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BASIC CONCEPTS IN PROJECT EVALUATION

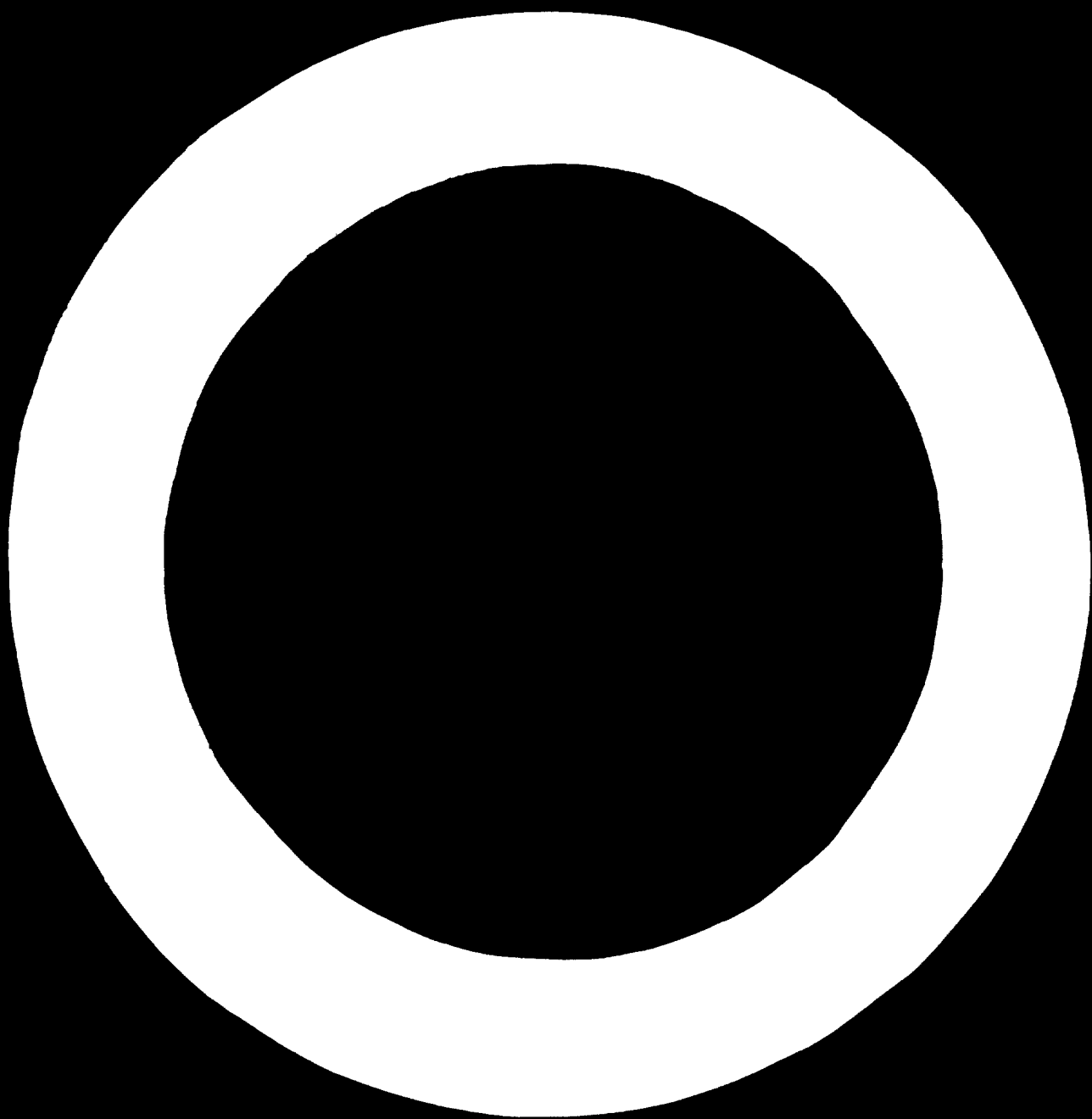
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Glossary of Related Terms

This paper was prepared by Mr. Mrinal Datta Chaudhuri, as consultant to UNIDO. The views and opinions expressed in this paper are those of the consultant and do not necessarily reflect the views of the secretariat of UNIDO.

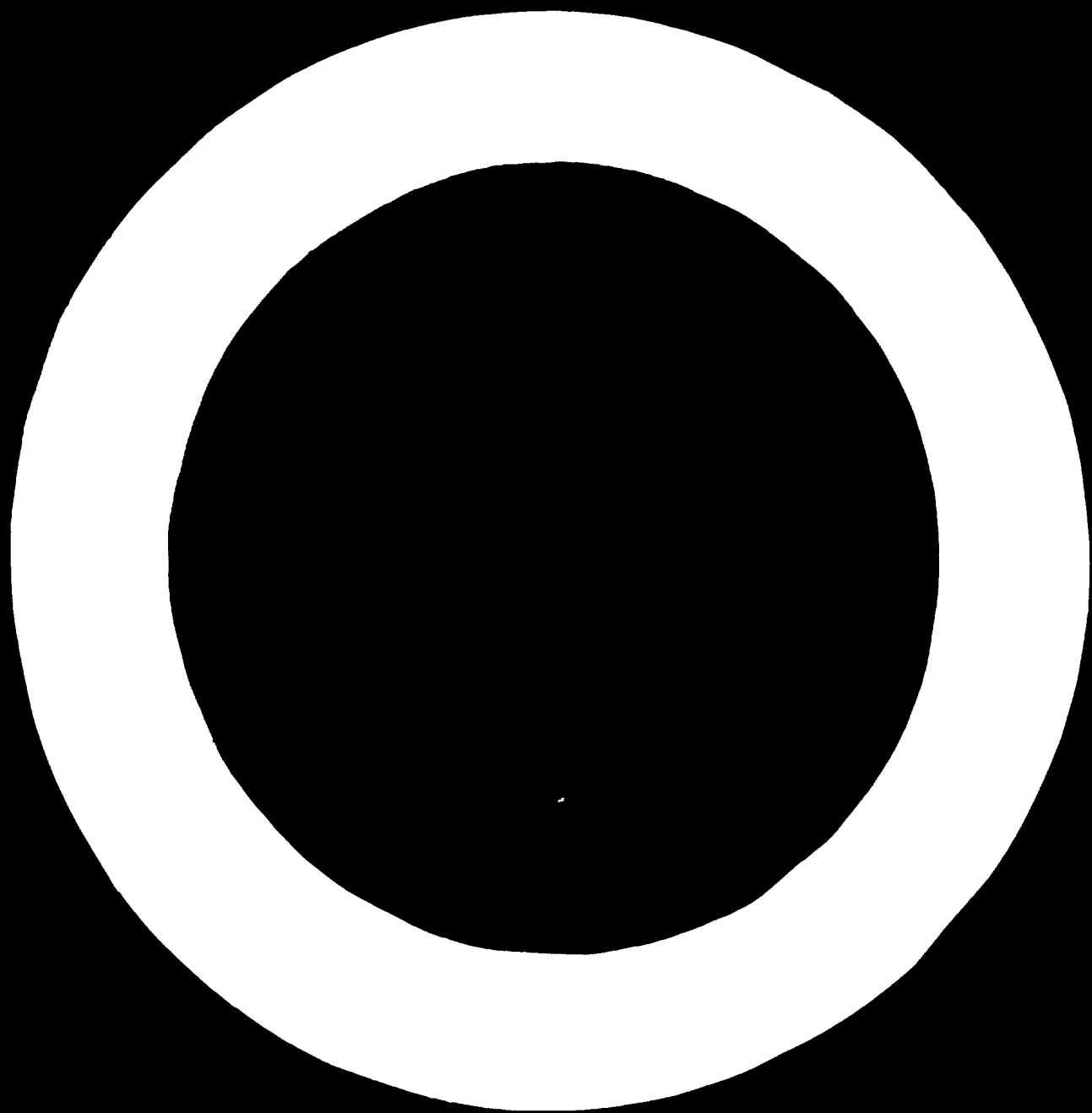
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We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.



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Foreword

1. Project formulation and evaluation is a field in which an interdisciplinary approach is most essential. Many people now active in this field have completed their professional training in engineering, accounting, banking and finance, management, and administration. They have learned the necessary economic analytical skills from a wide range of sources. These sources often provide instructions on how to compute the "correct" measure of a project's profitability, and possibly some consideration of the rationale of the procedure. Since practically all areas of economic analysis (e.g. price theory, income and employment theory, welfare economics, growth and capital theories, planning techniques) find their application in the economics of project evaluation, no single source can provide a thorough discussion of the rationale and relationship of all of its concepts.
2. The consideration of individual concepts is often in an abbreviated form concerned only with individual techniques, and can, at times, include concepts that are not always clear to the practitioner. As a result, a great deal of confusion has arisen over the meaning and the implication of much of the technical economic terminology of project formulation and evaluation.
3. This volume has been conceived to meet the growing and often expressed need for clarification in this field. It is obviously not a textbook on economics. It is intended to be used as a short guide and glossary for the economist and non-economist alike working in project formulation and evaluation. In this volume the various economic concepts and the terminology used frequently in manuals and articles on the subject are grouped in a number of mutually independent concepts. A separate chapter is devoted to each of these sets of concepts and each chapter is divided into two sections. The first section is devoted to a short exposition of the interrelationship of the concepts in the chapter and the relationship of these concepts to the main body of economic analysis. The second section provides a glossary of related terms used in connexion with the set of basic concepts, with a short definition of each term. An alphabetical index at the end of the volume will help the reader to locate each concept.
4. The reader is advised to read the general discussion in the first section of each chapter for a better understanding of the conceptual framework of the definitions given in the second section.

5. This paper was prepared for the United Nations Industrial Development Organization by Professor Mrinal Datta Chaudhuri of the Delhi School of Economics. The views and opinions expressed are those of the consultant and do not necessarily reflect the views of the secretariat of UNIDO.

I Commercial profitability, national economic profitability

6. Before he spends money, a rational individual usually asks: "Is it worth it?" If the expenditure is for an item of immediate consumption such as a theatre ticket, for example, the question is whether the show will be enjoyable enough to justify the expense. The decision involves a comparison of the benefits to be received with the cost involved in the venture. If the show is free the decision is not difficult because no sacrifice is involved.
7. An expenditure for a ticket, however, represents a sacrifice and therefore requires some calculation regarding the merit of enjoyment to be received from the show compared with the value of various other items that could be purchased with the same amount of money as the price of the theatre ticket. Similar decisions of evaluation are made frequently by everyone.
8. If the decision concerns something not for immediate consumption, but for investment, the basic rationale of weighing benefits against cost still applies. However, it is not so easy to decide on an investment as on the purchase of a theatre ticket. The worth of an investment is not immediately apparent and it is not easy to evaluate the yield of future returns.
9. An investor does not usually think in terms of producing goods for his own direct consumption; he invests in the hope of making a profit. A project is profitable if its yields prove to be worth more than its investment costs. Naturally, an investor tries to select only the most profitable ventures for his investments. He follows the same principle as that involved in buying a theatre ticket but the calculations are more complex.
10. It is logical to ask, "How does one calculate the worth of a project that involves investments and other expenditures over a period of time, and which promises to yield revenues at various periods in the future?"
11. Such a calculation involves comparing incomes and expenditures over various periods of time. Again, the principle is the same as that involved in comparing several commodities before making a decision to buy one. The willingness to pay more for one commodity than for others indicates the relative valuation (or relative prices) the buyer attaches to the commodities. Given the relative prices, the aggregate value of any basket of assorted commodities can be determined. Similarly, given the relative valuations of incomes and expenditures at various times, the net worth of a project can be determined.

12. The net worth is a measure of the profitability of a project because it is the difference between the value of all revenues and all costs associated with it. If the value of the future revenues exceeds that of the costs, the project is said to be profitable; otherwise it is unprofitable. The rational decision-taker always spends his resources in the most advantageous - the most profitable - manner.

13. Profitability therefore, is the name of the criterion by which an investor judges the worth of an investment project. A good measure of profitability is the "net worth" of the project. Net worth is calculated by deducting from the value of all future benefits (revenue) the value of all present and future costs (investments and recurring costs) of the project.

14. The next consideration is whether the profitability measure of a particular project is the same for all investors. The answer is obvious: if the valuation of all costs and all benefits is identical for everyone concerned, the project will appear equally profitable for all. For example, if the project under discussion happens to be the installation of a noisy printing press in a vacant lot 100 yards from the author's bedroom window, the project is likely to appear less attractive to the author than to most other investors. The basis, then, of any profitability calculation is the evaluation of costs and benefits. These valuations are invariably aimed at individual objectives. Genuine differences of opinion are therefore possible about the worth of any venture.

15. When the commercial profitability of a project is spoken of, this is the figure of its net worth. This figure is calculated on the basis of the prices at which trading actually takes place or is likely to take place in the market. If goods and services are bought and sold at certain known prices, if funds are borrowed and lent at a known market rate of interest, then the commercial profitability of a project (which is the net worth calculated on the basis of the given market prices) shows what price a particular project should command in a perfectly competitive market.

16. National economic profitability may be different from the commercial profitability of a project to the extent that market prices do not reflect the valuations the society would put on the various resources and benefits. Social valuations are supposed to reflect the availability of resources, the alternative possibilities of producing benefits, and the desire of the community to make individuals and groups prosper. Typically, the economic institutions of a country

(particularly of a developing country) are imperfect in the sense that they fail to transmit all the information about social goals into the prevailing market prices. These social objectives can be: (a) the desire to accelerate the growth of national income; (b) independence from external help; (c) rapid expansion of employment opportunities; (d) reduction of inequalities in the standards of living of various groups; and (e) provision for better health, education and other social services. These questions relating to the conscious social objectives for changing the structure of the economy should obviously affect the society's valuation of the different goods and services and the different ways of spending the national income. Furthermore, there are certain goods and services for which no rational pricing policy is possible, such as roads and municipal services, parks, facilities for health, or the education of workers in valuable skills. This shows that commercial profitability, calculated from market prices, may not indicate whether it is in the best interest of a society to accept a project or not to accept it.

Related terms

17. Benefit-cost analysis: An economic calculation made to arrive at a single indicator of the worth of a project. The project evaluator works out the value of all benefits to be derived from the project, as well as all items of costs to be incurred, in terms of his various objectives, in order to arrive at a single measure of value.
18. Efficiency analysis: An investigation into the efficiency with which certain precise, unquestioned objectives are to be reached. The purpose is to reach the objectives in the least expensive or quickest way. The desired objectives may be, for example, output targets in a country's economic development, or the expansion programme of a firm.
19. Investment effectiveness analysis: A crucially important aspect of economic planning is the allocation of the total investable resources among the various economic activities. An efficient allocation of an investment is one that produces the maximum advantage for the economy. Each investment has many different characteristics such as its expected life, the time-pattern of its outputs and the marketability of the product. Therefore, any simple concept such as the average profit rate in the market will not give a full indication of the effectiveness of an investment. From its definition it is obvious that a proper benefit-cost analysis should provide a measure of the effectiveness of the investment.

20. Benefits: Anything that contributes towards attaining the objectives of an evaluator is called a benefit. For example, the objective of a shopkeeper selling goods in the market is to make as much money as he can; for him the sales revenues are his "gross benefits". When he deducts from the gross benefits the costs of buying goods, storing them and so forth, he gets the net benefits or profits for which he is in business. He likes high revenues as much as he dislikes high costs. Costs, therefore, are equivalent to negative benefits to him; one dollar of extra costs takes away one dollar of net benefit from his business. In social benefit-cost analysis, the money value of the sales of the products in the market is not the only benefit. The value of the benefits (i.e. goods and services produced for use by the society) is proportional to their contribution towards social objectives. Insofar as the social objectives are not based merely on market demand - i.e. the ability and willingness of the consumer to pay - the social value of the benefits will differ from the private entrepreneur's valuation of them.

21. Private benefits: A private benefit is the particular valuation an individual gives to any good or service. As the value placed on a good or service may differ from person to person, the standard use of the expression "private benefits" refers to the value given by an entrepreneur who values it according to how much it would fetch in the market.

22. Social benefits: The valuation of any collection of benefits according to the objectives of a society.

23. Primary benefits, secondary benefits: When a good or a service is produced, its objective is to satisfy a private or social demand. The valuation of the satisfaction of needs that are immediately obvious is called primary benefits. The production or use of goods and services may help indirectly to meet some social objectives that were not calculated in the first round of valuation, i.e. "primary benefits" failed to take them into consideration. These additional indirect benefits from a project are called secondary benefits. (Sometimes they are called "direct" and "indirect" benefits.) For example, the primary benefit from the production and use of radio sets is the satisfaction of the demand for them. If the widespread use of radios is considered good in the sense that it hastens the spread of literacy, a proper social valuation of the use of radios would take this into account. Calling some benefits "primary" and some "secondary" is merely a matter of convenience and does not imply that the former are more important than the latter.

24. Redistributional benefits: If redistribution of income is a social objective, then a dollar accruing to a rich man has less social value than a dollar accruing to a poor man. The benefits of a project should be valued according to how much of the social redistributional objective they achieve. If, besides making income available to the society, the project also makes a positive contribution towards altering the distribution of income in the desired direction, it is said to provide redistributional benefits.
25. Incommensurable physical benefits: These are benefits to which it is impossible to attribute a money value or to apply any yardstick of measurement. An example is a project to reduce the pollution of air in a city.
26. Costs: Costs are the opposite of benefits. Goods and services command value because they provide or help to provide satisfaction. To take away any value from their alternative use (presumably for the purposes of creating greater benefits) is a loss of benefits and is thus a cost.
27. Private costs, social costs: The distinction between private and social valuation of costs is similar to that applied to benefits. The private valuation of cost may be different from its social valuation. For example, if in a country with widespread unemployment a private businessman employs an additional worker, this is a cost for him because the worker must be paid wages. This money could have been put to other use by the businessman, and thus wage payment is a loss of benefits to him. But, for the society as a whole, giving work to an unemployed person does not mean sacrifice or loss of benefits. There would have been a loss of benefits if the worker had been producing elsewhere. Cost, therefore, always refers to the sacrifice of alternative benefits. An individual's valuation of alternative benefits may differ greatly from those of the society.
28. Direct costs, indirect costs: The distinction here is the same as that made between benefits. Direct costs are those that are immediately apparent; indirect costs are not. For example, the loss of benefits due to the pollution of air from smoke coming out of a factory chimney is an indirect cost.
29. Benefit-cost ratio: When the value of the aggregate benefits of a project is expressed as the ratio (or percentage) of the value of aggregate costs, it is called the benefit-cost ratio. This concept is supposed to give the measure of profitability of the project, and may be expressed in a variety of ways such as: (a) the ratio of the present value of all benefits to the present value of all costs; (b) the ratio of the present value of the future net recurring

benefits to the present value of all investment costs; or (c) the ratio of the annual benefits to the direct and imputed value of annual costs.

30. When the benefit-ratio is used to decide whether the project should be accepted or not, it is necessary to know the minimum level of profitability (as expressed by the benefit-cost ratio) that any project should show in order to qualify for acceptance. Minimum benefit-cost ratio, cut-off benefit-cost ratio or break-even benefit-cost ratio are used interchangeably to express the same concept.

31. Employment: Reference may be made to the employment of any resource such as land, labour or capital for productive use. But the term employment usually means the employment of labour.

32. Gainful employment: When the employment of a worker provides him with some benefit, the worker is said to be gainfully employed. This concept is designed to exclude workers whose time is taken up in the pursuit of something of no social or commercial value.

33. Under-employment: This term refers to a level of employment that is less than full employment. A worker is under-employed if he does not have a job for all of the time he would like to work. An economy is said to have under-employment if it does not provide full-time jobs for all of its qualified job-seekers.

34. Unemployment: An economy has unemployment if some of its working force is idle.

35. Voluntary unemployment, involuntary unemployment: If a worker is unemployed due to his own preference and not because of a scarcity of jobs, he is said to be voluntarily unemployed. The opposite is involuntary unemployment.

36. Open and disguised unemployment: When unemployed job-seekers are actually looking for jobs to the extent that they can be counted in the employment exchanges, the situation is described as open unemployment (also called overt unemployment). Sometimes there are workers - typically in the rural areas of developing countries - who are not actually looking for jobs. Therefore, their number cannot be ascertained from any job market. They remain, for example, in family firms and lower the workload of others in the family, but their removal from the firm would not alter the efficiency or the production of the firm. In this situation, it may be said that these people are actually unemployed, although the unemployment is disguised. The firm would have produced no less in their absence.

37. Structural unemployment: When the structure of an economy is such that unemployment cannot be reduced in the short run because the country's various capital stocks and other facilities cannot absorb any more of the idle labour force of specific skills, the situation is described as structural unemployment. It is so called because the remedy for such unemployment is a change in the structure of capital stocks and in the composition of the demands for the various goods and services. This type of unemployment should be contrasted with the better known "Keynesian unemployment", commonly discussed in the context of business fluctuations in the developed market economies. Keynesian employment is due to the deficiencies in the aggregate demand. If the demand for goods and services is increased by government purchases or by higher export demands, or by greater investment activities, unemployment can be reduced.
38. Technological unemployment: This term, similar to structural unemployment, is commonly applied to the unemployment arising from changes in the structure of an economy owing to technical change. If a new method of producing goods is invented that uses fewer or different types of workers for the same output, then unemployment is created until the demand for the goods increases and the workers acquire new skills or become absorbed in some other employment.
39. National self-sufficiency implies that an economy can sustain the desired level of consumption and investment without aid or loans from abroad. This does not mean that the country produces all it needs and does not engage in trade with the rest of the world (a condition called autarky). Self-sufficiency or self-reliance means only that the country is in a position to buy whatever it needs from abroad by selling what it produces. It may be that the only way a country can attain self-sufficiency is by restricting its purchases from abroad - in other words, by approaching a state of autarky. This means that the country cannot profitably expand the sales of its produce abroad. Generally speaking, a country can approach self-sufficiency in one of three ways: by expanding its exports so that it can pay for its imports; or by restricting its imports so that its import-bill is reduced to the size of its export earnings; or by the two measures combined.
40. Import substitution: When a domestic product is substituted for an imported product in the production or in the use of the economy, the situation is said to involve import substitution. This usually takes the form of setting up or expanding the domestic production facilities to produce products which are currently imported. It can also take the form of doing away with certain imports

through local production of items that are a close substitute. When the prospects for expanding foreign exchange earnings through export promotion are not very good, only two courses of action are available for achieving self-sufficiency: import substitution or self-denial - i.e. producing the good that cannot be imported or doing without it. The effectiveness of an import-substitution programme cannot always be fully measured by the foreign exchange value of the product that replaces the import. This is called the gross foreign exchange effect of the import substitution programme. The correct measure of the effectiveness of the programme is its net effect on the foreign trade of the country. In calculating the net effect, one should take into account the foreign exchange that the economy is foregoing in the process of producing the commodity. In other words, if some inputs for the product are actually imported or could otherwise have been exported, then the net foreign exchange effect of this activity is the foreign exchange value of its production (which is replacing that much of the imports) minus the foreign exchange value of some of its inputs which will come from the country's foreign trade. For example, the gross foreign exchange effect of an import-substituting automobile industry in a country is the foreign exchange value of the automobiles produced by the industry. The "net effect" is the difference between the foreign exchange value of the automobiles and that of the various inputs, such as steel, which come either from imports or from the alternative of exports.

II Feasibility, efficiency, optimality

41. In any discussion of an investment project or a national plan or a sectoral programme of an economy, the terms feasibility, efficiency and optimality usually arise. The first question asked about a programme is, "Is it feasible?" This question includes the following:

- (a) Is it technically sound? In other words, is the suggested or implied technique of production possible in engineering terms?
- (b) Will it be possible to procure from the market the various goods and services required at specified periods of time?

If the answers to these questions are positive, then the programme is judged feasible. That is to say, with the known techniques of production, and with the resources available in the economy, it will be possible to carry out the programme. If the programme is not feasible any further examination of its merits becomes irrelevant. Once a project or a plan passes the test of feasibility, the question arises whether there are other ways of producing the same results. In other words, could alternative plans result in the same outputs? If there are alternative plans, then a choice must be made from them, assuming that the outputs are needed. An efficient plan is one that outlines the best methods of achieving the targets. How is the best method determined? If the targets of output, and the quantities of all but one of the resources to be used in the plan are specified, then the programme is "inefficient" if there is still scope for economizing on the use of that remaining resource. Alternatively, given the various resources assumed in the plan, if there is a possibility for gaining more of one target without sacrificing any other target, then the plan has not been conceived in the most "efficient" manner.

42. While discussing the efficiency of a plan - i.e. the most efficient way of achieving a set of targets one does not consider the desirability of the scheme. At this stage, the question of whether an attempt should be made to try to reach the targets at the stated costs is left unanswered. To answer that question one must consider the question of optimality. In judging the optimality of a plan, there is a question whether the highest net value will be gained according to the choice made among all the conceivable alternative schemes. An optimal plan is the most desired plan because it offers the best results from the valuation made of its various aspects.

43. From this discussion of "feasibility", "efficiency" and "optimality", it should be clear that the "optimum" plan must also be an "efficient" plan because

if it were not efficient, then more of one desired objective could be obtained without sacrificing other objectives, and thus a "more optimal" solution would result. Naturally, it is assumed that every "efficient" plan is feasible.

44. Thus in examining a project or plan the first question is, "Is it feasible?" If it is feasible, the next question is, "Is it efficient, or could the same thing be done in a less wasteful manner?" Finally, "How important is it?" In other words, is the project valued highly enough in terms of economic and social objectives so that it should be accepted in preference to other relevant alternatives?

Related terms

45. Feasibility: A plan or a project is feasible if it is at all possible to achieve it as outlined, within the constraints of technical knowledge and available resources. The basis of any feasibility study is a project report which details the technical, economic and managerial requirements for the project. Feasibility of a project must be examined with respect to each of the constraints facing the planner. For example:

- (a) A technical feasibility study examines the question of whether the technical processes described or implied in the project report are within the range of the available scientific and engineering know-how. The question is whether the processes will work or not.
- (b) An economic feasibility study examines the question of whether the demands for goods and services created by the project or programme can be met by the available resources. Sometimes the expression "economic feasibility" is used to connote the profitability or the economic viability of a programme, but this is incorrect. The profitability or the economic viability of a project can be ascertained only after the various costs and benefits have been evaluated. A feasibility study is not dependent on the prices of the inputs or the product.
- (c) A managerial feasibility study examines whether, with the available skill and know-how of the managerial personnel, the work of construction and operation of the project can be performed as outlined.

After it is determined that the project is feasible, a profitability study or an economic viability study must still be made. This study will include the financial, commercial and national considerations.

46. Efficiency: An efficient programme is one in which the results could not be obtained by using economy in any one resource without diseconomy resulting elsewhere. Alternatively, given the resources, the results could not be improved without suffering loss somewhere else. This concept of efficiency is also called "technological" or "economic" efficiency. Sometimes efficiency in the

use of one particular resource, for example, managerial personnel is examined keeping all other factors constant. Thus a project has managerial efficiency if the same results could not have been obtained by using less managerial skill or know-how.

47. Since efficiency implies economy in the use of every kind of scarce resource, it is difficult to construct a reliable index that will measure the efficiency of a project or a programme. Customarily, various indexes called the norms of efficiency are constructed to throw light on the different aspects of an operation. For example, in order to get some idea of the efficiency of the operation of a railroad network, various norms of efficiency could be constructed such as: (a) the average speed of trains; (b) wagon turn-around time; (c) energy consumed per wagon mile; and (d) gross revenue per employed worker.

48. Optimality: A decision is said to be "optimal" if it gives the best results and also satisfies all constraints facing the decision-maker.

49. Social optimality: The worth of a project can be judged only in relation to the expressed objectives. Economic decisions generally concern the welfare of individuals and groups of people. Typically, an economic decision benefits some people in varying degrees, leaves others unaffected, and is harmful to still others. Unless a yardstick is devised for measuring and comparing the welfare of the various groups within a society, it is difficult to state precisely the desirability of a scheme from the point of view of the entire society. Where such a yardstick (called the "social welfare function" - see chapter VII) has been devised according to political processes, the national planning authority is in a position to judge projects or plans by the standard of social optimality. A plan is a social optimum if, with the available resources, it enhances the welfare of the society to the utmost in terms of social objectives.

50. Pareto optimality: Where no political process exists for arriving at a unique collective judgement concerning the preferences of the numerous individuals forming a society, it is not possible to evaluate projects according to their precise social contribution. However, in certain cases judgements about the worth of a plan can still be made. If a certain project makes some persons prosper without making anyone else suffer, it can be said that the group situation has improved without making a group welfare comparison. It is in this sense that the criterion "Pareto optimality" is used to judge the welfare of a

group. A plan is "Pareto optimum" if, with the available resources, it is impossible otherwise to make some people better off without altering the condition of others. It should be borne in mind that a scheme that involves any redistribution of income cannot be judged by the criterion of Pareto optimality because the worth of a redistributive measure cannot be judged without making an interpersonal comparison of welfare.

51. It has been mentioned earlier that the judgement of the desirability of a project from the point of view of the collective values of a society may be different from the corresponding judgement of a private businessman, since the latter considers only the market valuation of the goods and services and has as a sole objective the maximization of his private profits. Since the basic valuation of goods and services is different in the social and private cases, the resultant calculations about optimality will also be different. For example, a private businessman's calculations of the best size for a cement plant may be different from the socially optimal scale for the cement industry. Generally speaking, a socially optimal project scale differs from a privately optimal project scale.

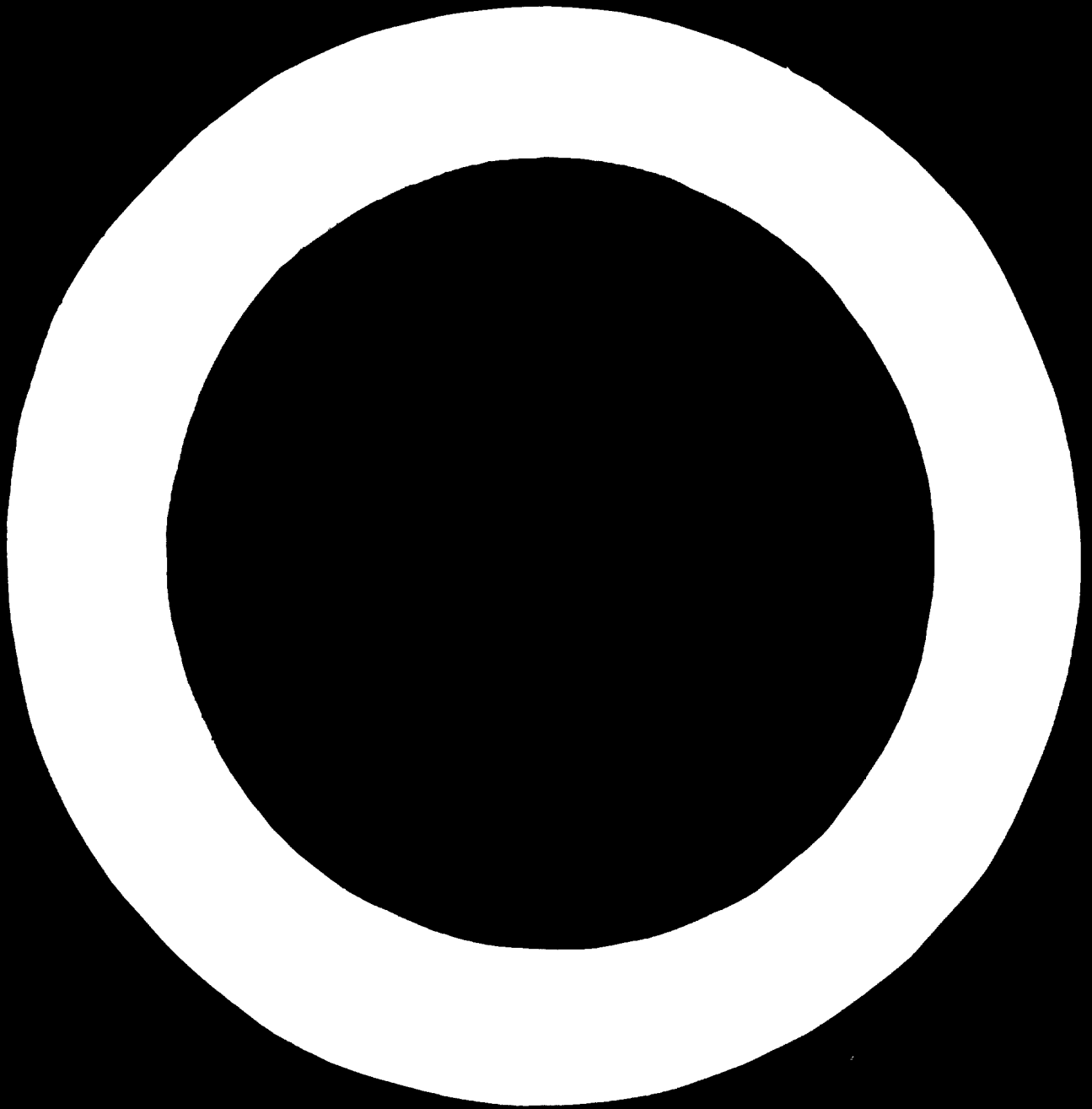
52. Optimization: The mathematical exercise in which the maximum or the minimum of something is sought subject to certain constraints is called "optimization". For example, a well defined optimization problem is the maximization of the value of the national product at any time subject to the availabilities of the various resources and technical skills. This example illustrates what is known as the static optimization problem because the problem of augmenting resources over time (dynamic optimization) is not tackled here.

53. Growth paths: Of crucial importance to any plan of economic development is the problem of augmenting the productive capacities of an economy over a period of time. A particular scheme of expanding production and productive capacity is described as the "growth path". The growth path of national products, the growth path of the product of any sector of the economy, the growth path of productive capacity in an industry, are examples of how this term is used.

54. Given the productive capacities of an economy and the optimum forecast of foreign trade, foreign aid and loss, current and future, the various feasible growth paths for the economy can be worked out. Feasibility here, as in the general discussion earlier, implies that the assumed techniques of

production are sound and that at no time will the demand for any good be allowed to exceed the supplies that can be made available.

55. The problem of dynamic optimization is faced when a choice must be made from the various feasible growth paths. The only way of making a rational choice is to introduce explicitly a criterion of social preferences - in this case the preferences between alternative time patterns of welfare for the society. The optimum growth path is the feasible growth path which is judged according to existing social preferences to be the best of all feasible growth paths.



III Relative weights

56. If a decision process involves only one objective, the problem of choice is relatively simple. For example, the businessman who has a given amount of funds to invest has as his sole objective to get the maximum profit out of his investment. He knows all the market prices at which he can buy and sell various goods and services. He also knows all the possible projects in which he can invest his money. His decision-making process could be described as follows: He computes the commercial profitability for each of the possible projects, ranks the projects in the descending order of profitability, and chooses to invest in the highest ranking projects until his funds are exhausted. In a similar situation, a social benefit-cost analyst with only one objective will show a similar mode of behaviour, but the criterion will be social profitability, which means the contribution of each project towards the single social objective.
57. When there is more than one objective facing a decision-maker, the problem becomes a little more complicated, because there is no reason why the ranking of the various projects should be identical with respect to each of the objectives. If, however, such ranking is identical with respect to two objectives, for example, the aggregate consumption objective and the employment objective, then, again, there are no difficulties in satisfying both goals simultaneously. But, if the contributions to the aggregate consumption objective and to the employment objective for every conceivable project are perfectly correlated, it can then be said that whatever maximizes consumption also maximizes employment. There is no conflict between these two objectives, so that there is no point in treating them separately.
58. A more interesting, as well as a more realistic, situation is one that involves potential conflict between objectives. What maximizes aggregate consumption does not necessarily maximize employment, or, the rapid expansion of education and health services puts constraint on how soon the country can become self-reliant, and so on.
59. In an optimization exercise how does one deal with a situation involving multiple objectives? There are three procedures that can be followed:
- (a) First, a certain hierarchy can be introduced among the objectives, that is, objective one will always take precedence over objective two, and so on. According to this decision rule, the projects are ranked according to the first objective. When there is a tie between

two projects according to the first objective, one project is selected in preference to the other according to the next important objective. The third and the following objectives on the priority list are brought into play only if they are needed to help make the decision because the higher ranking objectives have failed to discriminate between the projects. Before recommending this decision rule, it should be determined whether such a strict hierarchy among the objectives is in conformity with the genuine aspirations of the society. The objectives are supposed to represent these aspirations. Such a strict priority system means that there is really only one objective for social decisions. Only in situations where the decision-maker is indifferent (according to the social objective) will he consider the subsidiary criteria. This rule does not guarantee that a minimum of any of the objectives, especially those low in priority will be satisfied.

- (b) If a minimum of each of the secondary objectives must be met, then the requirements should be stated explicitly as constraints in the optimization exercise. In that case the optimization problem becomes one of maximizing with respect to one objective subject to a number of constraints. These constraints include the technical possibilities, the availabilities of various required supplies, and the minimum requirements of the other objectives. Any such optimization process first selects a feasible solution, that is, a solution that satisfies all the constraints. If there is only one such feasible solution, then that one is also the optimum solution. But, typically, there are numerous feasible solutions, so that the optimization process proceeds by exploring other feasible solutions with a view to achieving higher values for the objective function. The feasible solution for which the objective function reaches the maximum is the optimum solution. A well known mathematical property of such an optimization exercise is the so-called duality of the solution, which gives a value to each of the constraints. The process of maximization of the objective function, subject to certain constraints, is mathematically equivalent to minimizing the cost of the programme in terms of the constraints. If a constraint concerns the availability of any good, the optimization process tells how much the maximand (the objective which is being maximized) can be increased if an extra unit of this good were available. The process also tells how much the maximand would fall short if one unit of the good were taken away. This value is called the shadow price of this good and the term will be considered in more detail in chapter X.

Similarly, corresponding to the constraint regarding the minimum requirement of an objective, a shadow price can also be ascertained. This shadow price will tell how much the maximand would fall short if the minimum requirement were set at a slightly higher level. Alternatively, if a slightly lower target were accepted with respect to this objective, how much more of the objective, which is being maximized, could be achieved. This shows that in a multiple objective case an effort can be made to maximize gains with respect to one objective while setting down targets of minimum requirements with respect to all other objectives. However, the optimization process indicates the rate of exchange between an objective and the objective which is being maximized. This rate of exchange can vary, of course, with the minimum target laid down in advance. But the

important fact is that there is a unique correspondence between the targets with respect to the various objectives and the rate at which one is exchanged for the other at the margin. These rates are the implicit weights attached to the various objectives. If, instead of setting down targets with respect to all but one objective, a weighted sum of the various objectives was maximized (the weights being the ones obtained in the case of specified targets) the same would result.

- (c) If, as indicated in the preceding paragraph, target-setting implies assigning relative weights between the various objectives in an efficient programme, would it not be possible to combine the different objectives into one single social objective, which is the weighted sum of all the objectives? The question is one of convenience. If it is easier to apply judgement about the relative importance of the various objectives (in terms of weights) without knowing their precise physical implications (that is, how much of the different objectives would be satisfied) then, of course, the optimization with respect to a weighted sum of objectives would be preferred. Where it is easier to apply judgement concerning the physical requirements, the method of target setting should be preferred. However, in any exercise of this sort, some trial and error is inevitable before either the weights or the targets can be specified.

60. Constraints: A problem can be posed in terms of a number of constraints. For example, in seeking a point inside a closed geometric shape, such as a circle or a square, the mathematical problem is to define the limits of the two Cartesian co-ordinates corresponding to the boundaries of the particular geometric area. These limits imposed on the co-ordinates are called constraints of the problem.
61. An economic problem of allocating scarce resources among alternative uses can also be posed in terms of a number of constraints. Each of these constraints will reflect the economic necessity that the demand for any scarce resource should not exceed its total available supply. Furthermore, additional constraints reflecting certain minimum requirements regarding social objectives may be imposed on the solution of the allocation problem. Some such constraints may be due to the political feasibility of a plan.
62. In short, economic, technological, social or political realities limit the possibilities of an economic programme. Any solution of the problem that satisfies all these constraints is feasible. Typically, there are many feasible solutions, which brings up the problem of choice.
63. Maximization, minimization: When there are a number of solutions to a problem, how is a choice made? The rational procedure is to choose a criterion that measures the value of the solution, or its costs. If it is the former, the problem is formally one of maximization. This means that what is being

sought is that solution for which the criterion function attains its maximum value.

64. When the criterion function is formulated in terms of costs that are to be minimized, the problem formally becomes one of minimization. This means that the required solution is one for which the criterion function attains its minimum value.

65. Hierarchy, priorities, relative weights: There may be more than one criterion for choosing between feasible solutions. There may be more than one social objective or more than one element of cost. How, does one construct a meaningful decision rule or a well-defined criterion function? One way of solving the problem is to introduce certain priorities or a hierarchy among the various elements constituting the set of criteria. For this purpose, the objectives (or items of costs) are arranged in order of their importance. Only when an objective of a higher order fails to discriminate among the feasible solutions is the objective next in line considered in making the choice. When the multiple objectives are combined to construct a single well defined criterion function, relative weights have been placed explicitly or implicitly on the various objectives.

66. Weights are the arithmetic measures of the relative importance of the various elements that constitute the total valuation of a subject of interest.

IV Markets, equilibrium, allocation of resources

67. In everyday language, the market is the place where goods and services are bought and sold. Economists also use the word market essentially in the same sense, but they have broadened it to mean the entire process of buying and selling of some or all commodities in the entire economy or in some isolated segment of the economy. It does not mean simply a location where people buy and sell. For example, economists often use concepts such as the labour market in India, the commodity market in the United States or the bond market in the Federal Republic of Germany.

68. Since in a market economy the process of buying and selling in the market essentially determines prices, incomes, employment and so forth, some information about the organization and the structure of the market is essential. The mere assumption that sellers want to maximize profits, while the buyers want to maximize utility, is not enough to predict the outcome of the transactions in a market. In some fashion the nature of the market should be described in terms such as the relative bargaining powers of the various participants, the ease with which new business can enter the market or peoples' expectations about the future.

69. In reality every market has a distinctive characteristic of its own; but for theoretical discussion certain clearly defined types are considered for building theoretical models. Perfect competition as a market organization is the best known theoretical construct. This is not because it is the most commonly observed phenomenon among market economies. As a matter of fact, no known market economy approximates this construct. Its popularity among economists stems from the fact that a number of worthwhile welfare propositions about the performance of a market economy can be deduced from the assumption of perfect competition.

70. Perfect competition is the state of a market in which a large number of buyers and a large number of sellers participate in the buying and selling of a number of homogenous commodities with perfect knowledge of the future. Homogeneity of output means that no seller can create the impression in the market (by advertisements) that his product has distinctive properties. In the economists' language there is no product-differentiation in a perfectly competitive market. Furthermore, it is assumed that any new seller (or buyer) can enter the market without costs or difficulties. In such a situation, obviously, no single buyer or seller can influence the market price of any commodity.

Producers accept the market prices as given data, and decide the nature and the quantities of their produce, the techniques of production, according to their objective of profit maximization. Since new entrants can always enter the market without cost, profit in excess of the "necessary" entrepreneurial remuneration is eliminated in the long run.

71. Similarly, every buyer has to accept the market prices as given. His supply of primary factors gives him income, which he spends among the different available commodities in such a way that he attains the highest level of welfare permitted by his income. The simultaneous decisions of a large number of buyers and sellers determine the market prices in such a way that all markets are cleared and everybody is satisfied. In this way, a perfectly competitive economy is said to have attained equilibrium.

72. Economists have proved the goodness of a perfectly competitive market organization in the following sense. It leads to the "best" allocation of resources, (according to Pareto's definition of the "best") that is, Pareto optimality. This means that, given the initial endowments of the primary resources and their distribution among the different resource-holders in the economy, perfect competition leads to such an allocation of resources among alternative lines of production and such a distribution of incomes among the different resource-holders, that it is impossible to enhance the well-being of anyone without diminishing that of someone else. Given the fact that every commodity is of some "value" to some consumer, it follows that perfect competition leads to "efficient" production.

73. Departure from perfect competition can take place in several ways; thus imperfect competition is necessarily a very heterogeneous category. Some special forms of market imperfections have been clearly identified and studied closely. Monopoly is brought about by having only one producer (or seller) and a large number of buyers in a specific commodity market. A monopolist has to make both the quantity and the price decision for his output in such a fashion that, given the market demand for his produce, he can attain the maximum profit. The polar opposite of monopoly is monopsony in which a large number of sellers of a product compete for the custom of a single buyer.

74. Oligopoly is the situation in which a small number of sellers compete with each other in a market with a large number of buyers. A special case of oligopoly is duopoly where there are only two sellers. This has been studied in great detail in economic theory because this situation brings out with great simplicity the essential characteristics of an oligopolistic market.

75. Another situation of market imperfection is monopolistic competition in which a large number of sellers compete with one another offering goods that are imperfect substitutes for one another.
76. The price theory in economics mainly concentrates on the concept of equilibrium. Equilibrium is said to be achieved in any market if every participant in the buying and selling operation of the market has no further incentive to move away from the equilibrium position. If, of course, the basic data change, the equilibrium will be disturbed and the system moves to a new equilibrium position. Since all the markets in the economy are interrelated in the sense that goods compete with each other for the factors of production as well as for the shares of the consumers' limited expenditure budgets, a truly satisfactory price theory can be based only on a study of the equilibrium in all the inter-related markets of the economy. This is the study of general equilibrium. However, on the assumption of equilibrium in all but one market, equilibrium for a single commodity can be investigated on the basis of the demand and supply curves for the commodity. This is called partial equilibrium analysis. This analysis, although lacking in logical rigour, is a great help in empirical research because, in a large number of cases, the quantitative impact of assuming away inter-industry dependence is negligible.

Related terms

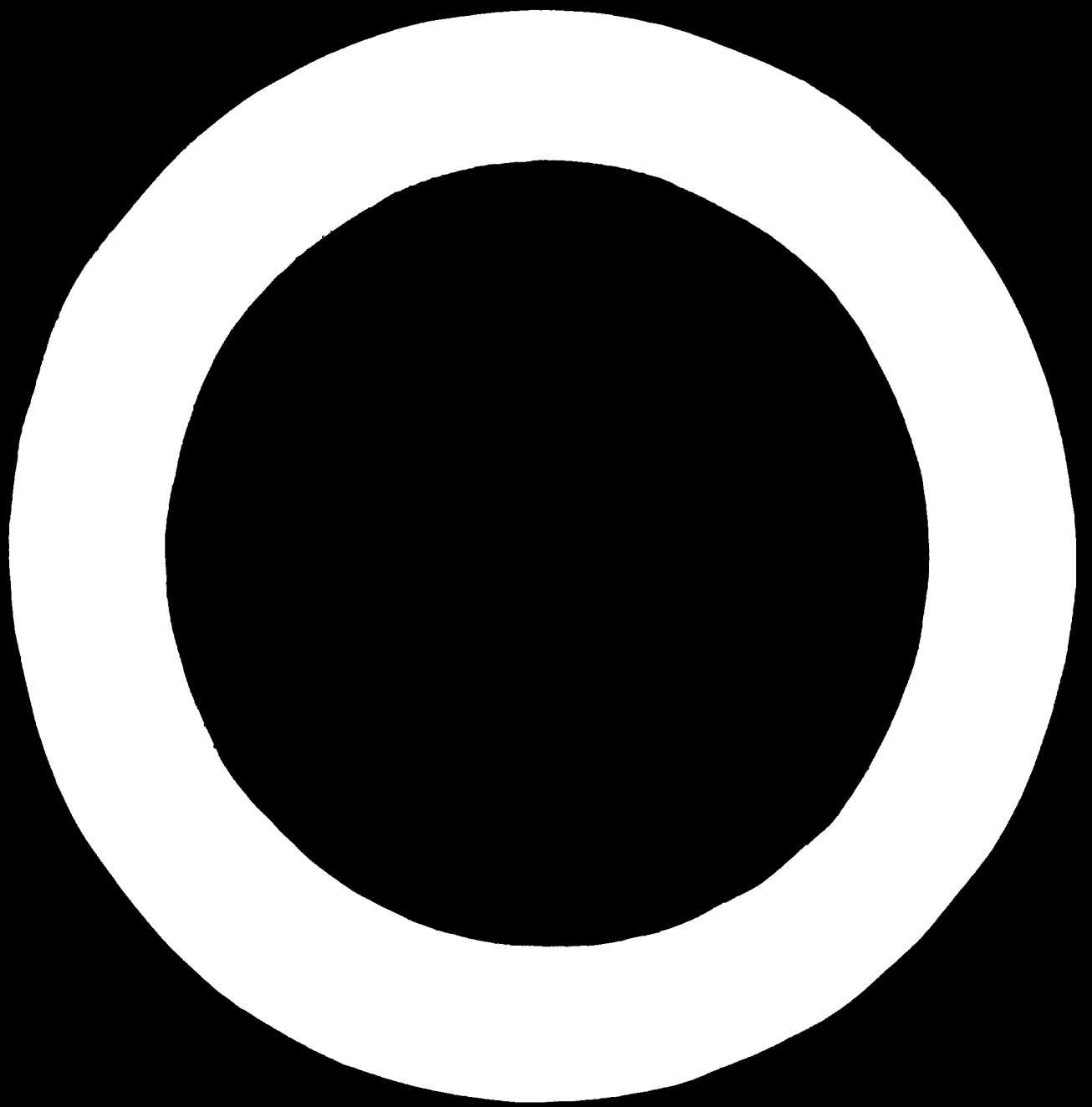
77. Market: The operation of buying and selling a commodity (or commodities) is called the market.
78. Perfect competition, pure competition, perfect market, competitive market: The first two terms (and sometimes with less precision the other two terms as well) are used interchangeably to describe the organization of a market economy where a large number of buyers and a large number of sellers trade with perfect foresight for a number of homogeneous products. Each buyer or seller has no influence on the market for any commodity so that he must make his decisions using the market prices as given from outside.
79. While perfect competition or pure competition is a description of the market organization for the whole economy, perfect market or competitive market can be used to describe any single market in the economy where these conditions are satisfied.
80. Imperfect competition is the market organization in which the conditions of perfect competition are not satisfied so that the sellers do not behave like price-takers.

81. Oligopoly is the market organization in which a small number of sellers compete among themselves to sell a commodity to a large number of buyers.
82. Dupoly is the situation involving only two sellers who compete with each other in a market with many buyers.
83. Monopolistic competition: A number of sellers competing with each other to sell products that are imperfect substitutes for one another.
84. Monopsony is the market organization in which numerous sellers compete for the custom of a single buyer.
85. Resources: Usually means primary resources, such as land and other natural resources, labour, and fixed productive assets.
86. Allocation of resources: The process of distributing resources among alternative economic activities.
87. Mis-allocation, mal-allocation of resources: The situation in which the resources are not allocated in the "best" possible way. These terms usually describe the situation where the economy fails to attain efficiency in production.
88. Static theories of resource allocation: The economic theory of resource allocation under which the various primary resources such as land, labour and other productive assets are taken as invariable, is called "static" because the theory does not take into consideration the possibilities of growth in the supply of these resources. But in time the labour force grows, and the capital accumulation leads to growth in the stock of the productive assets.
89. Dynamic theories of resource allocation take into account the growth of the labour force and the accumulation of capital over time. They explain the allocation of resources at every period among the various consumption and investment good industries, and thereby explain the growth of the economy over time.
90. Equilibrium is the situation in which, given the constants of the model, there is no incentive to move away from the position attained.
91. General equilibrium analysis: This is the theory of the determination of prices, incomes, employment and outputs by the simultaneous interaction of the forces of demand and supply in all the commodity and resource markets of the economy.
92. Partial equilibrium analysis: The theory of the determination of the price and the output of a commodity by the interaction of the forces of demand

and supply in the market, under the assumption that all other variables in the economy remain unchanged.

93. Disequilibrium: A condition under which the various economic agents in the market have incentives to move away from their current state.

94. Structural disequilibrium: The disequilibrium situation may be due to the particular conditions of the market, such as a price rigidity or the absence of suitable technological alternatives, rather than to an unfinished state of a slow process of adjustment leading to the equilibrium. A situation under which certain technological or market conditions prevent the system from reaching or moving towards equilibrium is called structural disequilibrium. (See above structural employment.) When a system is in structural disequilibrium it will not move towards equilibrium on its own accord, it will remain where it is.



V Marginal analysis

95. The concept of "margin" is very important in economic theory, particularly in what is called neo-classical economics. If the commodities are perfectly divisible, and because only one price can prevail in the market for a homogeneous commodity, a rational buyer or a profit-maximizing producer should make his purchase or sale decision in such a fashion that one unit less of the commodity would have kept him dissatisfied and one unit more of it would make him regretful. For example, a buyer in an orange market purchases an orange for five cents. Given the prices of all other commodities the buyer knows what else he could buy with his money. However, he likes oranges well enough to buy one with his five cents. Will he buy a second orange? If at this stage he still prefers oranges he will spend another five cents for one and thus go on purchasing one orange after another until his desire for oranges is so well satisfied that he decides to spend his next five cents on something else. In other words, he will keep on buying oranges until the satisfaction he gets out of the marginal orange does not fall short of the satisfaction he can get from some alternative purchases made for the same price.

96. Similarly, the producer of a perfectly divisible commodity makes his production decision by equating his income at the margin with his expenditure at the margin. Conceptually we can think of him as making a production decision unit by unit. He will keep on increasing his output until he makes a profit. When will he stop expanding his output? He will stop when one extra unit of output will result in a loss.

97. Obviously, the kind of reasoning developed above will always hold if the demand curves, cost curves and other factors are smooth and continuous. If the cost curve, for example, is not smooth and continuous, then the producer should not accept the signal given at the margin as the correct indication for the nature of things that lie far beyond the margin without exploring further. Thus, on the assumption of "well behaved" functional relationships, neo-classical economic theory postulates that stable equilibria can be reached if the economic agents equate their marginal revenue with marginal costs or their satisfaction at the margin with the cost at the margin etc.

Related terms

98. Margin, marginal, at margin, incremental: These terms refer to a unit of commodity just beyond the actual amount bought or sold; sometimes the margin

may refer to the last unit. However, if the commodity is very finely divisible and if the unit of account is very small, then for all practical purposes, there is very little difference between the incremental and the immediate intra-marginal unit.

99. Intra-marginal, supra-marginal: The first term refers to a margin below the actual value; the second term refers to the margin above the actual value.

100. Marginal cost pricing: Under this principle of pricing a public enterprise should sell its output at a price which is equal to its marginal cost. This rule corresponds to the equilibrium condition under perfect competition. In a situation where the assumptions of perfect competition cannot be maintained this principle obviously loses its full significance. However, the fact remains that if the price (the consumer's willingness to pay) is greater than the marginal cost, then the expansion of output should provide marginal benefit (measured in terms of the consumer's willingness to pay), which is greater than the marginal cost (measured again in terms of the consumer's willingness to pay for the outcome of the alternative use of the resource).

VI Opportunity costs

101. To cite a personal example, suppose the reader has just finished building a house, is about to move in, and a neighbour asks, "How much did the house cost?" The reader knows it has cost him a lot of money (and a lot of trouble): money to buy land and building materials; money to pay the contractors, carpenters, and electricians, and money to buy furniture and kitchen equipment. As a careful accountant, the reader does not forget to add to these costs the interest payments lost during two years because of the money withdrawn from his savings bank account to build the house. He thinks also of the time and energy he and his wife have spent making selections and supervising the workmen; these must be valued in order to have a proper measure of the cost of the house. Perhaps a more remunerative job in a distant city has been turned down in order to be near the building project. This too represents a loss.

102. The list can be extended to cover all such items of direct expenditure in terms of money and all hidden costs in terms of losses and sacrifices. But one thing should be obvious and that is that "costs" like "benefits" are measures of value. This value is expressed in terms of money because money is the standard unit of account in modern society. It is always known what money can buy so that the utility of an amount of money is easily recognized. If a complete account is made of what the house cost and it comes to \$50,000, the reader means that he could have had \$50,000 worth of other valuable things if he had not chosen to own this house. Therefore, the only meaningful sense in which "costs" can be spoken of is in terms of opportunities or benefits foregone. In other words, "costs" are negative "benefits". This is so because costs and benefits are both measures of value, and the only source of value is human judgement regarding the usefulness of things.

103. Because the source of value is in human judgement, the valuation of a thing can differ from person to person. If, however, people can trade freely among themselves, then the prices (strictly speaking, the price-ratios or the terms of trade) should be equalized in a free market. Whenever a purchaser is willing to pay more for an extra unit of a commodity than the price quoted in the market, he will demand more of the commodity and bid up the price. This process of free exchange leads to the equalisation of prices. A commercial enterprise makes its calculations primarily on the basis of the free market prices.

104. An organized society may have definite social objectives, for example, the two objectives of military preparedness and economic growth. The cost of a programme to build up the nation's military potential can then be expressed only in terms of the opportunity of economic growth sacrificed in order to attain its military objective.

105. In practice it may be difficult to calculate exactly the "cost" of one thing in terms of the other objective, but the concept should be clearly borne in mind while searching for a common measure.

Related terms

106. The opportunity cost of something acquired is the possible benefit foregone in order to acquire it. The opportunity cost of the wheat produced by a man on an acre of land with only one pair of bullocks can be expressed in terms of any other alternative output that this combination of factors (land, man and bullocks) could have produced instead of wheat. It could also be expressed in terms of its value in money, if the outputs are for a market with known prices. In that case the opportunity cost of this amount of wheat is the highest alternative money value these factors could have produced if applied to other crops.

107. The private opportunity cost is the value of the opportunities foregone by a private individual in terms of his own subjective valuation of benefits.

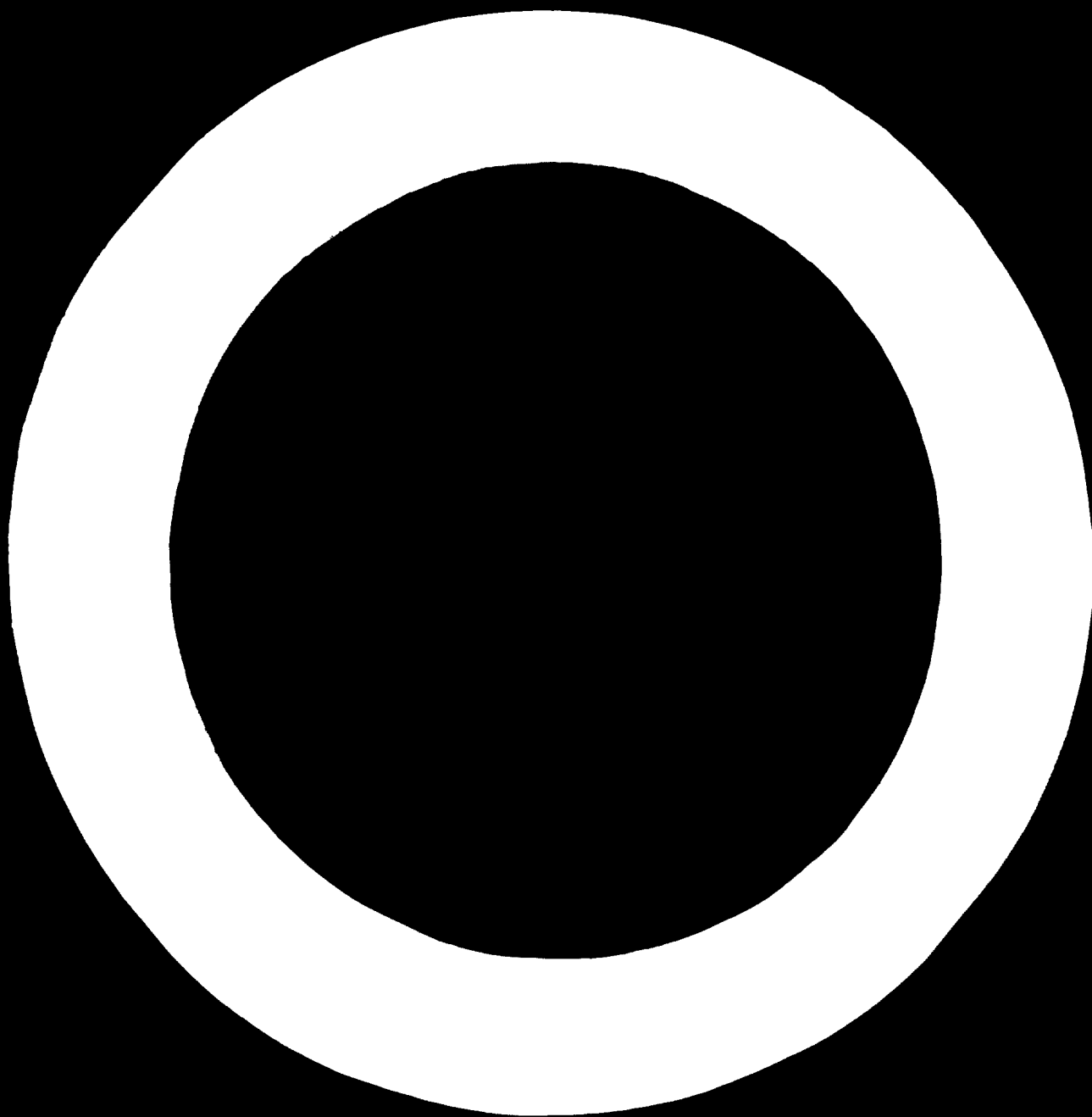
108. The social opportunity cost of a thing is the social value of the sacrifice made by the society to attain it in terms of the society's objectives.

109. Opportunity cost of capital put to a certain use is the opportunity of "profits" sacrificed in a possible alternative use. For example, the opportunity cost of a certain amount of money capital invested in a savings bank is the opportunity of profits sacrificed if this amount were employed in other forms of assets.

110. Opportunity cost of investment: Investment is only an increment to the capital stock. But, unlike capital stock, which may not be easily convertible from one form to another, new investments can be made in a large variety of ways; or, they need not be made at all, in which case the opportunity cost would be consumed. To that extent the opportunity cost of a stock of capital may be different from that of new investments. When a society makes an investment in a particular venture, it sacrifices the opportunities of either augmenting current consumption or attaining the social objectives by investing

elsewhere in the economy. The maximum of all such alternative benefits foregone is the social opportunity cost of this particular investment.

111. Opportunity cost of labour: When a worker is given a job, the cost to the enterprise can be measured in terms of the wages paid to him. The entrepreneur's private opportunity cost is the market value of the wage payments in cash or in kind. The social opportunity cost of this new employment is, however, the value of the outputs sacrificed elsewhere in the economy, because of the withdrawal of this worker from the rest of the economy for this particular job.

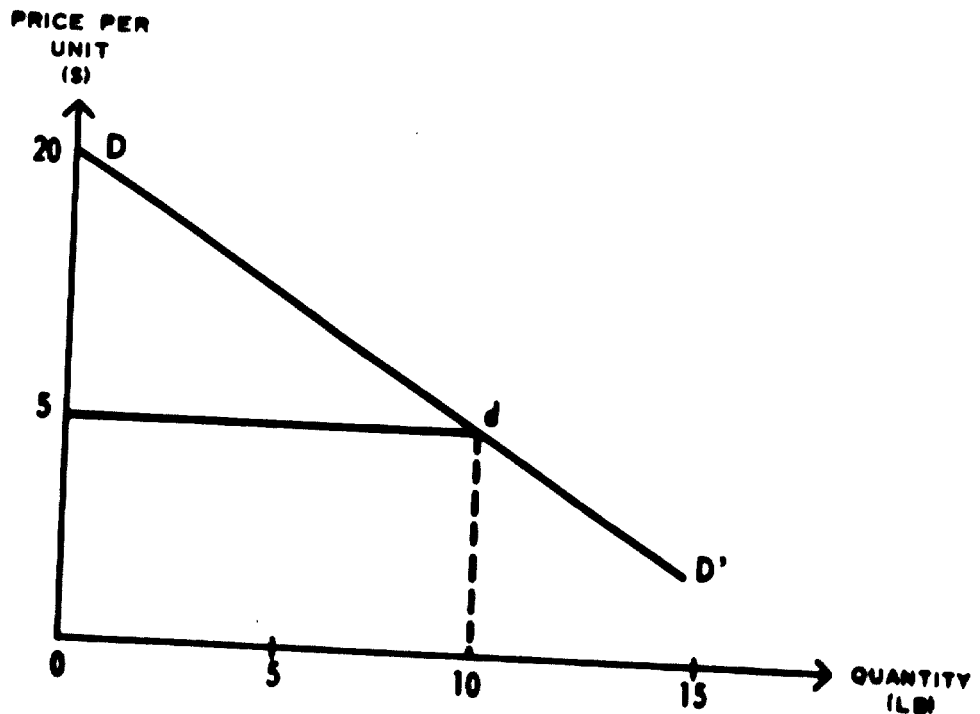


VII Willingness to pay, consumers' surplus, producer's surplus, merit wants

112. In a free market the price of a commodity is determined by the forces of demand and supply. Various factors can influence the demand for and the supply of a commodity, for example, its price, the prices of its substitutes or the incomes of the consumers. Let us assume for simplicity that all factors other than the price of the particular commodity remain unchanged and that the commodity itself is bought and sold in small units so that the purchase of one extra unit does not make too large a demand on a typical consumer's purchasing power. In that case it is possible to find out how much of the commodity each buyer is prepared to buy if the price is \$1 per unit. Similarly, it is possible to prepare a schedule of purchases the buyer is willing to make for different price quotations. This is called the individual buyer's demand schedule. Adding up the quantities demanded by all the buyers in the market for each price, a market demand schedule can be determined. It is reasonable to assume that the demand schedule for either an individual buyer or for the market as a whole is more or less downward-sloping, that is, the quantities demanded are higher for lower prices.

113. An individual buyer's demand schedule is indicated by DD' in Figure 1 below. If the price is \$20 or more per unit, the buyer will not buy the commodity. At the actual market price of \$5 a unit, he buys ten units, i.e. he is willing to pay \$5 for the tenth unit of the commodity. For the ninth unit he was willing to pay \$6.50 and so on. For the first unit he was prepared to pay \$18.50. This is so, because the marginal utility or the satisfaction received from a commodity is normally assumed to diminish as more and more of it is available for consumption. At any level of consumption, the willingness to pay for a commodity is determined by the satisfaction expected from the marginal unit of that commodity. In other words, the consumer's demand price is determined by his willingness to pay for the marginal unit when he is free to buy any amount of the commodity.

Figure 1



114. If, however, he is confronted with an all-or-nothing choice (so that in the earlier example, he must buy ten units of the commodity or nothing at all) then, his willingness to pay for the ten units cannot be determined by the choice at the margin, because such a choice does not exist for him. He will, we shall assume, be prepared to pay \$125 for the ten units, which is the sum total of his willingness to pay for each of the first ten units. The difference between the \$125, which he is willing to pay for the ten units of the commodity rather than go without it, and the \$50, which he actually pays when he is allowed to buy any amount of the commodity, is called the consumers' surplus. It is called a surplus because the existence of a market in which one can freely buy the various quantities makes it possible for a consumer to pay less than what he would be willing to pay and thereby enjoy a surplus.

115. In a free and competitive market, a producer will supply a commodity up to a point where the market price is equal to the marginal cost of the last unit produced. In a normal situation it is expected that the marginal cost of the successive units of the commodity will increase with increased production, at least in the relevant range of production decision. If this were not so, the producer faced with a given market price would have no reason for limiting production to any particular level.

116. In such a situation, the producer may find that even though the marginal unit of his produce costs as much as the market price of the good, he was able to produce the pre-marginal units less expensively. In such a situation, obviously, the average cost per unit for his total production is less than the marginal cost which he equates to the market. There is a profit or a surplus accruing to him for the whole operation. This is called the producer's surplus.
117. It should be noted in this connexion that such profits may attract new producers in the market so that in the long run such profits may be eliminated by increased production in the industry.
118. In the foregoing discussion of the demand analysis, it was assumed that the market demand schedule can be obtained by aggregating individual consumers' demand schedules. However, there are a number of economic goods and services, such as national defence or public parks, of which the consumption is social by its nature. The demand for such facilities cannot be measured in terms of an individual consumer's willingness to pay; such goods are called public goods.
119. In another category of goods, as in education or health, the aggregate of individual demands can be calculated, but there are good reasons for not accepting such an aggregate as the true social demand. Besides helping the recipient, education improves the productivity and the quality of life of the total society. The neglect of one person for his health can lead to an epidemic. Or, for example, the ignorance and apathy of some members of a community demands correction by social action for the greater good of the society. The demand for this category is called merit wants.

Related terms

120. Surplus is the excess of receipts over payments.
121. Consumer's surplus: The excess of the consumer's willingness to pay for the entire quantity of a good he actually buys rather than to go without it over what he actually pays is called the consumer's surplus.
122. Producer's surplus: The profits that a competitive producer can make in the short run in which his marginal cost (= market price) is greater than the average cost is called the producer's surplus.
123. Investable surplus: When an enterprise can retain a part of its earnings after paying all its dues, it is said to have an investable surplus, with which it can acquire more assets. For the economy as a whole, the excess of the gross products over current consumption constitutes the investable surplus.

124. Foreign exchange surplus: The excess of the receipts on the foreign account of an economy over its payments to foreigners is the foreign exchange surplus of that economy.
125. Wants: The desire to have more of a commodity is a "want". Economically meaningful wants are those that can only be satisfied at a cost, and for which consumers, individually or collectively, are prepared to pay.
126. Willingness to pay for a good in terms of money (purchasing power) or other valuables provides the economic measure of the intensity of the consumer's want for the commodity, and is based on his income and tastes. The schedule of a buyer's willingness to pay for the various measures of a commodity is his demand schedule.
127. Demand analysis: The study of the consumers' demand for goods and services is called the demand analysis.
128. Effective demand: When the demand for all the goods and services in an economy (at the given price) are aggregated over the various consumers, investors, exporters and government purchasers, the measure of the effective demand in the economy can be determined.
129. Merit wants: Wants that deserve to be valued not in terms of the consumers' willingness to pay, but on the basis of some social judgement of their merit, are called merit wants. Health and education are examples.

VIII Utility, social welfare function

Utility

130. Economists have tried to build a theory of consumer behaviour on the assumption that the consumer behaves rationally. A rational consumer carefully calculates the losses and gains, satisfaction and dissatisfaction, and benefits and costs of the various courses of action, and then chooses the most advantageous one. But what criterion does he apply to differentiate between the different bundles of consumables? Obviously, such a criterion has to reflect his likes and dislikes and his own sense of the usefulness of things. The earlier economists postulated that a rational consumer tries to maximize his own strictly measurable concept of "pleasure". He weighs everything that he buys or can buy with this yardstick, which the economists called utility. In this framework it is assumed that a rational consumer when confronted with any arbitrary bundle of goods will be able to say how many "utils" (units of utility) this bundle of goods represent to him. The later economists noticed that for the purposes of economic theory such a concept of strictly measurable utility, called cardinal utility, was unnecessary.

131. If for every conceivable pair of commodity baskets, a consumer can say either that he prefers one to the other, or that he is indifferent and does not have a preference, then it is usually possible to construct an ordinal utility function. Such a utility function would assign a higher utility index to A than to B if A is preferred to B. The same index would be given to each basket if the consumer happened to be indifferent and had no preference. The exact numerical value for the utility index is immaterial for the purpose of explaining the consumer's behaviour.

132. To explain cardinal utility, it is assumed that the extra utility derived by a consumer from a marginal addition of a good to his consumption is positive (i.e. that a good continues to be of value to him). But it is also assumed that with each successive addition of the good to his consumption, the marginal utility declines (meaning thereby that the intensity of his enjoyment diminishes as more and more of the same good is available to him). This is called the assumption of the diminishing marginal utility. This assumption helps to explain the observed behaviour of a consumer who, other things being equal, buys less of a good if its price goes up. The corresponding assumption in the case of ordinal utility function is the diminishing marginal rate of substitution,

which means that if a consumer is to be persuaded to part with successive units of a good he will demand increasing quantities of another good.

Social welfare function

133. Just as a consumer is assumed to make his choice according to his own utility function, the planners in a society can make social choices based similarly on a complete pre-ordering of the social alternatives, which normally can be represented as a utility function for the whole society. Such a utility function is usually called the social welfare function.

Related terms

134. Utility: The index of the value a consumer attaches to a good or a collection of goods. If the consumer can assign precise numerical values to his utility indexes (e.g. 5 oranges provide 2 units of utility; 6 oranges provide 2.2 units) then he is supposed to have cardinal utility. If, on the contrary, he can arrange different commodity bundles only as more, less or equally preferred, then his utility is ordinal.

135. Disutility: Negative utility is called disutility. If utility connotes pleasure, then disutility should mean pain.

136. Marginal utility: If the utility is cardinal, then marginal utility of a good can be defined as the extra utility derived by the consumer from an additional unit of the good.

137. Diminishing marginal utility: It is assumed that a consumer's marginal utility from a commodity declines when he consumes more and more of the commodity. The desire for apples, for example, diminishes as more and more apples are eaten.

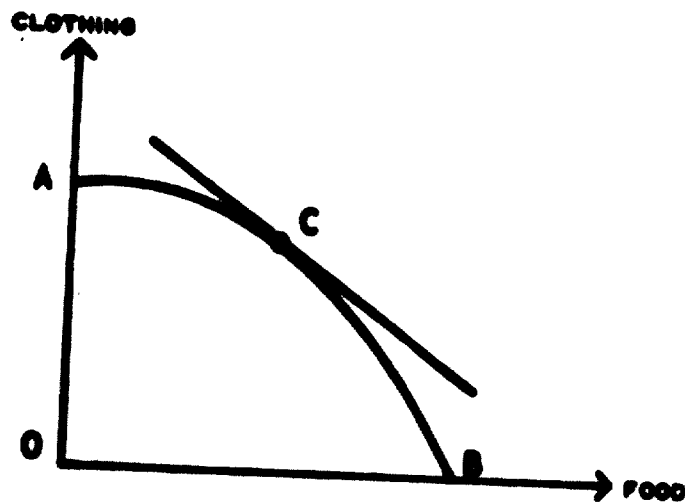
138. Social welfare function: The utility function for the society is usually called the social welfare function. Obviously, social welfare is some sort of an aggregate of individual welfare, which is the same thing as individual utility. Such a welfare function may be either cardinal or ordinal. It is worth noting that unless the society as a whole is prepared to make a judgement involving a comparison of the different individuals' welfare, no useful social welfare function can be defined. Thus, the "comparability of individual welfare measures" is a necessary assumption for a useful social welfare function.

139. Welfare economics: The branch of economics that is concerned with the problem of measuring or enhancing a community's welfare.

IX Transformation, substitution functions

140. An economy (or an enterprise) has at any given time a limited stock of primary resources, such as land, labour and various kinds of fixed productive assets. Given the technical skill available to the economy, all these primary factors can be employed in the production of a variety of goods and services. Any scheme of production is inefficient if it can produce more of any commodity without reducing the output of other goods or services with the help of the given stock of primary resources. An efficient scheme of production is one in which the output of any commodity can be expanded only at the cost of reducing the output of some other commodity. Usually the primary factors are versatile enough to allow a large number of alternative schemes of efficient production with the given stock of primary resources. If all commodities are perfectly divisible and production is possible at any output level, then it is possible to draw a locus of all efficient points of production in the commodity space. For example, if there are only two commodities, food and clothing, then the commodity space is two-dimensional. The line AB in the following diagram is the locus of all efficient production points. It is called the transformation curve. (If the commodity space has more than two dimensions, the corresponding locus is called a transformation surface.) Production is possible at any

Figure 2



point within the closed area OAB, called production possibility set; but only the points on AB are efficient. Suppose the actual production is at C. The

slope of the straight line, the tangent to the transformation line through C, is called the marginal rate of transformation (MRT). MRT measures how much extra clothing the economy could produce if it gave up the production of one unit of food. In other words, this gives the opportunity cost of food in terms of clothing or vice versa.

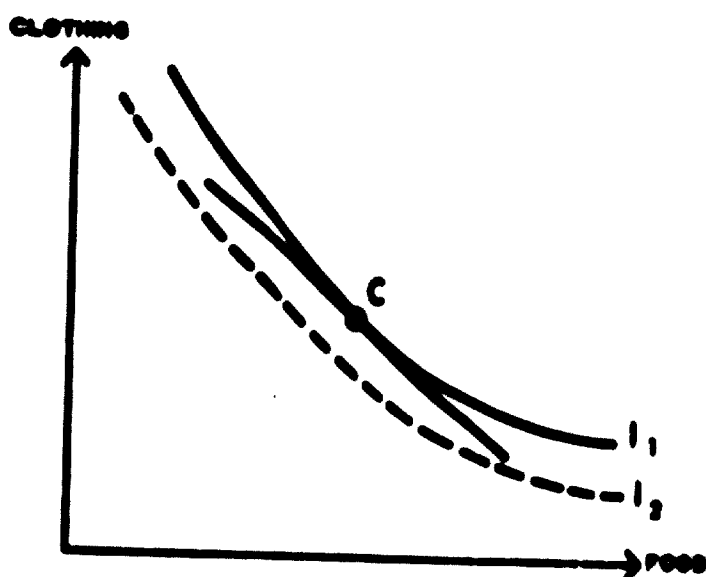
141. The production economy will be in equilibrium if the actual price-ratio is equal to the MRT. If this is not so, it will pay the production agents in the economy to divert resources from the production of one good to production of the other and make profits. For example, if the actual price-ratio is 1 unit of food for 2 units of clothing, when the MRT is $1:1\frac{1}{2}$, then it should be profitable to withdraw resources from the clothing industry and employ them in the food industry so that, for every $1\frac{1}{2}$ units of clothing lost, 1 unit more of food output is gained, which can then be traded for 2 units of clothing. A profit of $\frac{1}{2}$ unit of clothing emerges easily from this simple operation.

142. So far, we have considered only the production or the supply side of the economy, but market equilibrium is brought about by the forces of demand as well as of supply. The equilibrium condition on the demand side should be such that at the market prices (and income level) the consumers would have no incentive to buy any combination of goods different from what is produced in the economy. In the context of the discussion in the previous section of this paper this means that the ratio of the marginal utilities of two goods should, in the equilibrium, be equal to the price-ratio. This is so because if the actual price-ratio and the ratio of the marginal utilities differ, then by exchanging one good for the other at market prices the consumers can further increase their welfare.

143. The ratio of the marginal utilities is called the marginal rate of substitution, because this ratio indicates at what rate the consumers are willing to substitute one good for another without loss (or gain) in welfare. The concept of the marginal rate of substitution (MRS) is not dependent on the utility function being cardinal, i.e. that the marginal utilities can be measured. It is a meaningful concept also for ordinal utility. In considering the food-clothing two-dimensional commodity space it is possible to trace the locus of all points where the consumer's utility index remains the same. In other words, the consumer is indifferent as to the various points on the curve. This is called an indifference curve (figure 3). Actually, there will be a large number of such non-interesting indifference curves for any individual (or for

the community in the case of social welfare function) in the commodity space. Each indifference curve will correspond to a particular level of utility. As

Figure 3

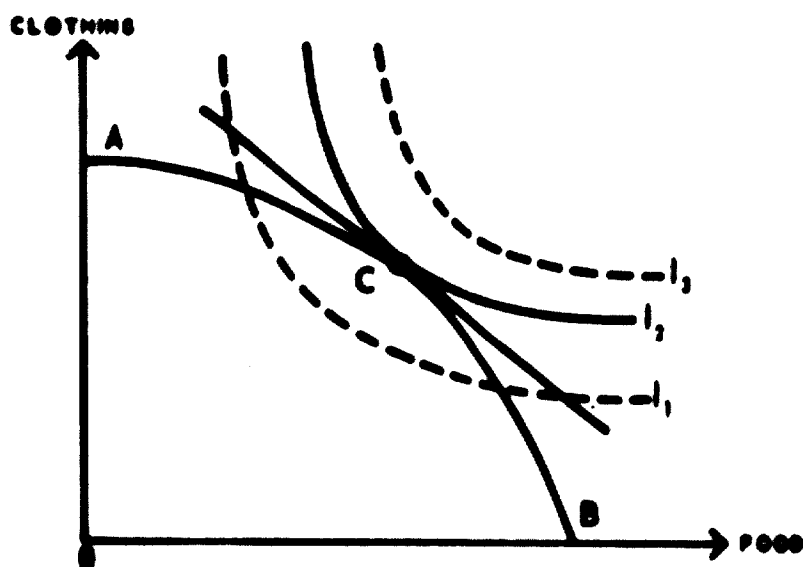


long as the goods continue to be a source of utility, a higher indifference curve (i.e. one to the north-east in figure 3) will correspond to a higher level of utility. The slope of the tangent to an indifference curve at any point measures the MRS. The assumption that is equivalent to that of diminishing marginal utility is that the indifference curves are convex to the origin. This means that as the consumption of food goes up larger quantities of food are substituted for one unit of clothing.

144. The equilibrium in the commodity market is assured when $MRT = MRS =$ actual price-ratio because, at that price-ratio, the producers do not stand to gain anything by shifting to a different scheme of production, and the consumers have no incentive to move to a different consumption bundle. In figure 3 the optimum point of consumption and production is C because the economy, with its limited resources, can choose only an output-combination within the production-possibility block OACB. The highest level of welfare can be attained if the community can reach the highest-valued indifference curve attainable, and that is the curve, I_2 , which just touches the production possibility block. If both the production possibility block and the indifference curve are smooth and conveniently

shaped (as in Figure 4 below), then the tangents to the two curves and the point of intersection are identical, and that is the equilibrium of price-ratio.

Figure 4



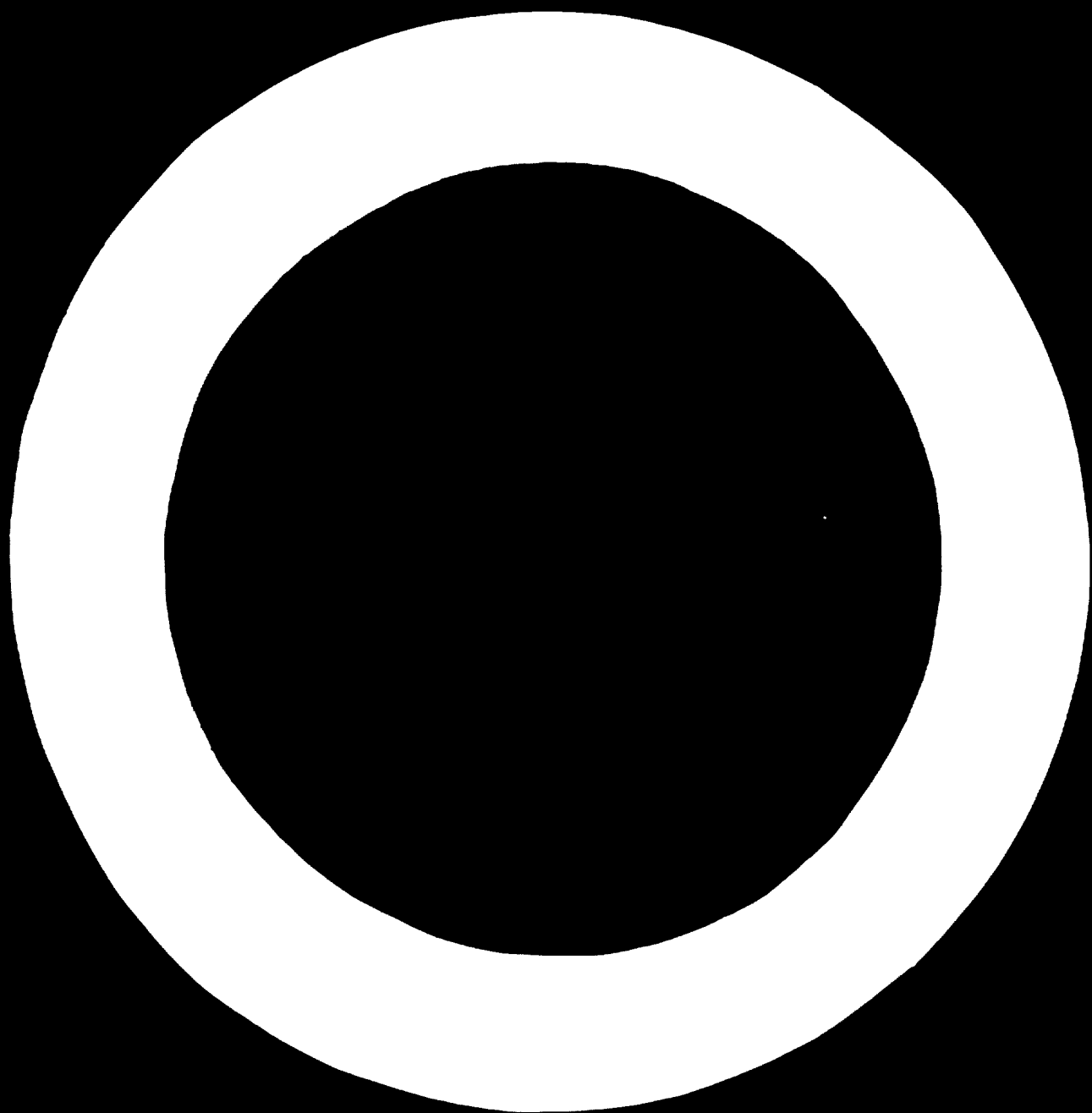
Related terms

145. Production possibility set: The set of all combinations of outputs, made possible by the endowment of primary resources and technological knowledge is called the production possibility set (PPS).

146. Transformation curve (surface): The set of all efficient points in the PPS, that is, all such points, where the output of one good cannot be expanded without reducing the output of some other good. This is so called because this curve shows how one output can be transformed into another by rearranging the production scheme in the most efficient manner. This is also called the production possibility frontier.

147. Foreign trade transformation function: Apart from the rearrangement of the domestic production scheme, a good can be transformed into another by foreign trade, if such a possibility exists. The functional relationship showing how one good can be transformed into another by the terms offered by foreign trade is called foreign trade transformation function.

148. Marginal rate of transformation: When the economy is at a certain point on the transformation surface, the slope of the tangent at that point shows at what sacrifice in terms of one good a marginal unit of another good can be produced. This ratio is the marginal rate of transformation.
149. Indifference curve: The locus of all points in the commodity space from which the consumer derives an equal amount of satisfaction is called an indifference curve. Corresponding to various levels of satisfaction there are different indifference curves. The collection of all such indifference curves for an individual (or for the community) is called his indifference map.
150. Marginal rate of substitution: The consumer's willingness to pay for one extra unit of a commodity in terms of another. Hence it is measured by the slope of the indifference curve at the point in which the consumer happens to be. MRS is also the ratio of the marginal utilities of the two goods.



X Market price, shadow price, accounting price

151. Rational decisions regarding the use of resources must be made on the basis of the relative value of goods and services. Prices are the measures of value in terms of money, which at any time is assumed to have a known purchasing power. It has already been explained in chapter IV that under "perfect competition" (which results in an optimum use of resources in Pareto's sense) the market price of a commodity reflects its scarcity-value measured in terms of the consumer's willingness to pay for it. For example, on the one hand, the market price of bread will measure every consumer's willingness to pay at the margin. On the other hand, it will measure the opportunity cost of the resources used in its production. If the society is satisfied with the distribution of income and wealth among its members, and if it has no intention of interfering with individual preferences, the social value of a commodity is identical with its market price under perfect competition.

152. But "perfect competition" is a theoretical construct, hard to come by in real life, particularly in the developing world. Moreover, a concerned society in a developing country cannot help but have the purposeful social objective of promoting an equitable distribution of income. The textbook prescription of correcting the income distribution by non-distortional fiscal policy is a myth and impossible to realize in any economy. The fact is that a typical developing country is very far removed from the idealized state of a competitive economy. Imperfect markets, social rigidities, imperfect communication, the presence of large non-monetized or semi-monetized sectors, are typical of these economies. In such a situation, the administrators of public investment policy cannot accept the market prices as the sole guide to the value of scarce resources. The administrators have to compute the appropriate measures of scarcity value for the resources in terms of social objectives. In other words, they have to compute the shadow prices or some approximation to the "shadow prices", called the accounting price.

Related terms

153. Price is the measure of the value of a commodity.
154. Market prices are the prices at which commodities are actually bought and sold in the market.
155. Demand price is the consumers' willingness to pay for the marginal unit of a commodity. The social demand price of a commodity is the society's

willingness to pay for it, which may be different from the demand price reflected in the free market.

156. Supply price is the price at which the suppliers are prepared to offer the given quantity of the good to the market. In a competitive market, the supply price of a commodity is the marginal cost of producing it.

157. Factor prices: The prices of the factors of production are called the factor prices, for example, the prices of labour, capital and land. Since the factors of production are not for direct consumption (in which case their valuation could spring directly from the consumers' willingness to pay), the factors derive their prices indirectly from their productivity in producing ultimate consumables.

158. World market prices, or international prices are the prices in terms of a convertible foreign currency, at which the country can buy and sell these commodities in the international market. A small country, whose demand or supply conditions do not affect the world market, can take international market quotations for the purposes of determining its trade and production policies. For a big country, with a significant share of the world market, world prices and domestic prices may differ owing to the restrictive trade policy pursued by the country.

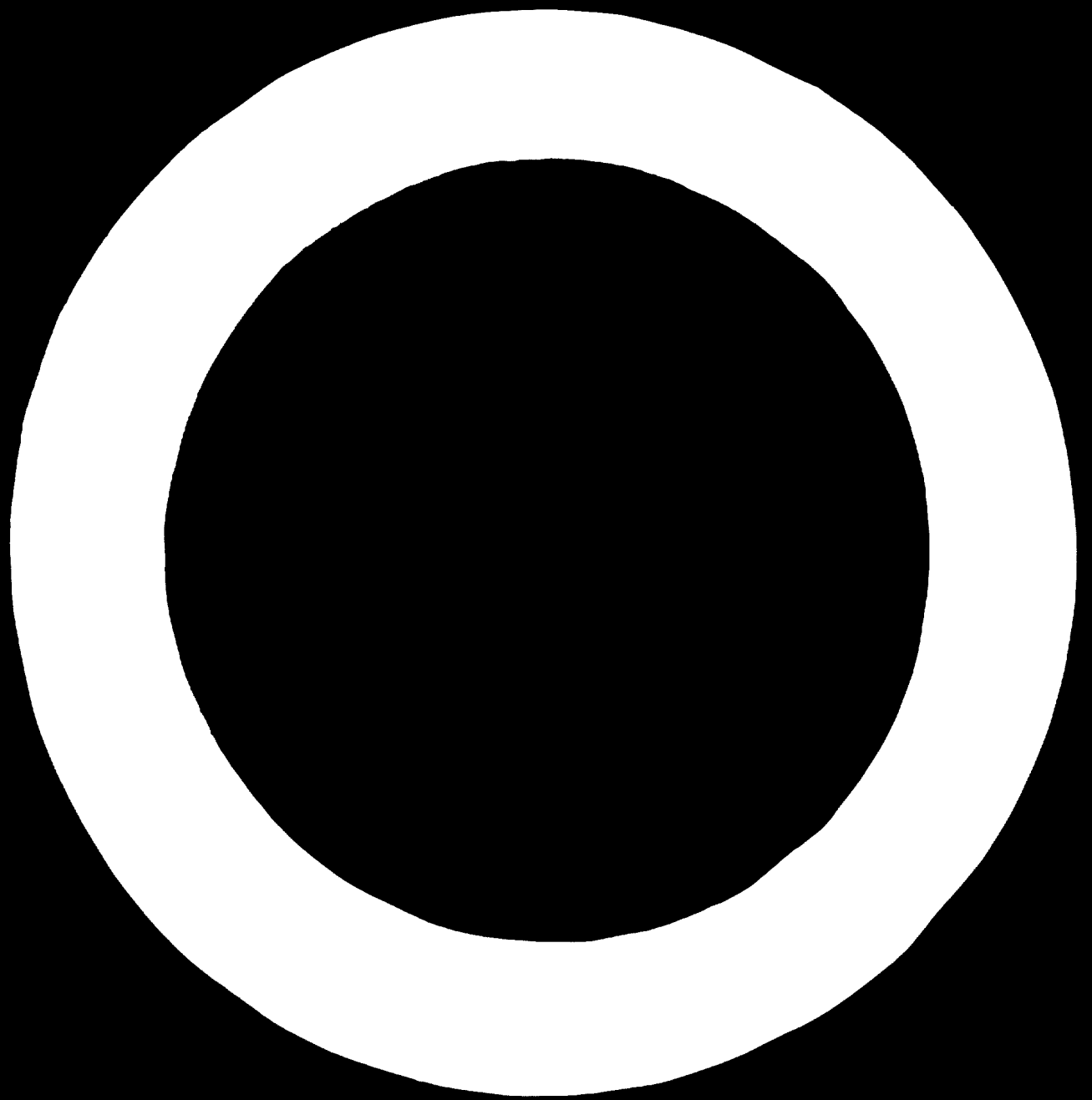
159. Promotional pricing: Whenever an enterprise or a country prices its product lower than the cost of production, in order to promote the demand with a view to maximizing its long-term profit, the policy is called "promotional pricing". It should be noted that the assumptions of perfect competition rule out the possibility of promotional pricing.

160. Non-price rationing: Whenever the demand for a commodity in a market is satisfied not by a freely fluctuating price, but by rationing the commodity according to some measure of the needs of individuals, the situation is called rationing. This policy is followed even in a market economy during emergencies such as wars or famines. The reasoning is that, when supply is inadequate, the auctioning of the limited supply (which a free market is supposed to do) can lead to extreme hardship for poor people.

161. Shadow price: The shadow price of a resource is the social value of an extra unit of it, measured in terms of the social welfare function. In other words, it is the social willingness to pay for the marginal unit of the resource in terms of the aggregate social objective.

162. Accounting price: Shadow prices are difficult to compute because an enormous body of data and large computing facilities are required to do so. (See chapters II, III and IV.) The project evaluators must therefore work with certain approximations of the shadow prices, called the accounting prices. Such approximations may be arrived at by informed judgements, or by short-cut analyses.

163. Imputed price: A number of goods or services are not actually marketed, even though they are sources of value to their consumers. An owner-occupied residential building is an example. For the purposes of computing income (or benefits) some value should be imputed to the services provided by such a building. Imputed prices are normally estimated by comparison with market prices for similar facilities.



XI Interest rate, intertemporal comparison

164. People spend a part of their incomes in acquiring productive assets, or entitlements to such assets, which will generate income in the future. How does a rational individual divide his income between current consumption and investment? Investments (acquiring productive assets) as such, are not supposed to be the source of direct utility to a rational consumer. Investments derive their value from the fact that they make extra income or extra consumption possible in the future. Thus a rational individual's consumption-saving decision can be viewed as a decision between consumption at different periods of time. The notion of the willingness to pay for an extra unit of consumption tomorrow in terms of today's consumption - a notion equivalent to the supply price of an individual's savings - can be introduced here to build a price theory applicable to the intertemporal consumption decision. This situation is variously described in economics literature as "time preference" or "intertemporal preference". If the consumer is willing to forego one unit of consumption at the margin this year for a price of 1.1 units of consumption in the next year, then the consumer is supposed to have an "individual rate of time preference" or "rate of discount" or "subjective rate of interest" of 10 per cent per year.

165. In real life an individual's savings behaviour is determined by many factors other than rational intertemporal consumption preference in the face of perfect certainty. But, for the sake of theorizing in a simple framework, economists have introduced the notion of a perfect capital market in which the intertemporal price of consumption is supposed to be determined by the forces of demand and supply in a competitive setting. The demand price of investment is determined by its productivity in terms of future consumption. Thus, the "rate of interest" in this theory is determined by the interaction of the time preference of consumers and the productivity of investments guaranteed by the entrepreneurs, in a perfect capital market where there is no uncertainty.

166. There are more compelling reasons why a perfect capital market is further removed from reality than the concept of a perfectly competitive commodity market in a static framework. Uncertainty is almost invariably linked with time, and the various ramifications of uncertainty, such as technological change in production, death, illness, or calamities connected with future consumption demand, are not easy to incorporate into this simple model.

167. However, the logic of this model has a certain intuitive appeal in formulating a rational social policy regarding collective savings. After all, the society is in a better position to predict the future, because the law of large numbers enables it to balance errors in the positive and negative directions. Thus the "social rate of discount" can be a useful concept in transmitting the society's preferences for savings at different periods of time to the project administrators whose decisions influence the consumption-savings mix in the economy.

168. The absence of a perfect capital market makes it impossible to accept the market-determined rate of interest - in fact, there are numerous rates of interest prevailing in any economy - as a true indicator either of the productivity of the marginal investment or of the true time preference of the community.

Related terms

169. Rate of interest is the price at which the borrowers and the lenders transact business in a given economy. If an entrepreneur borrows from a saver (perhaps through the intermediary of a bank) a sum of \$100 with the promise of paying \$10 per year as long as the principal amount is not returned, the rate of interest is 10 per cent per year. The equilibrium rate of interest is, as usual, determined by the equality of the supply price (of the lenders) and the demand price (of the borrowers).

170. Rate of discount, or individual rate of time preference, or subjective rate of interest: The rate of interest that an individual consumer demands in order to withhold from current consumption (i.e. to save) one unit of consumption at the margin.

171. Social rate of discount, or social rate of time preference: The rate of interest that the society demands to cut down the current consumption at the margin by one unit.

172. Internal rate of return or marginal rate of return over cost: Typically, an investment project requires investment expenditures spread over a certain period in the beginning, after which net returns are expected to accrue as long as the project facilities last. If a bank is prepared to borrow or lend any amount of money for any length of time at a fixed rate of interest, it can be calculated how much profit can be made by undertaking the project on the basis of bank loans, which will be serviced by the future returns from the project. Obviously, the amount of profit or loss will depend on the rate of interest.

The internal rate of return for the project is that rate of interest at which the project does not show any net profit or loss.

173. Recoupment period: If a project is financed from hoarded savings and the sum is replenished over a period of time from the net income from the project, then the period of time need for recovering the entire initial investment costs of the project is called the "recoupment period".

174. Present value of a series, discounted cash flow: If the rate of interest at which funds can be borrowed or lent is indicated, then the value of a project can be determined at that rate of interest in terms of an equivalent amount of funds in a bank. For example, if the present value of a project, at an interest rate of 5 per cent per year, is \$1 million, then the net earnings of the project (financed out of a bank loan at 5 per cent) is equal to the earnings from \$1 million deposited in a bank at an interest rate of 5 per cent per year in perpetuity.

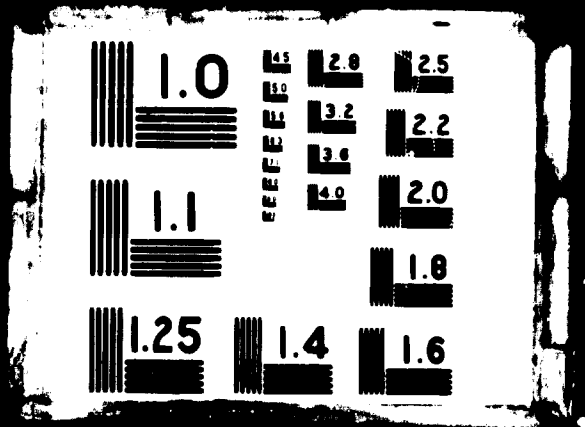
175. The gestation period of a project is the period of time that elapses between the beginning of an investment project and the time when the project starts to produce.

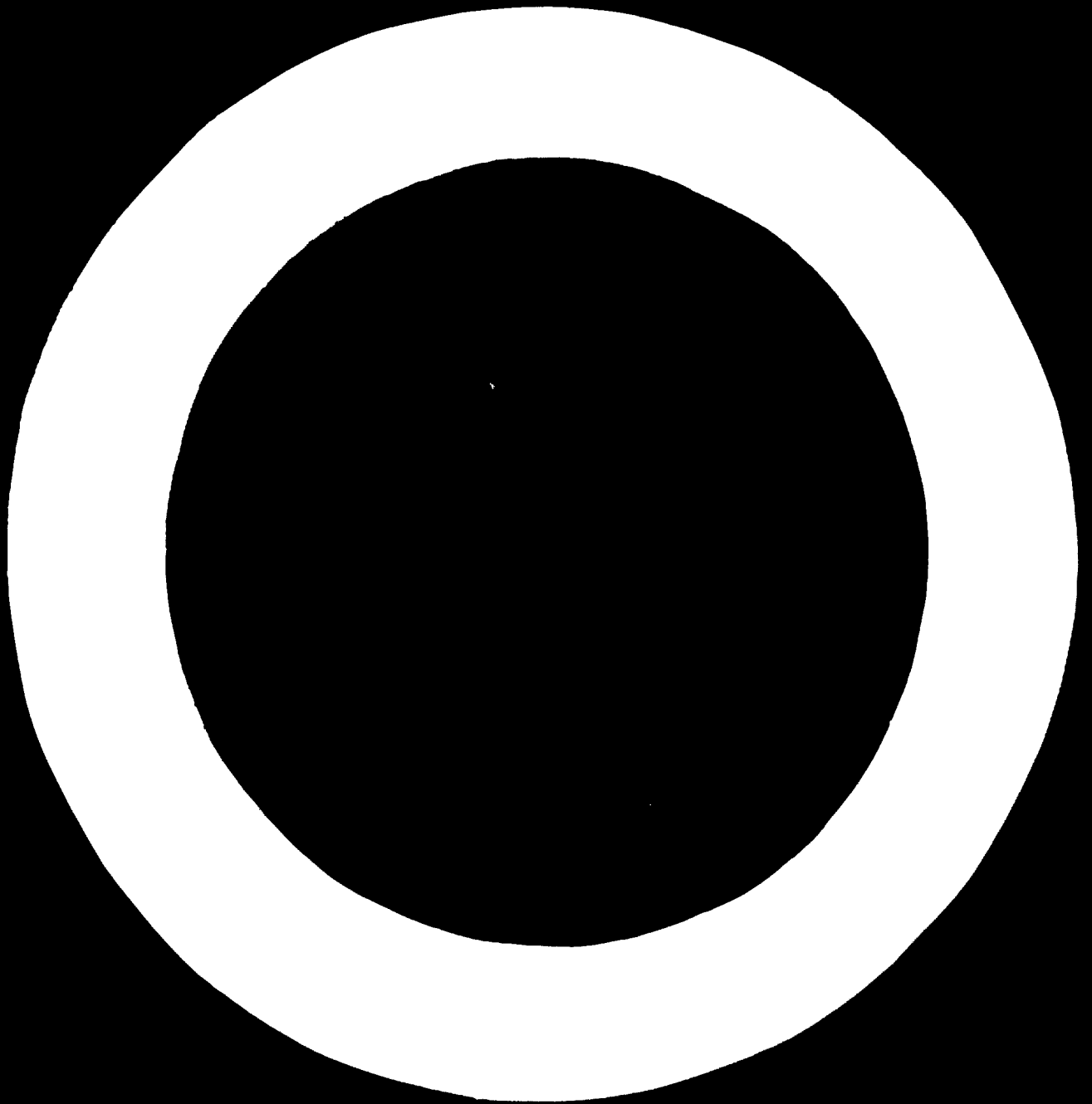


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XII Miscellaneous terms

176. Returns to scale: In an economic production process an output is produced with the help of inputs. The "return to the scale" of the production process measures the proportion by which the output would change if all the inputs were increased or decreased by a constant proportion. Constant returns to the scale occurs when the output is doubled if all the inputs are doubled. In increasing returns to the scale the output goes up more than proportionally to the constant rate of increase of all inputs. Similarly in decreasing or diminishing returns to the scale, the resulting increase in output is less than proportional to the rate of increase in every input. The latter two circumstances are also described as the internal economies or diseconomies of scale. It is "internal" because the economies or the diseconomies are reflected directly in the output of the firm. The expansion of a firm, however, may have an indirect effect on the economy, which is not reflected in the economies of the firm itself. This is "external economy".
177. External economy: Sometimes the production decision of a firm results in beneficial or harmful consequences to other producers or consumers in the economy, so much so that these positive or negative benefits are not reflected in the profitability calculations of the particular firm. These are "external economies". External economy may be pecuniary, in which case the external effects are transmitted through the price system, as by lowering the market prices of certain products or factors. On the other hand, the external economy may be technological, in which case the decision of the firm affects other producers or consumers directly. The standard example is the smoke emitted by a factory which affects the well-being as well as the productivity of the people in the neighbourhood.
178. Factor proportions: The factors of production are available in different economies in different proportions. The United States of America has more acres of land per member of its working force than has Japan. Rational production planning for the two countries would suggest therefore that the United States should try to economize on its scarce labour relative to land, whereas Japan should try to do the opposite. In other words, the United States should use "land-intensive" methods of production and Japan should choose "labour-intensive" technology. Similarly, a capital-abundant country should use "capital-intensive" methods of production. This is true if there are alternatives available among the production processes so that a rational "choice of technique" is possible.

179. The technological alternatives may be so limited, however, that it is impossible to choose sufficiently "labour-intensive" techniques for a labour-abundant country to provide employment for the entire labour force because of the limited supply of the other factors of production, for example, land and capital. Even if the technical alternatives are there, it may be uneconomical to exploit some of them unless the wage rate (and the behaviour of the consumers) can be changed appropriately.

180. Rent: Rent is the price paid per unit of time for hiring a fixed productive asset, such as machines or land. The rent of a fixed factor depends on its productivity as well as its scarcity. If a homogeneous factor is in unlimited supply, obviously positive rent cannot be charged for it. If a sum of rent were charged, owners of similar, but idle assets would offer them for hire at a lower rent. Therefore, the source of positive rent for a fixed asset lies in the fact that it is in fixed supply, or, in other words it is scarce. The exact amount of rent for any homogeneous fixed asset is, of course, determined by its demand price, which, again, is derived from the productivity of the marginal unit of the asset. This concept of rent is called scarcity rent.

181. Elasticity: If there is a well-defined relationship between two quantifiable variables such that one depends on the other, it is valuable to find out the exact quantitative measure of the degree of this dependence. In the example of the price and quantity of a commodity defining a consumer's demand schedule, one measure of the degree of dependence can be: by how many kilos does the demand for the commodity increase if its price is lowered by five cents per kilo? The weakness of such a measure is that it is too dependent on the various units of account, such as kilos or cents. It would be better to devise a measure that would be a pure number, so that dependence of the different magnitudes measured in different units could be easily compared. Elasticity is such a measure. In the example given above, the elasticity of demand with respect to price, usually called the price elasticity of demand is the percentage change in the quantity demanded caused by a one per cent change in the price, thus the ratio:

$$\frac{\% \text{ change in quantity of the good demanded}}{\% \text{ change in the price of the good}}$$

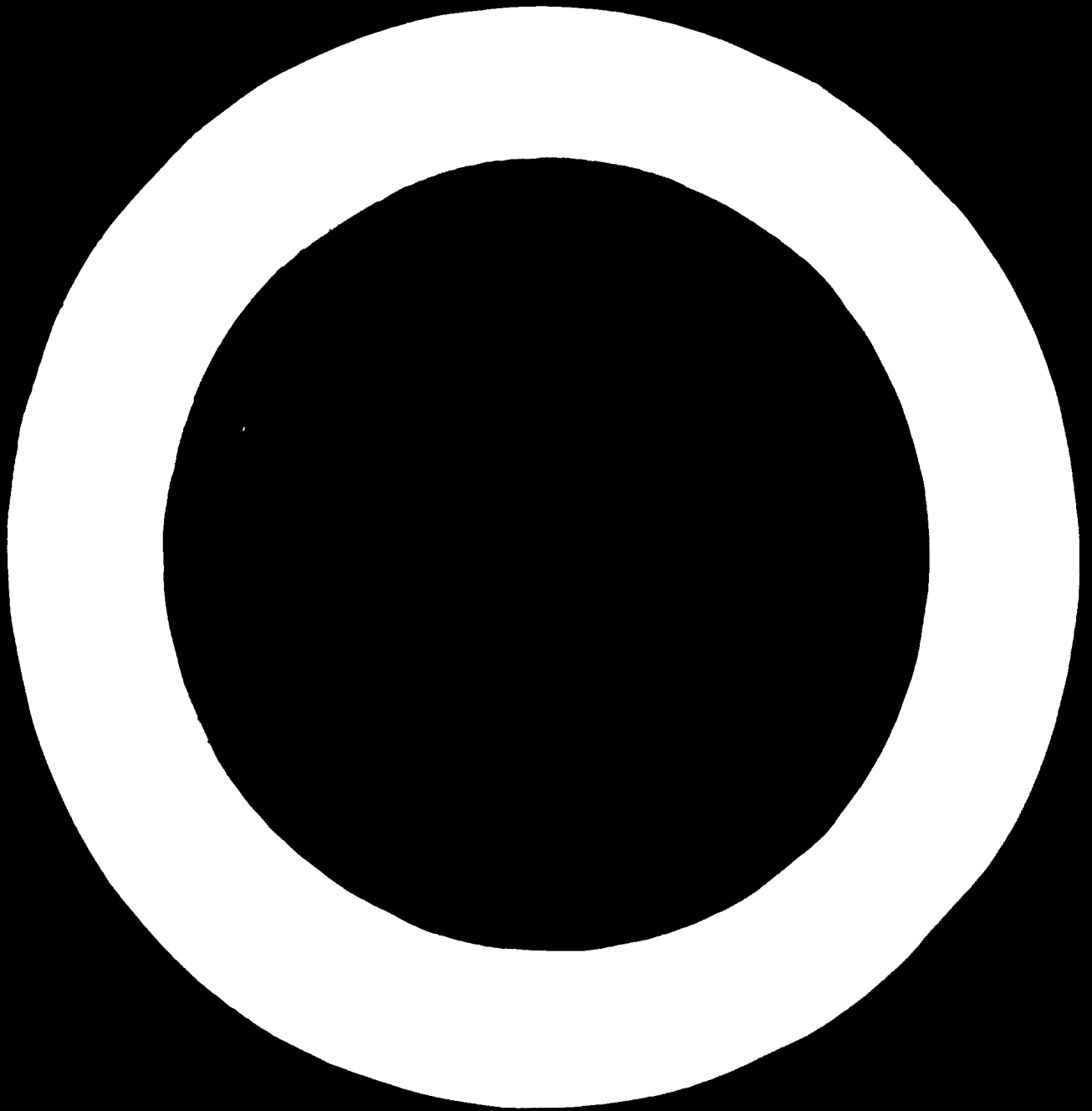
In a similar fashion it is possible to measure income elasticity of demand for a commodity as the ratio of the percentage change in the quantity demanded to one per cent change in an individual's or a group's income.

182. If both the changes happen to be in the **same** direction (as is likely for most goods with respect to income) the elasticity is positive. In the opposite case, where a change in the positive direction for one variable corresponds to a change in the negative direction for the other, as in the case of the price-quantity demand relationship, the elasticity is negative.

183. If the value of the elasticity remains the same throughout the entire range of variation for the two variables, the relationship is characterized as one of constant elasticity. A particular case of constant elasticity is unitary elasticity, in which one per cent change in the independent variable corresponds to one per cent change in the dependent variable.

184. A relationship is said to be inelastic if no change is possible in the independent variable, in which case the elasticity measure is zero. When elasticity is significantly different from zero, the relationship is said to be elastic. In the opposite extreme, when a very small change in the independent variable leads to a very large change in the dependent variable, the relationship is said to be perfectly elastic.

185. Risk, uncertainty: No fine distinction exists between a "risky" situation and an "uncertain" situation. In economic theory, however, the following distinction made by Frank Knight between "risk" and "uncertainty" is often followed: Risk refers to a situation where the outcome is not certain but where the probabilities of alternative outcomes are known or can be estimated. Therefore, in a risky situation it is possible to protect oneself against the eventuality of an unfavourable outcome by holding an insurance policy, because under these circumstances an insurance market can exist. The term uncertainty, on the other hand, is used to describe a situation so doubtful that the outcomes cannot even be predicted in probabilistic terms.



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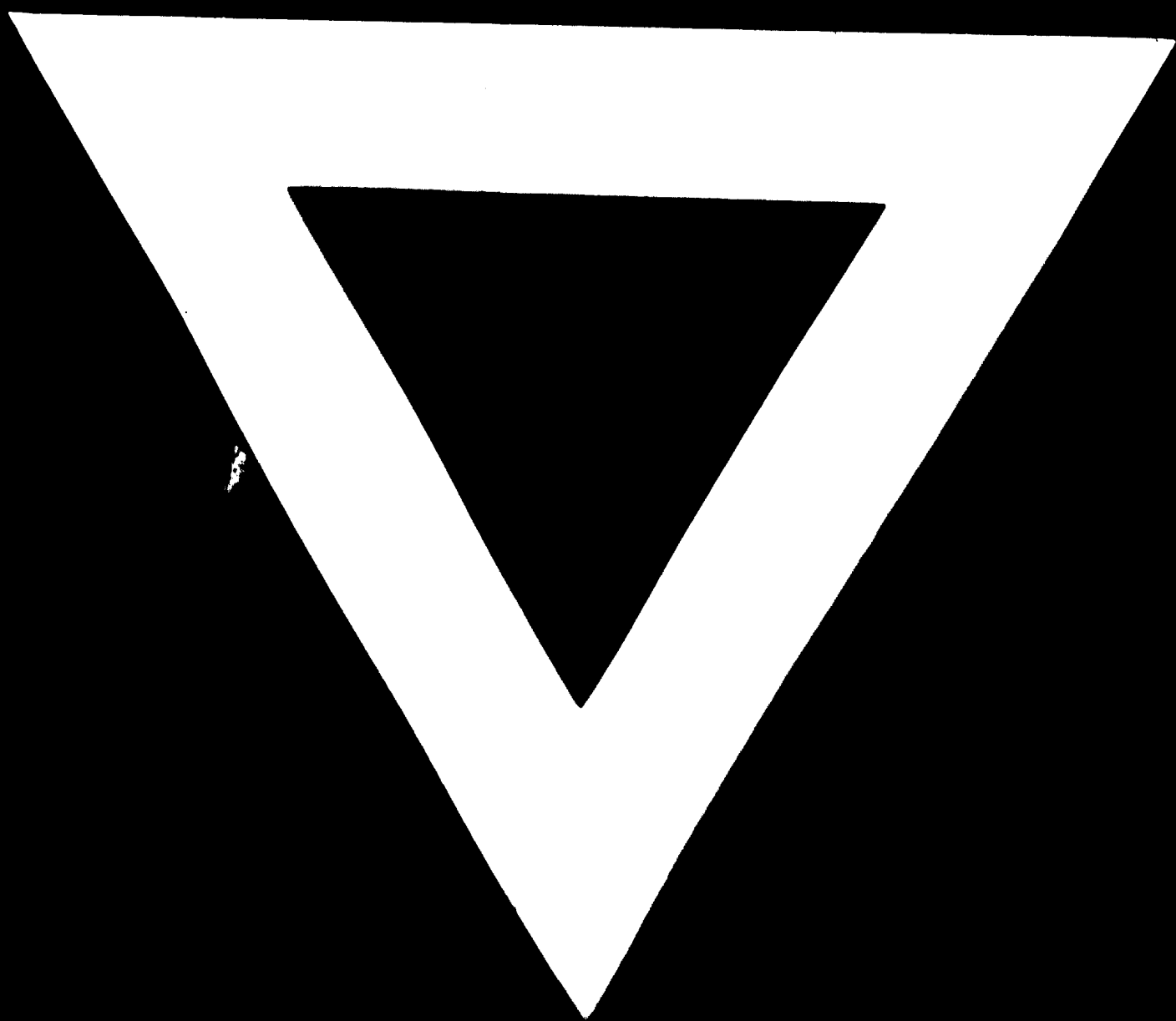
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