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MEASURES OF ECONOMIC GROWTH  
(Report by the Secretary-General)

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## I. INTRODUCTION

1. This paper consists of a preliminary outline of the statistical aspects of assessing and charting economic growth. It is intended to furnish the basis for discussion by the Statistical Commission of the character of future work on this subject.
2. Evaluating the growth of an economy of course consists of much more than measuring the expansion in the output of goods and services. As important aspects of the dimensions of growth are the increases in the potential capacity to produce and the improvements in the extent to which it is in fact employed. And the potential capacity to produce depends on the dimensions, character and productivity of the available labour and capital assets as well as the degree to which natural resources are exploited. It is common knowledge that the accumulation of capital and increasing productivity are essential elements in growth. Among other effects, these increases lead to improvements in per capita incomes and other facets of welfare, which are basic objectives in economic growth. Measuring the changes in levels of living is therefore also an essential part of assessing development.
3. Data on the dimensions of growth are not sufficient for purposes of taking steps to further this process. In addition, an understanding is required of the environment in which the expansion took place and the factors - stimulants and constraints - accounting for its pace. This involves delineating the structure of the economy and measuring the available resources. Examples of such measures are data on the size and character of the population, labour force and stock of fixed assets; on the distribution of agricultural holdings or industrial establishments according to size; or on the role of financial institutions and capital markets in financing enterprises. It also involves ferreting out the important relationships between production, the flow of incomes, consumption and capital formation - technological, behavioural and definitional - that operated in the economy, as well as the ties between the economy and the rest of the world. Examples of such relationships are input-output ratios for commodities, labour productivity or capital-output ratios in the case of technological relationships; the propensity to save or the income-elasticity of the demand for classes of consumer goods in the case of behavioural relationships; or the national accounting identities in the

case of definitional relationships. Delineating the circumstances of an economy and defining the strategic relationships in its operation provide bases for evaluating the possibilities of expansion, formulating an integrated and realistic set of objectives and targets for economic growth, and devising a plan of action for this purpose.

## II. ECONOMIC MODELS AND NATIONAL ACCOUNTING

4. In recent years a number of models consisting of technological, behavioural and definitional equations have been devised for use in projecting and planning economic growth. The scale and complexity of these models vary, depending on the number of variables it is considered necessary to take into account and the extent of disaggregation according to industries, regions, etc. It is not the purpose of this paper to go into the nature of these models, except to outline the way in which the models are related to national accounts and balances.

5. As might be expected, the variables dealt with in these models are in most instances encompassed in fully developed systems of national accounts and balances; and the definitional equations generally consist of national accounting identities. In a number of cases, the technological and behavioural functions are founded on coefficients derived from a set of national accounts. Variables and relationships with respect to population and the labour force provide the major exceptions. In some cases, a system of national accounts that is more or less comprehensive and detailed is included as an integral part of the model. This approach has a number of advantages. The national accounts can delineate, in some detail, the environment (e.g., the structural and technological characteristics and the level of activities and selected resources of the economy) in which the equations are to be applied. The national accounts can also provide a means of checking and iterating the estimates.

6. In some approaches to devising a consistent set of objectives and targets, national accounts and balances are employed without the assistance of a system of complementary functional relationships. The accounts and balances furnish the point of departure for detailed trial-and-error projections into the future, based on over-all objectives and policies and the knowledge and expectations of managers of industry and the like. The accounts and balances provide detailed checks of consistency at each phase of iteration.

7. The Commission is aware that the Economic Projections and Programming Centre of the Bureau of General Economic Research and Policies at United Nations Headquarters is working on models for long-term economic projections (see E/CN.3/338).

8. With the advice of an expert group, which met in June 1962, a set of related models was devised for projecting world production and trade. The models were designed as a basis for estimating the external environment within which the developing countries may plan to accelerate their economic growth. The models are described in Studies in Long-term Economic Projections for the World Economy: Aggregative Models.<sup>1/</sup> Different models were devised for the developing market economies, the developed market economies and the centrally planned economies, but they were designed to show the principal economic interrelationships among the groups of countries. As a first approximation it was assumed that rates of growth in the developing economies are a function of internal economic factors and internal variables dependent on their foreign trade and flow of foreign donations and long-term capital. The rates of growth in the other two sets of economies were assumed to be a function of internal economic factors only. The variables of the set of models are largely national accounting flows.

9. The model has been utilized to illustrate the implications of alternative rates of growth of the world economy up to 1970 and 1975. It has also been utilized to prepare projections of the trade needs of the developing countries in 1970. The Centre has also done a special study of trends in the import demand of the developed market economies for twenty-four major primary commodities in world trade up to 1970.

10. The Centre has started studies of alternative models at the country and sectoral levels.

11. Much of the basic data for computing the parameters of the models and the other calculations described above was supplied by the Statistical Office. The Office was also represented at the meeting of the expert group in June 1962. In view of the wide use made of national accounting data in the work of the Centre, the improvements taking place and proposed in the international reporting and compilation of these data should be of assistance in this work.<sup>2/</sup>

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<sup>1/</sup> United Nations publication, Sales No: 64.II.C.2.

<sup>2/</sup> See paper E/CN.3/326 on this subject.

12. The Statistical Office has examined some of the strategic factors and structural changes in economic growth, employing regression analysis. The results of these studies are presented in The Growth of World Industry, 1938-1961: International Analyses and Tables.<sup>3/</sup> The functions examined, though related and

consistent, one with the other, did not make up a complete system of equations.

13. The studies of relationships between rates of growth dealt with variables such as manufacturing output and the gross domestic product, exports and the gross domestic product, imports and the national income, the productivity of labour and output in manufacturing. The relationships examined between economic structure or performance, on the one hand, and stage of development or industrialization, on the other, involved such conditions as the average incremental capital-output ratio, capital intensity, the productivity of labour and the relative prevalence of heavy and light manufacturing. The experience and characteristics of developed and developing market economies were analysed separately. Countries were classified into one or the other group, depending on whether or not their per capita value added in manufacturing was \$US125 during 1958. As there was a very close correlation between this aggregate and the per capita gross domestic product, classification according to extent of industrialization was equivalent to classification according to degree of development.

14. The brief outline above of the econometric and related approaches to assessing and charting economic growth indicate that there are a number of statistical aspects to this work in addition to the provision of the required basic data. In the case of testing sets of equations and evaluating the parameters, problems arise concerning the identification of the variables, the forms in which the data are needed and can be supplied, and the appropriate techniques (e.g., regression, variance or factor analysis) for these purposes. Projections also involve choices among statistical techniques. Another statistical problem common to studies of economic growth, is the way in which rates of growth might best be computed. It might be noted in this connexion that the Statistical Office is planning to experiment with alternatives for doing this. A further area of statistical work might consist of investigation, in depth, of the ways, methods and forms of utilizing comprehensive sets of national accounts and related data in studying and planning economic growth.

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<sup>3/</sup> United Nations publication, Sales No.: 64.XVII.8.

15. The index-number problem is encountered in the case of a number of the statistics employed in studying economic growth. A number of these series are needed in constant prices or in the form of index numbers of price and/or quantum. This subject is receiving attention as part of the work of the Statistical Office on national accounting data in constant prices, the related indexes of quanta, and index numbers of prices.

### III. SELECTED AGGREGATES ON THE DIMENSIONS OF ECONOMIC GROWTH

16. The remainder of this paper is devoted to a brief review of selected series of data which have frequently been utilized as measures of the dimensions of growth, as variables in functional and other analyses of this question, or as targets in economic planning. The series discussed are restricted to output and the labour and capital employed in production. In order to deal with economic growth, data are of course also required on the flow of incomes from economic activity, the disposition of this income and other sources of demand for the product, and the means through which production, consumption and capital accumulation are financed.

17. This section of the paper is intended to illustrate another direction in which the work on measures of economic growth might be developed. A detailed discussion of the basic statistics required to compile most of the series on production that are discussed below is furnished in Statistical Series for the Use of Less Developed Countries in Programmes of Economic and Social Development.<sup>4/</sup> Also dealt with in this publication are series of data required for purposes of relatively detailed sectoral analyses. In the following paragraphs, attention is focussed on statistics of production of a more general nature, including analytical ratios and similar devices.

#### A. Output

18. In the case of the market economies, the gross domestic (national) product at constant prices is the measure of the real output of goods and services that is commonly utilized. It is a basic statistic in evaluating economic performance, in

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<sup>4/</sup> Statistical Papers, Series M, No. 31, Statistical Office of the United Nations, New York, 1959.

equations and other analysis relating to growth, and in setting targets in economic planning. Both the total product and the product for various industries is utilized in these ways. Some of these purposes (e.g., functional relationships), may be served by data in current prices. The gross domestic product distributed according to industrial origin furnishes a basic means of describing the structure of an economy; and its distribution among sources of expenditure indicates the relative importance of various sources of demand. In comparing levels of development, frequent use has been made of the per capita gross domestic product in constant prices. This measure not only is standardized for the size of the population, but also reflects, roughly, the efficiency with which manpower is employed.

19. The gross domestic product is proximate in coverage to the employment of the labour force and the use of fixed assets, and often enters into computations of the productivity of labour, capital-output ratios and the like, and production functions. This coincidence in coverage is not as great in the case of the gross national product. Estimates of the potential capacity to produce have been made in terms of the gross domestic product. These estimates are often based on data on the current level of the product, the amount and character of unemployment in the labour force, and the productivity of labour.

20. The gross domestic product may be valued at market prices or at factor cost. For many of the uses of data on the total product, valuation at market prices seems preferable. For example, expenditures on goods and services are valued at market prices, and the real incomparabilities between countries in measures of total output are likely to be less when valuation is at market prices. On the other hand, the inclusion of indirect taxes and the exclusion of subsidies in valuing the product, makes industrial distributions of it less useful in describing the economic structure or dealing with the allocation of productive resources. In many of the uses of data on the industrial origin of the product, valuation at factor cost seems best. This is also the case in compiling data on the average productivity of labour or capital-output ratios. In these data it is desirable to employ the net domestic product at factor cost, provided actual depreciation has been deducted, in order to avoid inflating the measure of the joint contribution of labour and capital to the product.

21. For purposes of input-output coefficients with respect to intermediate consumption, data are of course needed on the value of the gross output (i.e., including the cost of the goods and non-factor services utilized) of commodities in various industries. Figures in current prices are valuable for many of these purposes; factoring these data into quantum and price components would add to their usefulness. Statistics on gross flows are also required in analysing the sources of demand for the output of the various industries, linking changes in effective demand back to output, and balancing demand against supply. Arraying these data in the form of input-output tables is the most efficient way of serving these requirements.

22. Figures of the gross output of industries (i.e., the material branches of production, excluding most kinds of services) are utilized for a number of additional purposes in the centrally planned economies. These data in real terms are basic in setting plan targets, allocating productive resources, evaluating plan fulfilment and in measuring rates of expansion in production and labour productivity. In the case of the non-material branches of production, statistics of employment are mostly utilized for these purposes. For purposes of measuring and analysing the rate of growth of the economy as a whole, however, use is made of the real net material product (i.e., net of depreciation and not covering the activities of most kinds of services). The net material product in current prices classified according to use (consumption and accumulation) and according to income share (e.g., wages and salaries, profits, turnover taxes) enters into the financial analysis and balances of the economy.

#### B. Population and Manpower

23. The size and general characteristics of the population are basic considerations in evaluating and projecting economic growth. Data on the current population and its expected rate of increase enter into assessing economic welfare and projecting the demand for goods and services. These data classified according to age and sex, at least, and urban-rural, degree of literacy and other characteristics, in addition, furnish the basis for more refined measurement and treatment of these questions. The same type of data enter into estimates of the prospective size of the labour force and some of its key characteristics.



24. The numbers in the labour force and its distribution according to such characteristics as area of residence, skills and educational attainment, are utilized in balancing the anticipated supply of manpower against requirements, as well as in setting targets for output that will provide full employment. Not infrequently, first approximations to targets for output are based on projected magnitudes and the general characteristics of the labour force and the average productivity of labour. One of the basic characteristics required for this purpose is the distribution of the labour force according to kind of economic activity. The distribution of the employed labour force among the various industries has also been widely utilized in describing the structure of economies. Measures of the magnitude and character of unemployment and under-employment in the labour force are wanted for purposes of assessing the extent to which the available capacity to produce is under-utilized and for purposes of evaluating selected aspects of the welfare of the population.

25. For purposes of measuring the effective use of manpower and average labour productivity, more precise measures of inputs of labour into production than the average number of persons employed during a year, are desired. Man-hours worked during the period, or related but more approximate measures such as full man-year equivalents, furnish more precise indicators. As the average productivity of labour (i.e., average output per unit of labour input) differs from one activity to another and changes in the industrial distribution of labour are concomitants of economic growth, the statistics should be available both standardized and unstandardized for the distribution of labour among the various industries. Measures of average labour productivity are needed in the form of output per unit of labour input during particular intervals of time as well as in the form of indexes of the change between these intervals.

26. The magnitude of labour input is a basic variable in production functions or other ways of relating the output of goods and services and the input of labour. Here too, it is desirable if feasible, to measure the supply of labour in man-hours and to utilize the parameters of the relationship peculiar to each industry. Production functions have analytical advantages over less refined ways of defining the relationship between outputs and labour inputs. These functions are generally designed so as to measure the variation in the average productivity of labour due to

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variation in capital intensity (i.e., capital per unit of labour). The functions have sometimes been extended to cover technical and other progress as well, through the use of time as a variable. On the other hand, definition of useful production functions raises problems of measurement. For example, suitable data are required on the stock of fixed assets and means are needed to convert the quantum of labour and of capital employed in production to the same unit of measurement.

### C. Capital

27. The magnitude, character and industrial distribution of the stock of fixed assets place significant constraints on the capacity to produce. Expanding the supply of the appropriate fixed assets is a fundamental part of economic growth since in this fashion, not only is the stock of capital increased, but the joint productivity of the capital and labour employed in production is also raised. As this supply is relatively inelastic, in view of the time required to make fixed assets, and the resources and finance for producing these commodities are in competition with those for consumption goods and services, attention has been focussed on capital formation in dealing with the growth of all types of economies. Questions inevitably arise concerning the magnitude, characteristics and use of the existing stock of fixed assets, the most efficient plan of adding to this stock, the allocation of real and financial resources between consumption and capital accumulation, and so on. Since capital formation is also a dynamic but relatively unstable source of demand for the product, it has been the subject of attention as well in efforts to ensure steady economic growth.

28. The general uses made of data on the stock of fixed assets require statistics of the value of this stock distributed according to type of asset (e.g., machinery, transport equipment, non-residential structures) and industry of use. Value figures are required that may be utilized to measure real changes in the stock, related to the value of output in current or base-year prices (e.g., in the form of capital-output ratios), or combined with measures of the input of labour (e.g., in evaluating the parameters of production functions, compiling capital intensity ratios, measuring average joint productivity). For the first and third purpose, index numbers of value in real terms may be sufficient, but absolute figures would find wider use. For the purposes mentioned above, data have usually been sought on the

cost of replacing the fixed assets in their original condition, reduced by the accumulated consumption of these assets. For a number of these purposes (e.g., in comparisons with inputs of labour or in capital-output ratios), the prospective method of valuation (i.e., in terms of the discounted flow of income from the future use of the assets) would be preferable. This method of valuation, which is approximated by the current market value of the fixed assets, is however not utilized as frequently as replacement cost in view of the greater statistical difficulties and inconveniences. Either method of valuation reflects the expected life of the fixed assets, which should not be taken into account when valuing assets for use in production. It has been suggested that taking account of scrappings, but not depreciation, in reducing the values of fixed assets in their original condition, would be a suitable adjustment for this.

29. Appropriate data on the value of stocks of fixed assets are at this juncture available for a few countries only. This situation reflects the costs and difficulties of compiling these data through comprehensive and detailed censuses of fixed assets. A number of countries are exploring less expensive ways of compiling the data, for example, the perpetual inventory or casualty insurance approach; and suitable figures of the value of fixed assets may become more plentiful in the future. In the meantime, in some cases, use has been made of book values of fixed assets, adjusted to some extent for their well-known deficiencies.

30. Alternatively, measures based on figures of fixed capital formation, that are much more available, have been utilized in approximate fashion for some of these purposes. For example, the average ratios of fixed capital formation to gross domestic product, both in the constant prices of the same year, for ten years or so, have been employed as rough indicators of average capital-output ratios. This ratio has been called the average investment ratio; and, expressed in current prices, is a measure of the place of fixed capital formation in the demand for the product. The use of actual net, instead of gross, fixed capital formation and of longer periods of time is likely to reduce the crudeness of the investment ratio as an indicator of the capital-output ratio. Sometimes the gross domestic product has been lagged a year or so behind fixed capital formation in view of the time involved in putting the fixed assets to use. In any case, this rough measure would be more appropriate for machinery and equipment than for structures, and more useful when sub-divided according to kind of industrial activity.

31. The average investment ratio divided by the average annual rate of growth in the gross domestic product over the period to which the investment ratio refers has been utilized to approximate the average incremental (marginal) capital-output ratio. The classification of this measure by selected types of fixed asset and industry of use would enhance its analytical value.

32. Other substitutes for suitable data on the value of fixed assets have also been utilized in analytical studies. Substitutes are chosen which may be expected to vary in proportion to the value of important elements of this stock. For example, the capacity, rated, potential or effective, of installed power equipment in industrial pursuits has been utilized as an indicator of their stock of machinery and related equipment. In the volume The Growth of World Industry mentioned above, data on average capacity of installed power equipment and average energy consumed, each per person employed, have been used as indicators of average capital intensity in the case of the manufacturing industries.

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