b) How should the food item be allocated between the two sailors in order to ensure equality of utility among them? (Use the Edge worth diagram).

(c) How should the food item be allocated so as to maximise the sum of the sailors' utilities? (Use the utility maximising principle of the theory of consumer behaviour).

7.0 References/Further Reading

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Unit 2 The Efficiency of Perfect Competition

1.0 Introduction

Achieving efficiency and choosing among efficient allocation of goods and services among citizens has often been regarded by economists as a purely physical problem in relating societal tastes to available productive technology. Presumably, it can be said that a desirable allocation of resources can be brought about by a central government. All that would be needed by the government is complete information about individuals' tastes and the productive possibilities of all firms in the economy. However, even if it were possible to gather such information on individuals' tastes, it would be undoubtedly be prohibitively costly to do so. Consequently, alternative, less costly or efficient allocation methods would have to be sought. The allocation method that has received the greatest attention by economists is the price or competitive system. By relying on the self-motivation of productive decision makers, the price system has been noted to permit the decentralisation of allocation decisions. Relative to perfect central planning, an interconnected market system provides a method for relating individual tastes and productive technology in a low-cost way. It is assumed that the natural working of the market mechanism can generate information about tastes and technology in the form of prices. The question this unit attempts to investigate is whether in a market economy the price system can allocate resources efficiently, and how this can be done.

2.0 Objectives

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

- define a perfectly competitive market system
- explain equilibrium conditions in a perfectly competitive market
- explain economic efficiency and efficiency in exchange
- explain optimal allocation of resources
- enumerate the causes of failure in a competitive market system.

3.0 Main Content

We examine the principles of perfectly competitive price system and what economists regard as efficient allocation through perfect competition.

3.1 The Perfectly Competitive Price System

Economists believe that a perfectly competitive price system yields an efficient allocation of resources. There appears to be exact correspondence between a Pareto optimal allocation of resources and a perfectly competitive price system: every perfectly competitive allocation is Pareto optimal; and every Pareto optimal allocation has an associated perfectly competitive set of prices. Thus, the allocation problem and the establishment of competitive prices are dual problems.

However, not every Pareto optimal allocation is a social welfare optimum. Consequently, though a competitive price system may bring about an efficient allocation of resources, care should be taken in assessing the social desirability of such allocation. In addition, you should be extremely careful in drawing policy conclusions from the formal theorem of equivalence between perfect competition and Pareto optimality. Many of the theoretical requirements of a perfectly competitive price system may not be attainable in the real world situation. Two of the basic theoretical assumptions or requirements include equilibrium prices and behavioural assumptions concerning economic agents.

3.1.1 Equilibrium Prices

In a perfectly competitive price system, we assume the number, n, of well-defined, homogeneous goods in a given economy. Included in the list of available goods are consumption items, factors of production, and intermediate goods. Each of these goods has an equilibrium price established by the equality of supply and demand in the markets for the n goods. It is assumed that there are no transactions or transportation charges and that individuals and firms have perfect knowledge of the equilibrium prices, so that a given good trades at the same price regardless of who buys it or who sells it.

3.1.2 The Behavioural Assumptions

Given the prices of n goods, economic agents react to them in specific ways:

1. Each individual takes all n goods prices as given, and he/she adjusts behaviour *so as to maximise utility*, given the prices and budget constraints.

2. In making input and output choices, firms are assumed to operate *so as to maximise profits*. The firms treat all prices as fixed parameters in their profit-maximising decisions. Individual firms have no effects on market prices.

3.2 Prices and Economic Efficiency

The basic conditions of efficiency for a perfectly competitive environment require that the rate of trade-off between any two goods, X and Y, for instance, should be same for all economic agents. The ratio of the price of X to the price of Y provides the common rate of trade-off to which all agents adjust. Because prices are treated as fixed parameters in both individuals' utility-maximising decisions and firms' profit-maximising decisions, all trade-off rates between X and Y will be equal to the rate at which X and Y can be traded in the market, that is, P_X/P_Y. We examine one at a time: the efficiency in exchange; efficiency in production; and, efficiency in production and exchange.

3.2.1 Efficiency in Exchange

Efficiency in exchange requires that the marginal rate of substitution (MRS) for any two goods, say, X and Y, should be same for all individuals. But recall that utility maximisation requires that individuals equate their MRS of X for Y to the price ratio, P_X/P_Y. By so doing each individual equates the rate at which he/she is willing to trade good X for good Y to the rate at which these can be traded in the competitive market. Since every individual faces the same price ratio, the utility-maximising decision of each individual will lead to the

establishment of conditions for efficient exchange. In mathematical terms, let us consider two individuals, each of which faces the price ratio, P_X/P_Y, and chooses X and Y such that:

$MRS_1 = P_X/P_Y$ (for individual 1) (3.1)

$MRS_2 = P_X/P_Y$ (for individual 2) (3.2)

It follows that: $MRS_1 = MRS_2 = P_X/P_Y$ (3.3)

Equation (3.3) becomes the condition for efficient allocation of goods X and Y for the two individuals.

3.2.2 Efficiency in Production

It is an economic belief that perfectly competitive prices will lead to efficiency in production. This belief can be substantiated by three allocation rules:

Allocation Rule 1 requires that a firm has identical rates at which it can trade one input for another, that is, the rate of technical substitution (RTS), in all outputs it produces. This rule can only be assured by the existence of perfectly competitive market for inputs. In its cost-minimising behaviour, the firm equates the RTS between any two inputs, say labour (L) and capital (K), to the ratio of their competitive rental prices, w/r. By so doing, the firm will be led to adopting efficient input proportions in a decentralized and low-cost manner.

Allocation Rule 2 requires that every firm producing a particular good, say X, has identical marginal productivities of labour in the production of good X (MP_L^X). As a rule, a profit-maximising firm will hire additional labour up to the point at which the marginal value product ($P_X \cdot MP_L^X$) of labour equals the competitive wage rate (w): $w = P_X \cdot MP_L^X$). Since both P_X and w are determined by the market, each firm will equate its MP_L^X to w/P_X. Consequently, every firm will have the same marginal productivity of labour in the production of good X. Again, the market has been able to bring about an efficient allocation.

Allocation Rule 3 requires that the rate of product transformation (RPT) – the rate at which one output can be traded for another in the production process- between any two goods, say, X and Y, be same for all firms. This implies that the rate of product transformation (of X and Y), RPTxy, would be equal to the ratio of marginal cost of X (MCx) to that of Y (MCy). Each profit-maximising firm would produce that output level for which marginal cost equals the market price.. Therefore, for every firm in the perfectly competitive environment, Px = MCx, and Py = MCy, and hence, MCx/MCy = Px/Py for all firms. In this situation, the allocation rule 3 will be satisfied.

The above discussions demonstrate that the profit-maximising, decentralised decisions of many firms can achieve efficiency in production without any central direction. Competitive market prices act as signals in unifying multitude of decisions that firms make into coherent, efficient pattern.

3.2.3 Efficiency in Production and Exchange

Efficiency in production and exchange is attained at the point where the consumers' marginal rate of substitution (MRS) is identical to firms' rate of product transformation (RPT). This is true for any pair of goods. Once this condition is satisfied at any given point

in time, an efficient mix of goods will be produced and exchanged. Note two important functions performed by the market prices. First, market prices assure that supply and demand will be equalised for all goods. If a particular good is produced in excess, a market reaction will set in to cut back on production of the good and shift resources into other uses or employment. The market can react by ensuring that the price of the good in excess production falls. The equilibrating nature of demand and supply in the market assures that there will be neither excess demand nor excess supply. In the second important function, equilibrium prices provide market trade-off rates for both firms and individuals to use as parameters in their decisions. Because these trade-off rates are identical for both firms and individual consumers, they help in assuring efficiency.

The above principles can be illustrated according to figure 3.1 below. The figure shows the production possibility frontier for a two-good economy, represented by the curve PP. The set of indifference curves represents individuals' tastes for the two goods.

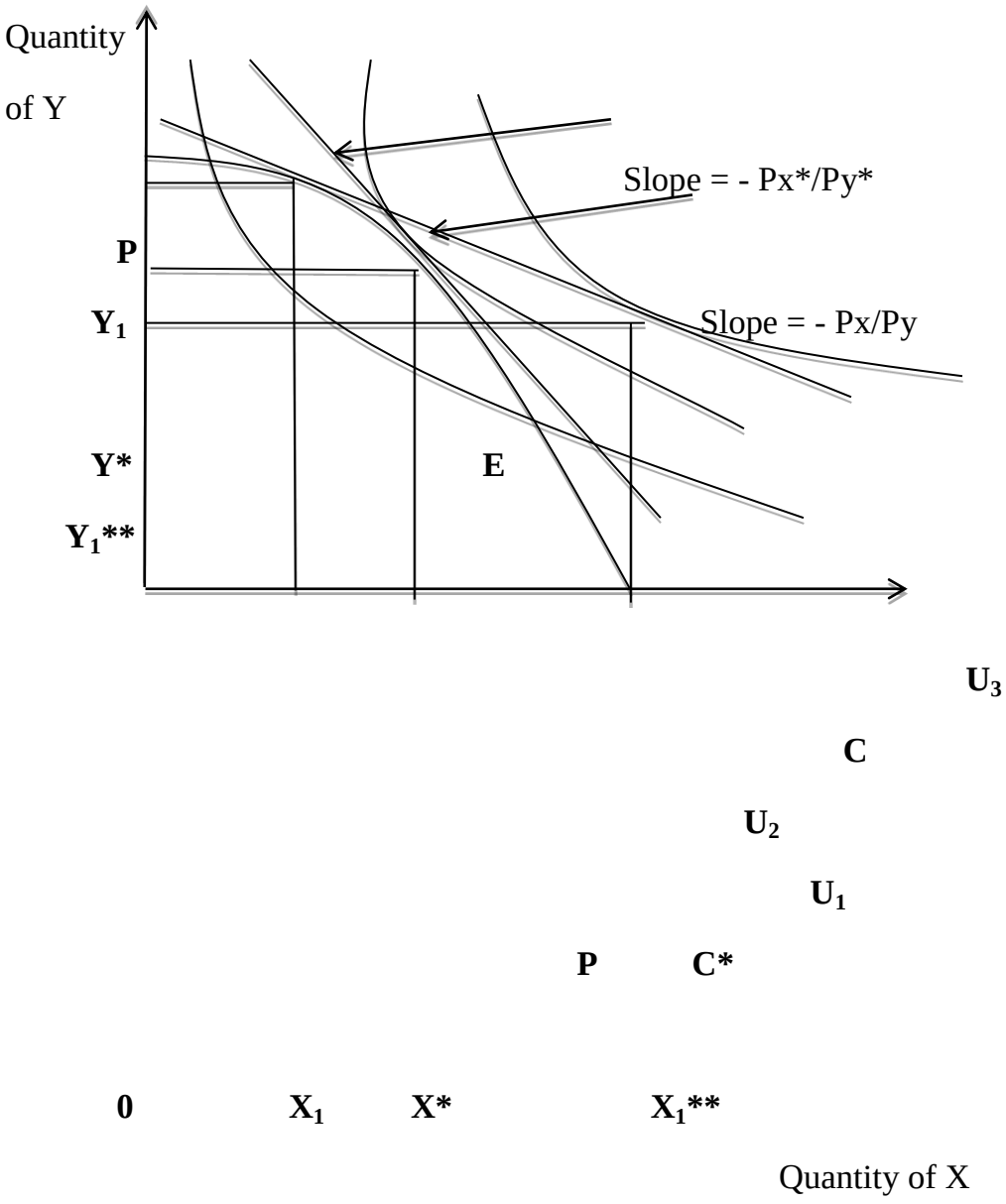

Figure 3.1: Perfectly Competitive Prices and Economic Efficiency

We first consider the price ratio Px/Py. The negative of this price ratio, -Px/Py, represents the slope of the budget constraint, line C. At this price ratio, firms will choose to produce output combination: X_1, Y_1. It is only at this point of the PP curve will price be equal to marginal cost for both goods. On the other hand, given this budget constraint, line C, individuals will demand X_1**, Y_1** units of goods X and Y, respectively. By inspection of figure 3.1, you will observe that with this budget line C, there is an excess demand for good X (X_1** > X_1 **),** and excess supply of good Y (Y_1 > Y_1** **).** The working of the market place will therefore, raise the unit price of good X and reduce that of good Y. Consequently, the price ratio, Px/Py rises causing the price line to take on a steeper slope. Firms will respond to these price changes by moving clockwise along the production possibility frontier, PP. By so doing, they will increase the production of good X and decrease that of good Y. At the same time, individuals will respond to the changing prices by substituting good Y for good X in the consumption choices. Actions of both firms and individuals will then serve to eliminate the excess demand for good X and the excess supply of good Y as market prices change

Equilibrium position is reached at point E, with quantities, X*, Y* traded at the price ratio of Px*/Py*. With this price ratio, supply and demand are equilibrated for both good X and good Y. In maximising output, given Px* and Py*, firms will produce X* and Y*. Similarly, with the budget constraint now given by the line, X* units of good X and Y* units of good Y.

3.3 Failure to Achieve Efficiency by the Market System

The effectiveness of a perfectively competitive price system depends on the assumptions underlying the competitive model. Outside the confines of the competitive model, and in our examination of the real-world allocation problems, certain difficulties become apparent. This section examines some of the impediments preventing the free-market system from generating an efficient allocation. A number of such impediments have been enumerated, but we can just present the classifications. The classifications have been taking from real-world occurrences, including: imperfect competition, externalities, and public goods.

3.3.1 Imperfect Competition

The term, imperfect competition is used to refer to situations in which economic agents exert some market power in the determination of prices. Specific markets that are in this category include monopolistic, oligopolistic, and monopsonistic markets. The special aspect of such markets is that marginal revenue (or marginal expense in the case of monopsony, on the demand side) is different from the market price, as opposed to the case of perfect completion where the market price equals the marginal revenue at equilibrium. A profit-maximising firm, by equating marginal revenue to marginal cost, will not be willing to produce at the point where price equal to marginal cost. Such behaviour of firms will lead to a situation where relative prices will no longer reflect relative marginal costs, and the price system will no longer ensure efficiency in production and distribution.

By creating a divergence between price ratios and technical trade-off rates, the imperfect competitor, such as a monopolist, will cause a failure in efficiency of the price system. In such situation, individuals and firms no longer equate their rates of trade off to the same market-determined magnitudes. Under conditions of perfect competition, it is the marginal revenue that is relevant to firms' decisions and price that is relevant to individuals' decisions.

But under conditions of imperfect competition, firms and individuals will differ in their decision variables.

A market power by an agent will always create a divergence between market price and the marginal figure that is relevant to the agent's decision. Because of this divergence, market prices will not carry the appropriate information about relative marginal costs. The workings of the price system will be 'short-circuited,' and an optimal allocation of resources will not be feasible.

Under perfect competition, P = MC, so that individuals are willing to pay for a good at exactly what it costs to produce that good. When the equality of price (P) and marginal cost (MC) fails to hold, demands and productive technologies will no longer be properly tied together, consequently, resources will no longer be allocated in an efficient manner.

3.3.2 Externalities

The price system can also fail to allocate resources efficiently where there are interactions among firms and individuals that are not adequately reflected in market prices. One common example of such occurrence is the case of a firm that pollutes the air with industrial smoke. Such is an example of *production externality*. This is an example of an interaction between the firm's level of production and the individuals' utilities that is not accounted for by the price system.

Let us look at why the presence of such non-market interactions interferes with the ability of price system to allocate resources efficiently. Recall that efficiency in production and exchange is attained at the point where the consumers' marginal rate of substitution (MRS) is identical to firms' rate of product transformation (RPT). We redefine this condition in a 'social' sense when we recognise the possibility of externalities. We can assert that, for there to be an efficient or optimal allocation of resources, the *social rate of product transformation*, SRPT (that is, the rate at which society can transform one good into another) must equal to the *social marginal rate of substitution*, SMRS (that is, the rate at which society is willing to trade one good for another). The problem arising from the presence of externalities is reflected in the fact that economic agents pay attention to only *private* rates of transformation and substitution in their production and consumption decisions. If private and social rates diverge, the perfectly competitive price system will not be able to generate an efficient allocation.

To see this logic much clearer, let us imagine two goods in an economy, say, steel and balloons.

Assume on one hand, the private marginal cost of balloons (MC_b) is identical to the social marginal cost (SMC_b), and that there are in other words, no externalities in balloon production. On the other hand, suppose that the production of steel entails water and air pollution thereby imposing costs (such as having pollutants in drinking water) on society in addition to production costs. In this way, the social marginal cost of steel (SMCs) exceeds the private marginal costs of steel (MCs). The social rate of product transformation of steel for balloons (SRPT) is then defined as:

$$SRPT = \frac{SMCs}{SMC_b}$$

In principle, the rate at which society can transform balloons into steel is given by the ratio of these goods' social marginal costs. It is easy to observe that this rate will exceed the private rate of product transformation (RPT). Thus,

$$SRPT = \frac{SMCs}{SMC_b} > RPT = \frac{MCs}{MC_b}, \quad (3.4)$$

because of the externalities associated with steel production (SMCs > MCs). Equation (3.4) indicates that the rate at which society can trade steel for balloons exceeds the rate at which they can be traded privately. It follows that, in given up 1 ton of steel production, additional resources for balloon production come from two sources: those resources that were previously used in steel production and those that were used in combating the effects of air and water pollution.

3.3.3 Public Goods

A third possible failure of the price system to yield an optimal allocation of resources in an economy arises from the existence of goods that must be provided on a "nonexclusive" basis. Such goods or services include national defense, inoculations against infectious diseases, criminal justice, and pest control. The distinguishing feature of these goods or services is that they can provide benefits to all individuals: once such goods are produced, it is impossible or very costly to exclude any individual from benefiting from them. Consequently, there is the likelihood that individuals will adapt to the position of a "free rider" by refusing to pay for the good in the hope others will purchase it and thereby provide benefits to all. The pervasive nature of this incentive will ensure that resources are under-allocated to nonexclusive goods. To avoid this under-allocation, countries may decide to have the government produce nonexclusive goods and finance this production through compulsory taxation. For this reason, nonexclusive goods are referred to as *public goods*.

Self-Assessment Exercise

Assume an economy with just two individuals, A and B. Explain the results of the following situations:

(a) Perfect competition in which individuals A and B accept prices as given by the "market".

(b) Individual A is a monopolist and can set any price he/she chooses.

Does each of these situations lead to a Pareto efficient solution? Use an Edge worth Diagram to explain this.

4.0 Conclusion

The unit examined the process of achieving efficiency in production and distribution through efficient allocation of goods and services. We learned that efficiency in resource allocation

can be more feasible through adherence to the principles of perfectly competitive pricing system. The principles operate on two basic behavioral assumptions: first is that individuals or consumers strive to maximise utilities; and the second is that firms strive to maximise profits. For efficient allocation of resources, these assumptions are as important as the corresponding allocation rules presented in the unit. The unit also identified the major reasons market fails in efficient allocation of resources, including: imperfect competition; externalities; and, public goods.

5.0 Summary

Economists believe that a perfectly competitive price system can yield an efficient allocation of resources. They believe there is exact correspondence between a Pareto optimal allocation of resources and a perfectly competitive price system: every perfectly competitive allocation is Pareto optimal; and every Pareto optimal allocation has an associated perfectly competitive set of prices.

In a perfectly competitive price system, we assume well-defined, homogeneous goods in a given economy. Included in the list of available goods are consumption items, factors of production, and intermediate goods.

It was observed that the basic conditions of efficiency for a perfectly competitive environment require that the rate of trade-off between any two goods should be same for all economic agents. We also observed that perfectly competitive prices will lead to efficiency in production and allocation of resources. This observation was substantiated by three allocation rules:

Allocation Rule 1 which requires that a firm has identical rates at which it can trade one input for another, that is, the rate of technical substitution (RTS), in all outputs it produces.

Allocation Rule 2 which requires that every firm producing a particular good, say X, has identical marginal productivities of labour in the production of good X (MP_L^X). As a rule, a profit-maximising firm will hire additional labour up to the point at which the marginal value product (P_X . MP_L^X) of labour equals the competitive wage rate (w): $w = P_X . MP_L^X$).

Allocation Rule 3 which requires that the rate of product transformation (RPT) – the rate at which one output can be traded for another in the production process- between any two goods, say, X and Y, be same for all firms. This implies that the rate of product transformation (of X and Y), RPTxy, would be equal to the ratio of marginal cost of X (MCx) to that of Y (MCy). Each profit-maximising firm would produce that output level for which marginal cost equals the market price.. Therefore, for every firm in the perfectly competitive environment, Px = MCx, and Py = MCy, and hence, MCx/MCy = Px/Py for all firms.

6.0 Self-Assessment Exercise

Consider an economy with one technique available for the production of each good, Food and Cloth. The available inputs are labour and land, as represented below:

Good:	Food	Cloth	**Total**
Labour per unit of output	1	1	**2**
Land per unit of output	1	2	**3**

(a) Suppose that land is unlimited but labour equals 100 units, formulate and sketch the production possibilities frontier (PPF).

(b) Suppose that labour is unlimited but land equals 150 units, formulate and sketch the production possibilities frontier (PPF).

(c) Suppose that labour equals 100 units and land equals 150 units, formulate and sketch the production possibilities frontier (PPF).

Hint: Identify the intercepts of the PPF in each case and consider when land is fully employed, when labour is fully employed, and when land and labour are fully employed.

7.0 References/Further Reading

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

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