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STATISTICS OF PRICES AND QUANTITIES AND NATIONAL ACCOUNTING IN CONSTANT PRICES

A system of price and quantity statistics

Report of the Secretary-General

72-16081

CONTENTS

INTRODUCTION

1. Work on an integrated system of price and quantity statistics, which covers the index numbers and the series of prices and quantities required for purposes of compiling the indexes, was initiated at the request of the fifteenth session of the Statistical Commission. The results of the work completed on the system before the sixteenth session of the Commission were presented in two papers - document E/CN.3/401, "A system of quantity and price index numbers", and E/CN.3/402, "The collection and compilation of price and quantity statistics". The Commission made a number of recommendations for modifications and extensions in the proposed system; they have been taken into account in preparing this paper and document E/CN.3/428, on series of prices and quantities. The comments in respect of documents E/CN.3/401 and E/CN.3/402, and somewhat earlier versions of them, that were made by meetings held in various regions of the world have also been taken into consideration.1/

2. Documents E/CN.3/427 and E/CN.3/428 are being presented so that the seventeenth session of the Statistical Commission may comment on the substance of these papers and may recommend the lines along which further work on the system of statistics of prices and quantities should proceed. Work on the system has not yet reached the stage where the system set out in the two papers may be considered for adoption by the seventeenth session. Additional consultations with national statistical authorities, through regional meetings and/or correspondence, further research into national practices and plans and the assistance of an Expert Group, is needed before a draft of the system of price and quantity statistics may be submitted to the Commission for that purpose.

3. This paper, like document E/CN.3/401, deals with the purpose, scope and structure of the proposed system of price and quantity statistics, the concepts, definition and classification of the series of index numbers to be included and the weighting, base periods and formulae to be used in compiling these indexes. The objectives and scope of the system are discussed first, in that order. Dealt with next is the national accounting framework within which the index numbers and series of prices and quantities are to be integrated. The following section discusses the character and classification of the series of index numbers of the proposed system. Dealt with last are the weighting, base periods and formulae for purposes of constructing the series of index numbers.

I. PURPOSES OF THE SYSTEM

A. Requirements for the series of data

4. Index numbers and aggregates of prices and quantities are required for a wide range of analytical and instrumental purposes. In order to build these series of data, as well as in order to analyse market conditions, it is necessary to have figures of the prices and quantity of individual commodities.

1/ See "Report of the session held in Geneva on 16-20 December 1968", Working Group on statistics and indices of prices and quanta, Conf.Eur.Stats/WG.31/4, "Report on seminar on statistics of prices and quanta", Addis Ababa, 13-21 October 1969, E/CN.14/NAC/36, "Report of the working group on statistics and indices of price and quanta", Santiago, 24 to 28 November 1969, E/CN.12/849, and "Report on seminar on statistics of prices and quanta, Bangkok, 15-22 June 1970, ASTAT:SPQ/5.

1. Measures of quantities

5. Index numbers and aggregates of the output of an economy in constant prices are watched in order to assess its economic growth and cyclical and seasonal fluctuations. Data on the volume of production of the various kinds of economic activity are wanted for purposes of determining their health, their role in economic growth and fluctuations, and the changes in the structure of production. These series are also needed in order to measure the technical coefficients, productivity and unit costs of industries, in order to correlate changes in output, productivity, costs and prices and in order to estimate the future demand for resources. For these purposes, it is necessary to have, in addition, constant-price data on the intermediate inputs and on the direct inputs into the various kinds of economic activity.

6. Series of data on the quantities of the various goods and services produced, imported, disposed of at home and exported, are used in analysing markets and in balancing supplies against demands. Index numbers of the volume of imports and exports are, in addition, required for purposes of analysing the balance of trade. Indexes and aggregates in constant prices in respect of the goods and services disposed of to various domestic uses are also wanted. The classification of the volume of goods and services consumed by households according to the object served, yields measures of the level and composition of their level of living. The amount of fixed assets acquired by the various producers of goods and services are indicators of the improvements made in their capacity for, and productivity of, production.

2. Measures of prices

7. Price index numbers are widely used in watching for, and studying, inflation or deflation. A number of different price statistics are wanted for these purposes. Indexes in respect of commodities and industries which lead in price fluctuations - for example, certain raw materials and semi-finished goods - are needed in order to detect incipient inflationary or deflationary pressures. Price indexes and aggregates of the gross output and of the intermediate and labour inputs of the various kinds of economic activity, coupled with their unit costs, are required for purposes of identifying the sources of these pressures and for purposes of tracing the ways in which changes in prices are transmitted through the economy. Price series on imports classified according to kind of commodity are also wanted for these studies. Comprehensive indexes of producers' prices, of the domestic supply of commodities and of consumers' prices, are commonly used to measure over-all movements in prices.

8. Price indexes and aggregates of the gross output and intermediate inputs of the various industries are also required for purposes of assessing their well-being and the changes in their terms of trade. Price indexes of exports and imports are watched in order to measure changes in the terms of trade of a nation and in order to explain the balance of trade. In the case of the wholesale and retail trades, the spread between the sales prices and the purchase prices of merchandise is of particular interest for purposes of determining price mark-ups as commodities pass from producers to users. The differences between the producers' prices and purchasers' prices of commodities are often used to measure the price components of trade and transport margins. Other important uses made of series of prices for commodities are in market analysis, in studies of price flexibility and in compiling price aggregates and index numbers.

9. Aggregates and indexes of consumers' prices are essential for purposes of compiling data on the cost of living and on "real" wages and salaries. Considerable use is made of price statistics for purposes of converting values to a common unit of measurement, for example in compiling national accounting figures in constant prices or data in national currencies to a common basis.

B. The need for a common framework

10. A number of countries gather and compile a range of statistics of prices and quantities in order to meet the analytical and instrumental requirements outlined above. They collect and issue many quantity and price series in respect of individual commodities and compile a number of different aggregates and index numbers from these data. However, because of differences in the ways in which the various series on prices and quantities originated and were developed, they are often incompatible, one with the other, and can not be easily coupled, either for analytical purposes or for reconciliation with series of current values.

11. The specifications of elementary series of prices and quantities - for example, the commodities or varieties of them, and the transactions to which they relate - often differ unnecessarily. And, the price and quantity aggregates and index numbers compiled from the elementary series are frequently unco-ordinated in respect of scope, in respect of weighting or in respect of classification.

12. For example, traditional index numbers of producers' prices generally deal with the gross output or sales of goods by domestic producers and are classified according to commodity groups. However, except in the case of the centrally planned economic, traditional index numbers of agricultural and industrial production relate to the constant-price value added of domestic producers, rather than to their gross output; and are usually classified according to the kind of activity of the producers. The traditional index numbers of prices are often also classified according to stage of fabrication of the commodities in question or according to the customary uses to which they are put. Index numbers of the production of commodities classified in these ways, are rarely compiled. Though the same trends in production should be shown by national accounting data in constant prices and by traditional index numbers of production, this is not always the case in practice. The traditional price indexes in respect of consumers' and other finished goods usually differ in concept, scope and classification from the corresponding national accounting series.

13. The proposed system of statistics of prices and quantities is designed to eliminate the deficiencies outlined above by co-ordinating and linking these data - elementary series, aggregates and index numbers - one with the other. A national accounting framework furnishes an efficient means for doing this. The framework is the System of National Accounts (SNA) in the case of countries with market economies and the System of Balances of the National Economy (MPS) in the case of countries with centrally planned economies. In either case, the accounts in respect of production and in respect of the supply and disposition of commodities delineate and integrate all of the flows that are of interest for purposes of the system. These accounts yield co-ordinated definitions and classifications for the series that meet most of the analytical requirements for them. The accounting identities of the framework - quantity multiplied by price equals current value, the sum of the costs

of production equals the value of gross output, the values of the supply and the disposition of commodities are identical - facilitate, in general, the compilation and use of the price and quantity series. The use of the national accounting framework also furnishes the basis for the integration, in respect of the elementary indicator series and the compilation of aggregates, of the traditional monthly, quarterly and annual index numbers of production and prices and the quarterly and annual national accounting data in constant prices.

14. In order to make it practicable to compile monthly, quarterly or annual index numbers of production and prices rapidly, it is necessary to simplify the national accounting framework in certain respects. This is, for example, the case for the detail of classification and the multiple forms of valuation called for in the SNA. In order to meet certain analytical requirements, it is also important to add certain series of index numbers to those included in the framework. For example while, for national accounting for a given period it is necessary to have the prices of the sales and purchases that take place during the period, for certain forms of market analysis it is desirable to have the prices of heavy capital goods that are contracted for during the period instead of completed during the period. In order to detect incipient movements in prices in the case of market economies, it is desirable to compile sensitive series of index numbers that are not delineated in the national accounts. And, while Paasche index numbers of prices best fit into the national accounting framework, Laspeyres index numbers of prices are more suitable for a number of analytical purposes. In each of these instances, it is feasible to delineate the links between the supplementary series of index numbers and the national accounting framework.

C. The purpose of the international guidelines

15. In view of the co-ordination and linkage of all price and quantity statistics in a national accounting framework, the proposed system is intended to furnish draft international guidelines in respect of national accounting in constant prices as well as in respect of the statistics of prices and quantities that are produced in other types of statistical work. These guidelines are mainly intended for the use of market-economy and centrally-planned countries in improving and expanding their own price and quantity statistics. For this purpose, it will of course be necessary for countries to adapt the system of the statistics that is recommended by the Statistical Commission to their own requirements and circumstances. National use of the recommended system should result in substantial improvement in the comparability of the index numbers of production and prices and of the national accounting data in constant prices that are gathered and compiled internationally.

16. The proposed system is intended, as a goal for improving and developing the collection and compilation of elementary series, aggregates and index numbers of prices and quantities. The system is quite comprehensive; few, if any, countries now compile all the included series or would find it practicable to reach this goal in a few years. National statistical authorities will find it necessary to develop the system in a sequence of stages, in terms of their own priorities. In order to assist the setting of these priorities, orders of priority in compiling the various series of the system are suggested below.

II. SCOPE OF THE SYSTEM

A. The flows to be covered

1. The full system

17. The system covers flows, the value of which may, in principle, be unambiguously partitioned into components of quantity and price in terms of the unit of measurement of the given flow. This may be done directly in the case of flows of goods and services and in the case of flows of direct inputs (factor services). The former flows consist of gross output, intermediate consumption, final consumption, gross fixed capital formation and increases in stocks, and imports and exports. The latter flows consist of the services of the labour and reproducible and non-reproducible tangible assets employed in production. The services of reproducible fixed assets may be taken to include their consumption (depreciation). While gross or net value added in production (the domestic product or the net material product) can not be directly partitioned into quantity and price components, the flow may be so factored indirectly, by means of double deflation, based on quantity aggregates in respect of gross output, intermediate consumption and consumption of fixed assets, if net, and on its value in current prices. The amount of taxes and subsidies which are correlated with quantity or value of given commodities produced, sold or purchased (commodity taxes and subsidies) may also be indirectly partitioned in terms of their own units of measurement by reference to the volume of the flows of the commodities in question. Thus, the system concerns all of the flows and stocks that are of interest for the analytical uses that are outlined above.

2. Direct inputs

18. However, the definition and compilation of quantity and price series in respect of factor services are not covered in this paper. This topic will be dealt with at a later stage of the work on the system. The delay is due to the difficulties of concept and measurement that are involved in constructing these series and the limited amount of national experience in this work. This is especially so in the case of the services of tangible capital assets.

19. The series on the volume of services of the tangible capital assets that have been compiled depend on estimates of the stock of tangible capital assets in constant prices, sometimes adjusted for the intensity with which they are used in production. Estimating the value of stocks of tangible capital assets in constant prices raises conceptual and practical problems which the Statistical Office of the United Nations is studying as part of its work on balance-sheet statistics. A small number of countries only have data in respect of the stock of fixed assets that are useful for the purposes under discussion. Fewer countries have the required data on the intensity with which the stock of tangible capital assets is used; the compilation of these data raises difficult conceptual and practical problems. Estimates of the price of the services of the stock of tangible assets have been based on either considering the current value of these services to be equivalent to the current value of gross operating surplus adjusted to eliminate such components as the share due to the labour of the self-employed or on certain interest rates and depreciation rates. Strong assumptions are involved in using either approach.

20. In order to partition gross operating surplus into quantity and price components in the case of the System of National Accounts (SNA), it would be necessary to divide the flow into at least two parts - one portion correlated with the stock of tangible capital assets owned and the other portion attributable to the labour and management of the working proprietors and unpaid family workers. While the operating surplus may also include windfall profits, it is of course impossible to isolate them. In the case of the Basic Principles of the System of Balances of the National Economy (MPS), the equivalent flow covers the returns to the same sort of direct inputs as in the SNA, except that depreciation is excluded. Allowances for the consumption of fixed assets are part of the intermediate consumption.

21. It is much less difficult to compile suitable estimates of quantities and prices in the case of the services of labour than it is in the case of the services of tangible capital assets. Man-hours worked, or even the number of persons engaged, weighted in terms of the quality of the labour services, have been used as estimates of the quantity. The quality of the labour services has been considered to be proportioned to base-year rates of wages and salaries, educational attainment or a combination of selected personal characteristics including educational attainment. It is difficult to gather the desired data in respect of employment in the scope and detail that is wanted in order to make these estimates. For example, suitable figures of man-hours worked are often available in respect of employees or in respect of operatives only, in industrial and construction establishments. And, detailed data on man-hours worked or number of persons engaged, correlated with wage and salary rates or personal characteristics, are rarely gathered. As compared to the estimates of the quanta and prices of labour services that have been made, the difficulties of partitioning the return to labour in the case of the SNA or in the case of the MPS are less severe because the flows in question relate to employees only. The price component of the labour services may be estimated from comprehensive statistics on wage and salary rates.

B. The flows excluded

22. Income flows such as interest, dividends, social security benefits and saving, are not covered in this system. These flows cannot be decomposed into quantities and prices in terms of their own units of measurement. While they can be expressed in terms of their purchasing power over given baskets of goods and services, the composition of the baskets should vary from one analytical use to another. Moreover, except for series in respect of the purchasing power of wages and salaries and national income and in respect of changes in the terms of external trade, such measures are not the subject of wide interest.

C. Transactions covered

23. For the analytical and instrumental purposes outlined above, the system of quantity and price statistics should relate to all the production in the period in question. In the case of the SNA, this consists of transactions in all the goods and services produced during the given period, whether for sale or for own account and in the case of the goods, whether actually sold, used on own account or added to stocks. Irrespective of the way in which the goods and services are disposed of, they are to be valued at the sales price on the market at the time the production takes place. In the case of the MPS, these transactions are restricted to all the goods and material services that are produced during the given period.

24. The quantity and price aspects of all production should be covered not only in the series compiled for use in national accounting, but also in the series compiled for other purposes. Total coverage is, for example, needed when the series are used for such purposes as: measuring economic growth and trends in the terms of trade and the well-being of producers and of consumers; assessing the effects of imbalances between demand and supply on prices; or tracing the transfers of cost-push or demand-pull pressures on prices through the economy. It has been argued that including the goods and services that are produced for own use, added to stocks or transferred between establishments owned by the same enterprise, in price series would attentuate the values of the series for purposes of studying market conditions and for purposes of measuring inflationary and deflationary pressures. This might be the case if the items that are not sold, were valued at prices different from those of the items that are sold. In this system, the use of sales prices on the market is recommended in the case of production of all goods and services. In any case, most countries would find it impracticable to restrict the weights for their producers' price series to the value of sales only. The data that they have for this purpose usually relate to gross output.

25. The sales prices of goods completed during a period of account are sometimes imperfect indicators of market conditions. This may, for example, be so in the case of heavy machinery, structures and other products of construction which are usually built to order and take a long time to produce. In these cases, the durable goods may be contracted for at a price which may be unrealistic in terms of market conditions at the time the item is completed and delivered. When these contracts include escalation clauses, this situation of course does not occur. If contracting for the production of heavy durable goods at fixed prices is important, it would be desirable to gather and compile price data in respect of the contracts made during a period, as well as in respect of items completed. The latter series would still be needed for such purposes as estimating constant-price national accounting aggregates or correlating unit costs and prices.

D. Frequency of the series

26. For purposes of assessing economic conditions, quantity and price indexes relating to flows of goods and services are wanted annually and more frequently. In practice, it will generally not be feasible to gather enough data for the compilation of monthly or quarterly series of quantity indexes or aggregates in as great detail, or as rigorously, as annual series, say in national accounting. A number of countries do, however, make detailed constant-price estimates of the domestic product and expenditure on a quarterly basis. In the case of index numbers of prices, most elementary price series will necessarily be gathered on a monthly, or even more frequent, basis but considerably more data will be available for weighting purposes annually than monthly or quarterly. It will therefore be advantageous to make use of the more comprehensive and reliable annual series of both quantity and price index numbers in improving the more current series. This could be done by compiling the monthly and quarterly series so that they extrapolate the latest annual index numbers.

27. Much more complete data may sometimes be available for purposes of compiling quantity and price index numbers at three or five year intervals or less frequently,

than for purposes of compiling these index numbers each year. For example, detailed and comprehensive inquiries into the production and distribution of goods and services may not be taken as frequently as annually. In these circumstances, use should be made of the detailed inquiries in order to compile benchmark series of indexes and aggregates, preferably in the framework of input-output tables. The years for which the most complete data are available would serve as the weight and comparison basis for purposes of compiling the annual series.

III. THE NATIONAL ACCOUNTING FRAMEWORK

28. The national accounting framework which it is suggested be used for purposes of the integrated system of index numbers of quantity and price is set out in matrix form in table 1. While table 1 consists of the production and expenditure accounts of the matrix of the SNA,[2] a similar matrix may be constructed for the MPS.[3]

29. The scope of industries and commodities in the case of the matrix for the MPS would be restricted to the production of goods and material services; and the units of the non-material sphere - private enterprises selling non-material services, government bodies and the equivalent of private non-profit services - would be treated as final consumers, not intermediate consumers, of commodities. The type of classifications used in respect of the transactors and the transactions of the material sphere are similar to those in the SNA. The routing of transactions in the case of the material sphere in the MPS matrix would also be similar to that in table 1.

A. Units of observation and classification

30. It may be noted from table 1 that two basic units of observation and classification are used in the production and expenditure accounts, namely, commodities and activities (establishments). A similar practice is followed in the MPS. The composition of the gross output of various industries and of imports are exhibited in the form of commodities; and the commodities are disposed of to the various types of intermediate and final use. On the other hand, establishments classified according to kind of activity are used in measuring the output, cost structure and capital formation of producers. A third set of classifications used in the accounts under discussion is the purpose or object of outlays on final consumption.

31. Each unit of observation and classification thus conforms to the manner in which the transactions to which it relates are organized and carried on. Further, the differing units of observation and classification used in table 1 correspond to the various analytical requirements for which quantity and price series are wanted. For example, attention is centered on the quantities and prices of commodities when assessing market conditions and competitiveness, studying sources of demand and supply for goods and services, or balancing demand against supply. In analysing the conditions and efficiency of production and the well-being of producers, however,

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2/ See table 2.17, A System of National Accounts, Series F, No. 2, United Nations, New York, 1968.

3/ See Basic Principles of the System of Balances of the National Economy, Series F, No. 17, United Nations, New York, 1971.

Table 1. The general framework

				Commodities by category of commodity		Activities by kind of activity			Final consumption expenditure			Institutional sector of receipt	Increase in stocks		Gross fixed capital formation of activities by kind of activity			Exports
				Basic values	Commodity taxes, net	Industries	Producers of government services	Producers of private non-profit services and domestic services	Household goods and services object	Government purposes	Purposes of private non-profit bodies serving households		Industries	Producers of government services	Industries	Producers of government services	Producers of private non-profit services to households	
				3	4	5	6	7	8	9	10	14	15	16	17	18	19	24
Production	Commodities by category of commodity	Commodities, basic value	3			$T_{3.5}$	$T_{3.6}$	$T_{3.7}$	$T_{3.8}$				$T_{3.15}$	$T_{3.16}$	$T_{3.17}$	$T_{3.18}$	$T_{3.19}$	$T_{3.24}$
		Commodity taxes net	4			$T_{4.5}$	$T_{4.6}$	$T_{4.7}$	$T_{4.8}$				$T_{4.15}$		$T_{4.17}$	$T_{4.18}$	$T_{4.19}$	$T_{4.24}$
	Activities by kind of activity	Industries	5	$T_{5.3}$	$T_{5.4}$													
		Producers of government services	6	$T_{6.3}$					$T_{6.8}$	$T_{6.9}$								
		Producers of private non-profit services and domestic services	7	$T_{7.3}$					$T_{7.8}$		$T_{7.10}$							
Consumption expenditure	Household goods and services		8									$T_{8.14}$						$T_{8.24}$
	Government purposes		9									$T_{9.14}$						
	Purposes of private non-profit bodies serving households		10									$T_{10.14}$						
Value added			11	$T_{11.3}$	$T_{11.4}$	$T_{11.5}$	$T_{11.6}$	$T_{11.7}$										
Imports			24	$T_{24.3}$			$T_{24.6}$		$T_{24.8}$									

Annex to table 1

The entries in table 1 in terms of sub-matrices are as follows.

$T_{3.5}$ The intermediate consumption of commodities classified according to type, reckoned at basic values, by industries classified according to kind of economic activity. Trade and transport margins make up a separate category of commodities.

$T_{3.6}$ The intermediate consumption of commodities classified according to type, reckoned at basic values, by producers of government services classified according to kind of economic activity.

$T_{3.7}$ The intermediate consumption of commodities classified according to type, reckoned at basic values, of the producers of private non-profit services classified according to kind of economic activity.

$T_{3.8}$ Commodities classified according to type, reckoned at basic values, entering into household consumption expenditure in the domestic market classified according to object.

$T_{3.15}$ Additions to the stocks of commodities classified according to type, reckoned at basic values, held by industries classified according to kind of economic activity.

$T_{3.16}$ Additions to the stocks of commodities classified according to type, reckoned at basic values, held by the producers of government services classified according to kind of economic activity.

$T_{3.17}$ Commodities classified according to type, reckoned at basic values, entering into the gross fixed capital formation of industries classified according to kind of economic activity.

$T_{3.18}$ Commodities classified according to type, reckoned at basic values, entering into the gross fixed capital formation of the producers of government services classified according to kind of economic activity.

$T_{3.19}$ Commodities classified according to type, reckoned at basic values, entering into the gross fixed capital formation of the producers of private non-profit services to households classified according to kind of economic activity.

$T_{3.24}$ Exports of commodities reckoned at basic values.

$T_{4.5}$ through $T_{4.25}$ Commodity taxes, net, classified according to type of commodity on the commodities disposed of to the uses indicated by the columns.

$T_{5.3}$ Commodity outputs classified according to type, reckoned at basic values, of industries classified according to kind of economic activity.

Annex to table 1 (continued)

$T_{5.4}$ Commodity taxes, net, classified according to type of commodity, on the outputs of industries classified according to kind of economic activity.

$T_{6.3}$ Commodity outputs classified according to type, reckoned at basic values, of the producers of government services classified according to kind of economic activity.

$T_{6.8}$ Government services entering into household consumption expenditure in the domestic market.

$T_{6.9}$ Services produced for own use by government services classified according to kind of economic activity and purpose.

$T_{7.3}$ Commodity outputs classified according to type, reckoned at basic values, of producers of private non-profit services to households classified according to kind of economic activity.

$T_{7.8}$ Domestic services and private non-profit services classified according to kind of economic activity entering into household consumption expenditure in the domestic market.

$T_{7.10}$ Services produced for own use by private non-profit services classified according to kind of economic activity and purpose.

$T_{8.14}$ Final consumption expenditure on goods and services in the domestic market by resident households classified according to object.

$T_{8.24}$ Final consumption expenditure on goods and services in the domestic market by non-resident households classified according to object.

$T_{9.14}$ Final consumption expenditure by general government classified according to purpose.

$T_{10.14}$ Final consumption expenditure by private non-profit institutions classified according to purpose.

$T_{11.3}$ Protective import duties.

$T_{11.4}$ Other import duties.

$T_{11.5}$ Values added, that is compensations of employees, operating surpluses, provisions for the consumption of fixed capital and indirect taxes, net, of industries, classified according to kind of economic activity.

$T_{11.6}$ Values added of the producers of government services classified according to kind of economic activity.

Annex to table 1 (continued)

$T_{11.7}$ Values added of domestic services and the producers of private non-profit services to households classified according to kind of economic activity.

$T_{24.3}$ Imports of commodities reckoned at c.i.f. values.

$T_{24.6}$ Direct expenditure abroad on goods and services by the producers of government services classified according to kind of economic activity.

$T_{24.8}$ Final consumption expenditure abroad by resident households.

establishments classified according to kind of economic activity are of interest. And, in examining the changes in the level and composition of household consumption and the activities of government, the primary interest is in quantity and price series on consumption expenditures classified according to the object or purpose of these outlays.

32. The use of commodities as a unit of observation and classification is also fundamental to the compilation of quantity and price index numbers because elementary series (units of measurement) for this purpose must be expressed in terms of individual commodities, or varieties of the commodities. For example, the cross-classification of the gross output of commodities according to class of commodity and kind of activity furnish the basis for building up quantity and price series in respect of the output of industries. This cross-classification also furnishes the basis for classifying commodities according to the industry in which they are characteristically produced. A classification of commodities of this type can be of considerable assistance in passing from elementary series of indicators in respect of commodities to indexes in respect of industries.[4/] Similarly, the cross-classification of the various forms of final expenditure according to object or purpose and class of commodity is basic to compiling series of index numbers concerning these outlays.

B. Valuation and other characteristics

33. Table 1 calls for the valuation of the supplies and dispositions of commodities at approximate basic values, i.e., the value of the market on commodities at the establishment of the producers, exclusive of the net commodity taxes levied at that point. A similar concept of valuation is used in the case of the centrally planned economies. The producers' values of the gross output of commodities are divided into approximate basic values and net commodity taxes. The purchasers' values of intermediate and final expenditure on commodities, i.e., the market value at which these outlays are made, are divided into approximate basic values, trade and transport margins and net commodity taxes. Net commodity taxes in respect of a given commodity are equivalent to the indirect taxes reduced by subsidies levied on the commodity, each of which vary with the quantity and value of the commodity and the source of disposition of the commodity.

34. Valuation at approximate basic values is emphasized in the production and expenditure accounts of the revised SNA in order to value commodities as uniformly as is possible for such purposes as input-output analysis in constant, as well as current, prices. Uniform valuation of commodities is also of assistance when using the commodity-flow approach in compiling quantity and price indexes, because the series in respect of the supply - the gross outputs and imports - of each type of commodity can be valued irrespective of the various forms of disposition. The data in respect of the various dispositions of the given types of commodities can then be compiled by adding the appropriate series on net commodity taxes and trade and transport margins.

4/ The Statistical Office of the United Nations is developing this type of classification. See "Draft international classification of all goods and services", ST/STAT.47, 25 June 1970.

35. Uniform valuation of commodities also facilitates checking the consistency of quantity and price series in respect of the supply and use of categories of commodities when these series are compiled independently rather than through the commodity-flow approach. It is evident from table 1 that the total values in current prices of the supply and dispositions of each category of commodities must be identical if valued in the same manner. It may be shown that this is also the case for values in constant prices, provided the total supplies and dispositions of commodities are valued identically and are compiled using the same weight base and formula.5/ If series of price and quantity index numbers are compiled so that the product of the two in respect of each group of commodities is equal to the corresponding index numbers of current value, the price index numbers of the total supply and the disposition of these commodities will also be equivalent.

C. The basic input-output tables and the integrated system of index numbers

36. Two tables of basic input-output data, which focus on commodities and industries, respectively, can be derived from the matrix of table 1. One table consists of the entries in rows and columns 3 and 4 and portrays the sources of supply and disposition of various types of commodities. The other table consists of the entries in row and column 5 and portrays the gross outputs and inputs of industries. Tables 2 and 3 and 11 and 12 of the SNA are versions of these tables in current and constant prices, respectively, abbreviated to omit such cross-classifications as category of commodity and object of household expenditure or category of commodity and kind of activity of the industries making fixed capital outlays.6/

37. These tables are of interest here not only because tables 11 and 12 call for comprehensive and co-ordinated series of constant-price data, but also because the tables detail the framework which national accounts furnish for purposes of devising and compiling the integrated system of quantity and price statistics. The tables show how the indicators and weights of the system may be systematically defined and classified and how consistent and comparable series of constant-price aggregates and index numbers may be built up and checked, one against the other. The tables delineate the building blocks which may be used in compiling the series of data and how series classified in one way may be converted to series classified in another way.

38. As most countries will find it feasible to complete tables 11 and 12 once every three or five years only, they must be simplified for purposes of compiling annual and more frequent series. The directions in which this needs to be done are discussed below.

IV. THE AGGREGATED SERIES OF THE SYSTEM

A. General features

39. Table 2 below sets out the annual and more frequent series of price and quantity index numbers and aggregates of the system that result from simplifying the

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5/ See "The identity: Total final expenditure equals total value added", paras. 4.107 - 4.111, A System of National Accounts, op. cit.

6/ See annex 8.3, A System of National Accounts, op. cit.

Table 2. Suggested index numbers[1] of quantity and price

Description of series	Frequency			Suggested most detailed classification[2]	Suggested orders of priority	Supplementary remarks
	Monthly	Quarterly	Annually			
I. Gross output and total supply of commodities classified according to kind of activity where the commodities are characteristically produced and class of commodity[2]						
A. Goods: Quantity and price indexes (producers' values)	X		X	ISIC major groups except ISCC classes for: Agricultural and livestock products, Metal ores, Other mining products, Construction	1 except 2 for Heavy capital goods and construction	In the case of the monthly and annual indexes, it may be necessary to condense the classification to ISIC divisions for a number of categories of commodities. It is desirable to gather and compile, in addition, (i) weekly or bi-weekly price indexes of the spot sales of commodities, the prices of which are very sensitive to market conditions and (ii) price indexes in respect of contracts made during the month in the case of goods which take a long time to produce and are usually made to order.
B. Distributive-trade services						
1. Quantity and price indexes (producers' values) of gross margins of wholesale and retail trades according to category of commodity			X	ISIC major groups except ISCC classes for: Agricultural and livestock products, Metal ores, Other mining products	3	
2. Quantity and price indexes (purchasers' values) of retail sales according to class of commodity	X		X	As in B 1 above	1	The series of index numbers are the expedient source of data on household consumption expenditure. It may be desirable or necessary to condense the classification of the monthly indexes issued to ISIC divisions.
C. Restaurant and hotel services						
1. Price indexes (purchasers' values) of sales	X		X	ISIC major groups	1	These index numbers are the expedient source of data on household consumption expenditure.
2. Quantity indexes (purchasers' values) of sales		X	X	ISIC major groups	3, quarterly 2, annual	
D. Transport and storage services						
1. Goods transport: Quantity and price indexes (purchasers' values) of transport services according to class of commodity freighted and kind of services			X	Commodities freighted: ISIC major groups except ISCC classes for Agricultural and livestock products, Metal ores and Other mining products. Transport services: ISIC groups	3	
2. Passenger transport services						
a. Quantity index (purchasers' values) of transport services furnished	X		X	ISIC groups	Monthly: 1 for railway, tramway, air, large-scale bus and water transport; 3 for other. Annual: 1 and 2 respectively.	
b. Price index (purchasers' values) of transport services furnished	X		X	As in D 2	1	These series of indexes are the most expedient source of data on household final consumption expenditure.
c. Storage services: Quantity and price indexes (purchasers' values) of services furnished according to category of commodities stored			X	Commodities stored: ISIC groups except ISCC classes for: Agricultural and livestock products, Metal ores and Other mining products	3	
E. Communication services						
1. Price indexes (purchasers' values) according to kind of disposition and category of services	X		X	Disposition: Households, Government services, Other, Kind of service: ISCC classes	1	
2. Quantity indexes (purchasers' values) according to kind of disposition and category of services		X	X	As in E 1 above	2, quarterly 1, annual	The series of indexes are the most expedient source of household final consumption expenditure.
F. Other services of industries						
1. Financial, insurance, real estate and business services: Quantity and price indexes (purchasers' values)		X	X	ISIC groups	3, quarterly 2, annual	
2. Health, recreational and personal services						
a. Price indexes (purchasers' values)	X		X	ISIC groups	1	These series of indexes are the most expedient source of household final consumption expenditure.
b. Quantity indexes (purchasers' values)		X	X	ISIC groups	3, quarterly 2, annual	

Table 2. Suggested index numbers[1] of quantity and price (continued)

Description of series	Frequency: Monthly	Frequency: Quarterly	Frequency: Annually	Suggested most detailed classification[2]	Suggested orders of priority	Supplementary remarks
II. Supply from imports of commodities classified according to kind of activity where the commodities are characteristically produced and class of commodity						
A. Quantity and price indexes (c.i.f. plus import duties)	X		X	ISIC major groups except ISCC classes for: Agricultural and livestock products, Metal ores, Other mining products.	1	It may be necessary to condense some of the categories to ISIC divisions in the case of the monthly series.
B. Quantity and price indexes (c.i.f.)	X		X	As in A above.	1	As in A above.
III. Total supply of commodities disposed in the domestic market, classified according to disposition and kind of activity where the commodities are characteristically produced and class of commodity[3]						
A. Commodities disposed of in the domestic market according to customary pattern of use						
1. Goods: Quantity and price indexes (producers' values)	X			Categories of commodities: ISIC major groups except ISCC classes for: Agricultural and livestock products. Disposition: Intermediate consumption, Final consumption, Gross capital formation	1 except 2 for heavy capital goods and machinery and for gross fixed capital formation.	It is desirable, or may be necessary, to condense the classification of commodities to ISIC divisions in a number of instances.
2. Services: Quantity and price indexes (purchasers' values)		X		Class of commodity: ISIC divisions. Disposition: Intermediate consumption, Final consumption, Gross capital formation.	3	
B. Commodities disposed of in the domestic market according to actual use						
1. Goods: Quantity and price indexes (purchasers' values and sub-divided into producers' prices and trade and transport margins)			X	Categories of commodities: ISIC major groups except ISCC classes for: Agricultural and livestock products, Metal ores, Other mining products. Disposition: Intermediate consumption, Final consumption, Increases in stocks, Gross capital formation.	2 for purchasers' values; 3 for subdivision of those values.	Price indexes are not to be compiled in the case of increases in stocks. It may be necessary to condense the classification to ISIC divisions in certain instances.
2. Services: Quantity and price indexes (purchasers' values)			X	Categories of commodities: ISIC major groups. Disposition: Intermediate consumption, Final consumption.	2	It may be necessary to condense the classification to ISIC divisions in a number of instances.
IV. Total supply of commodities disposed in exports, classified according to kind of activity where the commodities are characteristically produced and class of commodity[3]						
A. Exports of commodities: Quantity and price indexes (f.o.b. values, which identical to purchasers' values at the exporting country's border)	X		X	ISIC major groups except ISCC classes for: Agricultural and livestock products, Metal ores, Other mining products.	1	It may be necessary to condense certain of the categories to ISIC divisions, in particular, in the case of the monthly indexes.
B. Exports of commodities: Quantity and price indexes (purchasers' values sub-divided into producers' values and trade and transport margins)			X	As in A above.	3	It may be necessary to condense certain of the categories to ISIC divisions.
V. Output, intermediate consumption and gross fixed capital formation of industries according to kind of activity[3]						
A. Goods-producing industries according to kind of activity						
1. Gross output: Quantity and price indexes (producers' values)	X		X	ISIC major groups	1 except 2 for heavy capital goods industries and construction	It may be necessary to condense the classification to ISIC divisions in certain cases, in particular, in the monthly indexes.
2. Value added						
a. Quantity indexes (producers' values)	X		X	ISIC major groups	1	It may be necessary to condense the classification to ISIC divisions in certain cases, in particular, in the monthly indexes.
b. Price indexes (producers' values)			X	ISIC major groups	3	It may be necessary to condense the classification to ISIC divisions in certain cases.
3. Intermediate consumption: Quantity and price indexes (purchasers' values)			X	ISIC major groups	2	It may be necessary to condense the classification to ISIC divisions in certain instances.

Table 2. Suggested index numbers[1] of quantity and price (continued)

Description of series	Frequency: Monthly	Frequency: Quarterly	Frequency: Annually	Suggested most detailed classification[2]	Suggested orders of priority	Supplementary remarks
V. Output, intermediate consumption and gross fixed capital formation of industries according to kind of activity[3] (continued)						
A. Goods-producing industries according to kind of activity (continued)						
4. Gross fixed capital formation: Quantity and price indexes (purchasers' values) according to type of fixed assets			X	Type of fixed assets: Structures and other construction, Transport equipment, Machinery and equipment, Other fixed assets. Kind of activity: ISIC major groups.	3	It may be necessary to condense the classification of kind of activity to ISIC divisions in certain cases. In the case of Agricultural and livestock productions, it will be desirable to separate categories in respect of gross fixed capital formation in land improvements and plantation and orchard development and in breeding stock, draught animals, dairy cattle, etc. from the category "Other kinds of fixed assets".
B. Wholesale and retail trade according to kind of activity						
1. Sales						
a. Quantity and price indexes (producers' values) of sales of wholesale trade	X		X	Groups of 1958 version of ISIC[4]	2	Classification according to type of operation, for example Merchant wholesalers, Manufacturers' sales offices and branches, Agents and brokers, may also be of interest.
b. Quantity and price indexes (purchasers' values) of sales of retail trade	X		X	Groups of 1958 version of ISIC[4]	1	Classification according to type of operation, for example Self-service stores, Other shops and stalls, Mail order houses, Other retail trade units, may also be of interest.
2. Value added						
a. Quantity indexes (producers' values)	X		X	ISIC major groups and groups of 1958 version of ISIC[4]	1	Classification according to type of operation, as in B 1 above, may also be of interest.
b. Price indexes (producers' values)			X	ISIC major groups and groups of 1958 version of ISIC[4]	3	Classification according to type of operation, as in B 1 above, may also be of interest.
3. Cost of merchandise sold: Price indexes (purchasers' values) of purchases of merchandise by wholesale and retail trade			X	ISIC major groups and groups of 1958 version of ISIC[4]	2	Classification according to type of operation, as in B 1 above, will also be of interest.
4. Gross fixed capital formation: Quantity and price indexes (purchasers' values) according to type of fixed asset and kind of wholesale and retail trade			X	Type of fixed assets: Structures and other construction, Transport equipment, Machinery and equipment, Other kinds of fixed assets. Kind of activity: ISIC major groups and groups of the 1958 version of ISIC[4]	3	Classification according to type of operation as in B 1 above, may also be of interest.
C. Restaurants and hotels according to kind of activity						
1. Value added						
a. Quantity indexes (producers' values)		X	X	ISIC major groups	3, quarterly 1, annually	
b. Price indexes (producers' values)			X	ISIC major groups	3	
2. Intermediate consumption: Quantity and price indexes (purchasers' values)			X	ISIC major groups	3	
3. Gross fixed capital formation: Quantity and price indexes (purchasers' values) according to type of fixed asset			X	Type of fixed assets: Structures, and other construction, Transport equipment, Machinery and equipment, Other fixed assets. Kind of activity: ISIC major groups.	3	
D. Transport industries according to kind and storage						
1. Gross output of transport: Quantity and price indexes (producers' values), classified into transport of goods and of passengers	X		X	ISIC groups. Goods freighting, passenger transport	Monthly: 1 for railway, tramway, air, large-scale bus and water transport; 3 for other. Annual: 1 and 2, respectively	
2. Value added						
a. Quantity indexes (producers' values)	X		X	ISIC groups	Monthly: as in D 1 above Annual: 1	Quarterly instead of monthly series for storage.
b. Price indexes (producers' values)			X	ISIC groups	3	

Table 2. Suggested index numbers[1] of quantity and price (continued)

Description of series	Frequency: Monthly	Frequency: Quarterly	Frequency: Annually	Suggested most detailed classification[2]	Suggested orders of priority	Supplementary remarks
V. Output, intermediate consumption and gross fixed capital formation of industries according to kind of activity[3] (continued)						
D. Transport industries according to kind and storage (continued)						
3. Gross fixed capital: Quantity and price indexes (purchasers' values)			X	ISIC groups	3	
E. Communications						
1. Value added						
a. Quantity indexes (producers' values)		X	X		1	
b. Price indexes (producers' values)			X		3	
2. Gross fixed capital formation: Quantity and price indexes (purchasers' values) according to type of fixed asset			X	Structures and other construction, Transport equipment, Machinery and equipment, Other fixed assets	3	
F. Other service industries - financial, business, health, recreational and personal services - according to kind of activity						
1. Value added: Quantity indexes (producers' values)		X	X	ISIC groups	3, quarterly 1, annual	
2. Gross fixed capital formation: Quantity and price indexes (purchasers' values) according to type of fixed asset and kind of service activity			X	Type of fixed assets: Structures and other construction, Transport equipment, Machinery and equipment, Other fixed assets. Kind of activity: ISIC groups.	3	
VI. Output and gross fixed capital formation of producers of government services and of private non-profit services according to kind of activity[4]						
A. Gross output: Quantity indexes (producers' values), government services and private non-profit services separately			X	ISIC divisions	2	
B. Value added: Quantity indexes (producers' values), government services and private non-profit services separately			X	ISIC divisions	1	
C. Gross fixed capital formation: Quantity and price indexes (purchasers' values), government services and private non-profit services separately			X	ISIC divisions	3	
VII. Final consumption expenditure on goods and services according to object or purpose of the outlays						
A. Household final consumption expenditure according to object						
1. Price indexes (purchasers' values)	X		X	Third level of the classification of household goods and services	1	It may be necessary to condense the classification to the second level of classification in a number of instances. In addition, the price indexes are generally compiled for given income and other groups of the population.
2. Quantity indexes (purchasers' values)		X	X	Second level of the classification of household goods and services	3, quarterly 2, annually	In addition, the annual quantity indexes are of interest in respect of given income and other groups of the population.
B. Government final consumption expenditure: Quantity indexes (purchasers' values) according to purpose			X	First level of the classification of government purposes	2	
C. Final consumption of private non-profit services: Quantity indexes (purchasers' values) according to purpose			X	First level of the classification of purposes of private non-profit services	3	

1/ While the series set out in the table are described in terms of index numbers, they also relate, in general, to aggregates of prices in constant quantities. In addition to the series set out in this table, the data called for in tables 11 and 12 of the SNA should be compiled once every five or three years.

2/ Unless indicated otherwise, the ISIC classification is that in the International Standard Industrial Classification of All Economic Activities, Series M, No. 4, Rev. 2, United Nations, New York, 1968. The preliminary ISCC classification is set out in a "Draft international standard classification of all goods and services", ST/STAT.47, Statistical Office of the United Nations, 25 June 1970. The other classifications referred to in this column are given in A System of National Accounts, Series F, No. 2, Rev. 3, United Nations, 1968. The classification of gross fixed capital formation according to type is set out in table 6.3 of the publication; the classification of household goods and services, in table 6.1; the classification of government purposes, in table 5.5; the classification of private non-profit purposes, in table 5.4.

3/ Purchasers' values and producers' values are equivalent in the case of the rendering of services, in the case of the sales and output of retail trade and in the case of the producers of government services and of private non-profit services. Thought should be given to using approximate basic values in addition to producers' values in the case of the series on the supply of commodities and on the output of industries. Approximate basic values should also be considered when partitioning purchasers' values into producers' values and trade and transport margins in the case of one of the series suggested above.

4/ The classification of wholesale and retail trade according to groups is set out in International Standard Industrial Classification of All Economic Activities, Series M, No. 4, Rev. 1, United Nations, New York, 1958.

matrix of table 1, as delineated in tables 11 and 12 of the SNA. The system includes the compilation of tables 11 and 12 of the SNA once every five years to three years. Table 2 suggests how the series are to be classified and what orders of priority are to be assigned to the series, as well as the transactions which are to be covered and the frequency with which the series are to be compiled.

40. Table 2 is organized in accordance with the major distinctions between transactions that are drawn in the national accounting framework - (i) the transactions in respect of commodities, (ii) the transactions of producers and (iii) the transactions of final consumers. The first set of transactions concern the supply (production and import), transport and distribution, and disposition of commodities. The second group of transactions relate to the gross output, value added, intermediate inputs and gross fixed capital formation of producers. The third type of transaction consists of the final consumption of households, government and private non-profit bodies. So that the system will be of interest to countries using either the MPS or the SNA, the series on goods, the data on material services and the series on non-material services are distinguished, one from the other. These distinctions also correspond, on the whole, to the differences in frequency and order of priority with which the series should be compiled.

41. The annual series suggested in table 2, coupled with tables 11 and 12 of the SNA, cover all flows in respect of goods and services included in the constant-price tables of the SNA[1/]. The monthly and quarterly series are limited to urgently needed data for purposes of assessing current economic conditions which it is thought could be gathered and compiled rapidly. It will be necessary to use fewer series of indicators and more approximate methods of compilation in the case of monthly and quarterly index numbers than in the case of the annual index numbers. In general, the monthly and quarterly series should extrapolate the latest, complete annual series that is available. This approach would increase the reliability of the monthly and quarterly series and ensure that these data and the correlative annual series are comparable enough to be used in combination. The annual series, in turn, should be benchmarked on the results of the compilation of tables 11 and 12. The equivalent of the current-value versions of these two tables - tables 2 and 3 of the SNA - would furnish most of the base-year weights for purposes of compiling the annual and more frequent series.

B. Series in respect of supply and disposition of commodities

1. The supply of commodities

42. The series suggested in table 2 in respect of the supply (the gross output and the imports) of commodities to an economy and in respect of their transport and distribution are designed to serve both analytical and instrumental purposes. The distinction between the supply of commodities and the movement of the goods to end uses is of course a basic feature of the national accounting framework. In addition to the values of making the distinction that have been outlined earlier in this paper, it furnishes the basis for focusing attention on the producers' prices at which the commodities enter the market and on the purchasers' prices at which they leave the market to end uses. The additions to the producers' prices that result from transport and distribution are, on the whole, more difficult to measure directly than are the purchasers' prices.

1/ Tables 8 through 16, except 10, annex 8.3, A System of National Accounts, op. cit.

43. The series on the supply of the various categories of commodities are fundamental for purposes of measuring and analysing conditions in the market. They are wanted, for example in order to watch for, and pinpoint, fluctuations in prices and in order to study the sources of the supply of, and the sources of the demands for, commodities, one in relation to the other.

44. As the prices and quantities of individual commodities make up the elementary data of the system, the series under discussion, when classified in greater detail in a number of instances, furnish the building blocks in the commodity flow approach to compiling the other series of index numbers and aggregates suggested in table 2. For these purposes, the series on the supply of commodities must of course be cross-classified according to disposition and according to the kind of industry in which they were actually produced. In addition, the commodities disposed of to industries must be cross-classified according to the kind of economic activity of the industries and those disposed of to households, government services and private non-profit services, according to the objects of the expenditures. All of these cross-classifications are included in the matrix of table 1, and to a considerable extent, in tables 11 and 12 of the SNA, but they have been suppressed in the series recommended in table 2. The cross-classifications are not essential to most of the requirements for the data for purposes of analysing current economic conditions; they would also greatly complicate the task of compiling and publishing the series.

45. Most important for the purposes outlined above are price and quantity series in respect of the supply of domestically produced and imported goods. Excepting construction and heavy machinery, the series on gross output are, in general, more easily compiled than most of the other data of the system. They may also serve as the foundation of the system and are already the subject of considerable national attention. It is therefore recommended that index numbers on the gross output, import and supply of goods should be compiled monthly and annually and that excepting construction and heavy machinery, the series should be assigned the highest order of priority. It is also suggested that goods, the prices of which are very sensitive to changes in market conditions, should be the subject of a special series of price indexes and that a series of contract prices should be compiled in respect of construction and heavy capital goods.

46. The prices of goods sold at retail furnish basic data on the purchasers' prices paid by households and on their cost of living. This series of prices, coupled with data on the quantity of goods sold, yield needed measures of household consumption expenditure. The series on retail sales, classified according to class of commodity, should therefore be compiled monthly and annually and should be assigned the highest order of priority. On the other hand, price and quantity data in respect of the gross margins of the distributive trades are not important indicators of current market conditions and are difficult to compile. (In this compilation, use should be made of double deflation, based on data in respect of the quantities of goods sold at wholesale and retail and the sales and purchase prices of the merchandise). Annual compilation and the assignment of the lowest order of priority is therefore suggested in the case of the series on gross margins. None the less, it should be emphasized that these series are valuable for purposes of measuring the amount added by distribution to the prices and quanta of purchased goods and for purposes of partitioning data valued in purchasers' values.

47. The suggested series on transport margins in respect of various commodities are designed to serve the same purposes as the series on distributive-trade margins. While the data are less difficult to compile, the same frequency and order of priority of compilation is therefore suggested in the case of the former series as in the case of the latter series. However, figures are wanted in respect of the prices and quantities of passenger transport services for purposes of compiling data on household consumption expenditure. And, except for unorganized transport, for example small water craft or taxi cabs, the difficulties of gathering the elementary series and compiling the index numbers are not too great. Both monthly and annual compilation of the series is therefore proposed.

48. Monthly price indexes are also wanted in respect of the services rendered to households in order to measure trends in their cost of living. The interest in monthly index numbers of the quantity of these services that households purchase, is not nearly as great. Furthermore, it is more difficult to gather the elementary series for purposes of compiling the quantity series than those for purposes of compiling the price series. Less national experience has also been acquired in respect of the former series than in respect of the latter series. For these reasons, monthly price indexes and quarterly quantity indexes are suggested in the case of the services rendered to households and higher orders of priority of compilation are proposed in the case of the former series than in the case of the latter series.

2. The disposition of commodities

49. Price and quantity indexes in respect of the various ways in which commodities are disposed of, are wanted for a number of purposes. Examples of these purposes are delineating the market for the commodities, assessing the impact of the various kinds of demand on the prices and the output of the goods and services and identifying the sources and effects of demand-pull inflation. Monthly indicators of the current trends in the case of the different sources of demand serve some of these needs. More comprehensive annual and less frequent series of basic input-output data are needed for purposes of more reliable measurement and analysis of the topics.

50. Because adequate elementary series for purposes of compiling independent series of purchasers' prices may not be available monthly during the early stages of developing the system of price and quantity statistics, it is suggested in table 2 that the series of producers' prices compiled in respect of the supply of various categories of goods should be used. If adequate elementary series of purchasers' prices are gathered in respect of the end uses of goods, price and quantity indexes in purchasers' values should be compiled. As sufficient elementary series for purposes of compiling quantity indexes concerning the disposition of goods are unlikely to be available monthly, it is suggested in table 2 that when necessary, recourse should be taken to the usual proportions in which the gross output, in constant prices, of a given category of goods is disposed of to various domestic end uses. It should be feasible to compute the quantity of the goods in question that is exported from monthly external trade statistics; a high order of priority is assigned in section IV of table 2 to monthly compilation of this series. The supply of the category of goods in question that remains for domestic use might, in view of the character of the goods have a single end use only. If this is not the case, the apportionment of the domestic use of the supply might be based on the monthly constant-price data

in respect of the retail sales of the goods that is recommended in section I of table 2 and the annual constant-price data in respect of the actual disposition of the goods that is recommended in section II of the table.

51. There is considerably less interest in current price and quantity series in respect of the gross output of services. The demand for services is, on the whole, less volatile than that for goods and plays a smaller role in economic conditions. It is therefore suggested that quarterly, instead of monthly, series should be compiled and that these series should be assigned the lowest order of priority. The suggested frequency of compilation and order of priority is consistent with the proposals in respect of the gross output of the services. Once price and quantity data are available in respect of the gross output of services, the series on their disposition would not be too difficult to compile because except for financial and real estate, there would be no problems of allocation.

52. It is suggested that the annual series in respect of the dispositon of goods should deal with the actual situation and that the goods should be valued at purchasers' values. These index numbers might be compiled by summing detailed price and quantity aggregates in respect of the domestic end use of each category of goods, cross-classified according to the kind of activity of producers when the goods enter into intermediate consumption or gross fixed capital formation or according to object of expenditure when the goods enter into final consumption. The aggregates of interest are called for in sub-matrices of rows 3 and 4 in table 1, which concern the disposition of commodities. These detailed price and quantity series are also needed in order to compile a number of the suggested annual series in section V, VI and VII of table 2. The same order of priority, two, is suggested in the case of the annual series on the disposition of goods and in the case of the annual series on the characteristics of the producers and consumers using these goods.

53. The procedure for compiling the annual series on the disposition of services might be similar to those for compiling the annual series on the disposition of goods. It is suggested that the compilation of the former series also be assigned a priority of two. The data are more easily compiled than the series on goods as purchasers' values and producers' values are equivalent and most of the services are rendered to households.

54. The compilation of series on the dispositions of goods where purchasers' values are partitioned into producers' values and trade and transport margins is of course more difficult than that in the case of the series discussed in the preceding paragraph. Ideally, use should be made of the series suggested in section I of table 2 concerning the distributive-trade and transport margins in respect of categories of goods, classified according to end use. In practice, it may be necessary to base the compilation on the difference between elementary series of comparable purchasers prices and producers' prices, coupled with quantity series valued in purchasers' prices.

C. Series in respect of industries

1. The uses of the data

55. Price and quantity series in respect of the output, intermediate consumption and gross fixed capital formation of producers, in particular, industries, are put to a number of analytical and instrumental uses. Examples of these uses are

assessing general economic conditions and the well-being of the industries, measuring the productivity of labour and capital, and tracking the effects of changes in unit costs through the economy.

56. The series on the gross output of the various industries portray the market trends for their products and furnish the basis for correlating their well-being with the circumstances leading to changes in the demand for the products. The data on gross output, coupled with the series on intermediate consumption, may be used to compute technical coefficients and the price relationships between the two flows. Index numbers of production, in terms of gross output and/or value added, are widely employed in measuring economic growth and fluctuation. Price index numbers of value added may be used to portray the trends in the terms of trade of each industry. Data on value added in constant prices enter into measures of the joint productivity of labour and capital. Figures of the quantity of gross fixed capital formation of various industries furnish information on the expansion in their capacity to produce.

2. Gross output and value added

57. In compiling index numbers of production, countries using either the MPS or the SNA have devoted most attention to the goods producing industries. These industries play a major role in economic trends; and quantity index numbers of their gross output and/or value added are often less difficult to compile than the corresponding index numbers for other industries. It is therefore recommended in table 2 that monthly, as well as annual, quantity indexes of gross output and of value added should be compiled in the case of the goods-producing industries and that the highest order of priority should be assigned to this work. In order to watch changes in the well-being of these industries and in prices in general, it is also proposed that monthly, as well as annual, price indexes of the gross output of the goods producing industries should be prepared. In the case of the price indexes of value added, only annual compilation is proposed; they are not needed as frequently as the price indexes of gross output and are more difficult to compile.

58. The series of index numbers in respect of the gross output of the goods producing industries may be derived from the same quantity and price aggregates that are used in order to compile the series of index numbers of the gross output of goods that are discussed above. For these purposes the aggregates in question should be cross-classified according to categories of commodities and according to kinds of industries where each category of commodities is actually produced. In other words, use might be made of matrices, commodities x industries, in respect of quantity and price aggregates that are the equivalent of the sub-matrices in row 5 of table 1. Marginal totals of each of the two matrices would yield the basis for compiling the series of price and quantity index numbers in respect of industries.

59. Ideally, double deflation should be used in compiling quantity and price series in respect of value added. This of course requires quantity and price aggregates in respect of gross output and intermediate consumption. In practice, the required aggregates of intermediate consumption are unlikely to be available monthly. As a result, quantity index numbers of the gross output of industries classified in considerable detail, are often used in order to compile index numbers of their value added in constant prices. When suitable indicators of gross output are unavailable, data on employment are often used.

60. As for the gross output of services, quarterly, instead of monthly, quantity series of value added are recommended in the case of service establishments. Because service establishments usually render one kind of service only, it is not necessary to supplement the recommended series in respect of the gross output of each kind of service.

61. It is, however, proposed that quantity indexes of the gross output and value added of the transport industries should be compiled monthly. This is also the case for the sales and value added of the wholesale and retail trades. The volume of activities of these industries furnish valuable indicators of the trends in general economic activity. Monthly quantity and price index numbers of sales, rather than of gross output (gross margins), are proposed in the case of retail and wholesale trade, as the former series are much easier to compile and are valuable for purposes of compiling aggregates in respect of the purchases of goods.

3. Intermediate consumption and gross fixed capital formation

62. Index numbers of quantity and price in respect of the intermediate consumption and gross fixed capital formation of industries are, on the whole, much more difficult to compile than the corresponding series in respect of gross output and value added. The preparation of the indexes is complicated, especially in the case of fixed assets, by the need to gather elementary series on purchasers' prices and on quantities in respect of commodities which are purchased intermittently and which are often unstandardized. Further, the requirements for frequent data on these flows are much less urgent than those in respect of gross output and value added. Annual series only are therefore recommended in the case of intermediate consumption and gross fixed capital formation. As is noted above, these series may be compiled as the marginal totals of matrices in which aggregates are cross-classified according to categories of commodities and kinds of purchasing industries.

D. Series on other producers

63. Annual index numbers of quantities only are suggested in the case of the gross output, value added and gross fixed capital formation of the government and the private non-profit services. These series are required in order to measure the flow of services from the organizations and their contribution to the value added and gross fixed capital formation of the economy. The series on gross fixed capital formation of government services, in particular, are also of interest for purposes of measuring the improvements in the infra-structure of the economy and the government's capacity to render social and research services.

E. Series on final consumption expenditure

64. Quantity and price data on the final consumption expenditure of households are widely employed in assessing the level of, and cost of, living of households. It is therefore recommended in table 2 that monthly series of price indexes and quarterly series of quantity indexes, as well as annual data, should be compiled. The proposed orders of priority for these tasks reflect the relative urgencies of the requirements for the series and the relative difficulties of compiling them. For purposes of studies of the level of consumption of different groups of the population, the suggested series are also wanted classified according to levels of income of the population and according to socio-economic classes.

65. It should be possible to compile most of the series on household consumption expenditure from the recommended series on retail sales of goods and on services rendered. For these purposes, it is necessary to convert the classification of retail sales and services according to categories of commodities into classification according to object of household expenditure. This will be feasible if the series on retail sales and services are classified in the detail suggested in table 2. Another useful source of data for purposes of compiling annual quantity series in respect of household consumption expenditure is the household sample expenditure survey. Such surveys are generally the only source of data for purposes of compiling these series in the case of various income or socio-economic classes of the population.

66. Quantity series on government and private non-profit outlays on consumption, classified according to purpose are also needed in assessing the level of living of the population. These series are fundamental for purposes of analysing and planning the services rendered by government and non-profit units and the effects of these services on the economy.

V. VALUATION

A. Producers' and purchasers' values

67. Valuation in producers' values and in purchasers' values is emphasized in table 2 primarily because series that are so valued, are, in most cases, less difficult to gather and compile than series valued in other ways. In the case of the other modes of valuation, the prices and the current values of sales in approximate basic values may, in some instances, be gathered as easily as these data in producers' values. However, unless the market prices and current values of the corresponding purchases (i.e., the purchasers' values) are adjusted for the net commodity taxes, distortion in aggregation, for example in the case of value added in constant prices, will be introduced. And, it is not infrequently difficult to gather purchasers' prices and current values of purchases adjusted for the relevant net commodity taxes.

B. Requirements for other modes of valuation

68. None the less, one should not overlook the requirements for price and quantity series valued in terms of approximate or true basic values or in terms of approximate or true factor values. Attention is called earlier in this paper to the advantages of using approximate basic values in input-output analysis and in the commodity flow approach to compiling consistent quantity indicators of the supply and disposition of commodities. In addition, approximate basic values are more suitable than producers' values for purposes of portraying the structure of production. This is the case because net commodity taxes are often very unevenly distributed among commodities and industries. True basic values, where the direct and indirect intermediate inputs into production, as well as the outputs, are valued in basic values, are preferable for certain of these purposes as the aggregation problem mentioned above would be avoided. It would be desirable to have value added at true, or at least approximate, constant factor values for purposes of measures of productivity. In the case of true factor values, the direct and indirect intermediate inputs into production, as well as the output, are valued in factor values while in the case of approximate factor values, only the output is valued in this manner.

C. Basic values

69. While it may not be convenient to gather price series in approximate basic values, it should not be difficult to gather current and base-year data in respect of the gross output of the individual commodities valued in approximate basic value. These data, coupled with quantity series on commodity outputs and data on changes in commodity-type indirect taxes and subsidies per unit of commodity, furnish the basis for compiling quantity and price index numbers valued in approximate basic values in the case of the supply and disposition of the gross output of commodities and in the case of the value added of industries. The corresponding net commodity taxes may also be computed. It is much more difficult to compile series in respect of value added valued in true basic values. This requires the inversion of input-output tables of aggregates valued in approximate basic values.

D. Factor values

70. The compilation of quantity and price index numbers of value added when approximate factor values are used is much more difficult than when approximate basic values are used because certain types of indirect taxes and subsidies are not linked to the output or purchase of individual commodities. It is therefore necessary to make assumptions as to the way in which these taxes and subsidies are to be allocated among commodities. In order to use true factor values, it is necessary to invert input-output tables expressed in approximate factor values in order to value the direct and indirect intermediate inputs into each industry at factor values.

E. Trade and transport margins

71. As is indicated earlier in this paper, price and quantity series in respect of distributive-trade and transport margins may be calculated from matched series of producers' and purchasers' price aggregates or from series in respect of the margins that are gathered and compiled directly. The system calls for the data required for either approach.

72. It is important to reconcile the figures of the total trade and transport margins that result from the use of the two approaches. In gathering elementary series concerning purchasers' price, it is frequently difficult to determine whether two adjacent observations in time, or space, of the price of an item are comparable in respect of the quantity of embodied trade and transport services. And, it is often not feasible to include certain aspects of the embodied services in the specification of the items to be priced. For example, while the specifications may distinguish between purchases in self-service retail outlets and purchases in service retail outlets, distinctions in respect of the quality of the services of the latter outlets are often impracticable. Or, unless the item is unusual, it may not be feasible to specify the transport chain through which it should have passed.

73. In the case of the MPS, the differences in the prices of an item that are discussed above, are considered to reflect price factors rather than quality factors. In other words, the differences in price are not treated as differences in the quantity of production embodied in the item. In the SNA, however, differences in the magnitude or quality of the trade and transport services embodied in a commodity

should ideally, be treated as differences in quality. This is so because not only are the costs of production greater but also the behaviour of buyers indicates that they assign value to the differences. However, as is noted above, it is often not feasible to identify the differences in purchasers' prices which are due to differences in the embodied trade and transport services.

VI. THE SCHEMES OF CLASSIFICATION OF THE SYSTEM

A. The schemes

74. The earlier discussion of the classifications of the series of the system, has indicated that the major classifications used concern the kind of commodities, the kind of economic activities, the object or the purpose of consumption expenditure and the type of gross fixed capital formation. Appropriate standard international schemes exist in respect of each of these modes of classification, excepting that in respect of the kind of commodities.[8/]

75. Work is proceeding on the development of the ISCC, which is a scheme of classification in respect of kind of commodities.[9/] This scheme of classification is based on the principle that the point of departure for the classification of goods and services should be the kinds of economic activities in which the commodities are characteristically produced. This principle links the ISCC and the ISIC and facilitates the transformation of data classified according to categories of commodities into data classified according to categories of industries and vice versa. The first level of the classification therefore consists of the groups of the ISIC. The proposed ISCC contains two additional levels of classification - classes and sub-classes - in respect of the goods and services that are characteristically produced in a given kind of activities. Not infrequently, establishments classified to an ISIC group will produce a range of characteristic commodities which in terms of process of fabrication, physical composition, use etc. may be grouped into distinct categories, the members of which also differ in these respects but to a lesser extent. The criteria for raising the two detailed levels of the ISCC are (i) the use to which commodities are put, (ii) their cost-structure, raw materials used and physical composition, (iii) the process and technology of fabrication and (iv) their durability and characteristics of performance. The use of these criteria should result in detailed commodity categories, the members of which are relatively homogeneous in respect of the sources of, and circumstances of, demand and of supply and in respect of variation in, if not the level of, prices. The ISCC should therefore be suitable for purposes of the system of price and quantity statistics.

8/ The International Standard Classification of All Economic Activities, Series M, No. 4, Rev. 2, United Nations, New York, 1968; and "Classification of household goods and services", table 6.1, "Classification of the purposes of government", table 5.3, "Classification of the purposes of private non-profit bodies serving households", table 5.4 and "Classification of gross fixed capital formation according to type", table 6.3; A System of National Accounts, op. cit.

9/ "Draft international classification of all goods and services," op. cit.

76. In the case of the distributive trades, transport and storage, the classes and sub-classes consist of the categories of the ISCC in respect of the goods that are sold, freighted or stored. In the case of transport, an additional category is included for passenger transport.

B. The detail classification in the system

77. Levels of classification are suggested in table 2 in the light of the following criteria: (i) the requirements for data in respect of the series in question, (ii) the possibilities of issuing reliable data and (iii) the need to co-ordinate the various types of classification. In the case of certain schemes of classification, it is essential to use much greater detail of classification in gathering elementary series than in compiling aggregates and index numbers.

1. Goods and goods producing industries

78. In general, the major groups of the ISIC are suggested for use in the case of the classifications of goods and of the goods producing industries. This level of classification is sufficiently detailed for purposes of discriminating between categories of commodities and groups of establishments, the market for which, and the cost-structure and technology of which, may be expected to differ significantly. However, in the case of agricultural and livestock products or in the case of construction, there is marked diversity in the gross output of the units classified to the corresponding major groups of the ISIC. This is the consequence of low degree of specialization of the units that mainly engage in agricultural and livestock production or in construction. It is therefore suggested in table 2 that the commodity classes of the ISCC should be used in the case of agricultural and livestock products and in the case of construction.

79. While the use of the major groups of the ISIC draws suitable distinctions for many analytical purposes, the number of these categories is not too great, in most instances for purposes of the publication of reliable annual and even more frequent series of data. As the series in respect of commodities and in respect of industries are jointly used in analysis, it is recommended in table 2 that the same level of classification should be used in the case of both series.

80. However, in gathering and compiling data in respect of goods and the goods producing industries, it is essential to use much more detailed classification. For purposes of elementary series of prices and quantities, it is necessary to use the most homogeneous units of observation that are feasible, in general, varieties of individual commodities in the case of prices and individual commodities in the case of quantities. As aggregates in respect of commodities furnish the building blocks for the system, use should be made of at least the equivalent of sub-classes of the ISCC in aggregating data in respect of individual commodities. These aggregates need to be classified in various ways in order to compile series in respect of industries in respect of households, etc. In the case of industries, the first level of aggregation should be the most detailed level of the industrial classification, for example groups in the case of the ISIC. While it is desirable to begin to aggregate at the most detailed level of the preceding classifications, the feasible level of classification for this purpose will of course depend on the availability of elementary series as well as weights. In the case of monthly series, it may be necessary to start the aggregation at broader levels of the commodity and industrial classifications.

2. Services and service producing industries

81. In order to attain a level of discrimination that approximates that of the major groups of the ISIC in the case of the services and service producing industries, it is necessary to use the groups of the ISIC. As there are a limited number of ISIC groups in the case of the services, this level of classification should, on the whole, be manageable, at least for purposes of compiling and publishing annual data. In gathering elementary series and compiling aggregates, it may not, in a number of cases, be feasible to use as detailed classifications in the case of the services as in the case of goods. It may be difficult to gather required current-value weights and/or the required elementary series in respect of quantities. It should however be feasible to gather elementary series in respect of prices classified in greater detail than the elementary series in respect of quantities. In the absence of weights, it would of course be necessary to combine unweighted elementary series of prices.

3. Other classifications

82. In the case of the classification of the purposes of the government and the private non-profit services, it is suggested that the broadest levels of classification should be used. This should ease the difficulties of compiling quantity series in respect of their consumption expenditure classified according to purpose. More detailed classification than that is required in the case of the consumption expenditure of households. It is thought that it should, on the whole, be feasible to use the most detailed level of classification in the case of the series on prices but not in the case of the series on quantities. The next broader level of classification is therefore suggested in the case of the latter data.

VII. WEIGHTING, FORMULAE AND BASE PERIOD

83. This section of the paper deals with the weights, the formulae and the base periods which might be used in compiling the price and quantity series listed in table 2.

A. Weights

1. Scope

84. Aggregates in respect of the value of a flow during a base period are most commonly used as weights in compiling index numbers of prices and quantities. These aggregates must, of course, relate to, and cover all of, the given flow. Thus, the weights for price and quantity index numbers of the gross output of various commodities, or of various industries, valued at producers' values, should be the value during the base period of the gross output of the commodities, or of the industries, valued at producers' values. Similarly, the weights for price and quantity index numbers of household final consumption expenditure in purchasers' values, classified according to object should cover these flows during the base period valued in purchasers' values.

85. In some cases, quantities or prices are used as weights for purposes of compiling price or quantity index numbers, respectively. Aggregates in constant prices

or in constant quantities are always expressed in this fashion. If this practice is followed, for example in the case of gross output in producers' values, the product of the quantity and the price weights should amount to gross output during the base period valued in producers' values.

2. Net sector index numbers

86. Some countries compile price index numbers that concern a more restricted concept of the gross output of industries than is used in table 2. These systems of price index numbers are usually called "net sector" indexes. Gross output is, in these instances, limited to the gross output of establishments principally engaged in a kind of activities that is disposed of outside the given kind of activities. The corresponding concept of the supply (gross output) of a category of commodities might be the supply of the category of commodities that is not used in producing other commodities of the given category.

87. The "net sector" price indexes avoid duplication in transactions between the establishments or commodities that are allocated to the same kind of activities. This duplication takes place in price index numbers of gross output. "Net sector" indexes are therefore of particular value in assessing the terms of trade of each kind of activities with the rest of the economy and in delineating the structure of prices. These indexes are much more useful for these purposes than are price indexes of gross output especially when broad categories of kind of industries or of kind of commodities are used.

88. However, the "net sector" price index numbers vary with the detail used in respect of industrial classification and are not additive. Further, "net sector" index numbers of the type that are commonly compiled are not easily used in the case of input-output tables or in the case of national accounting data. Price index numbers of value added are better for these purposes, as well as for purposes of portraying the terms of trade and the price structure of production.

89. "Net sector" quantity index numbers are often compiled in respect of the part of the gross output of agriculture which goes to non-agricultural units. While these index numbers do not have any strong analytical advantages over index numbers of value added, they may be easier to compile than the value added series. Whether this is so depends on the types of basic data that are available in respect of agricultural outputs and agricultural inputs.

B. Formulae and base period

90. In the following paragraphs, the properties of certain index number formulae are reneved in order to furnish the basis for discussing the formulae and base period that might be used in the proposed system of price and quantity statistics.

1. The formulae

91. The most commonly used formulae in compiling the series of the system are the fixed base-weighted Laspeyres and the moving current-weighted Paasche formulae and the cross-weighted Fisher and Edgeworth-Marshall formulae. Recently, the Divisea formula, or variations of it, has also been employed in computing index numbers in

respect of the joint productivity of factor inputs into production. The Divisea formula is not dealt with in this paper because of the limited use to which it has been put and because of the difficulties of making computations.

92. The index number formulae which are discussed in this paper are set out below in the two forms of weighting described in paragraphs 84 and 85 above.

Laspeyres:

$$P^L = \frac{\Sigma p_1 q_o}{\Sigma p_o q_o} = \sum \frac{p_o q_o}{\Sigma p_o q_o} \left[\frac{p_1}{p_o}\right]$$

$$Q^L = \frac{\Sigma p_o q_1}{\Sigma p_o q_o} = \sum \frac{p_o q_o}{\Sigma p_o q_o} \left[\frac{q_1}{q_o}\right]$$

Paasche:

$$P^P = \frac{\Sigma p_1 q_1}{\Sigma p_o q_1} = \sum \frac{p_1 q_1}{\Sigma p_1 q_1} \left[\frac{p_o}{p_1}\right]$$

$$Q^P = \frac{\Sigma p_1 q_1}{\Sigma p_1 q_o} = \sum \frac{p_1 q_1}{\Sigma p_1 q_1} \left[\frac{q_o}{q_1}\right]$$

Fisher:

$$P^F = \sqrt{P^L P^P} = \left[\frac{\Sigma p_1 q_o}{\Sigma p_o q_o} \cdot \frac{\Sigma p_1 q_1}{\Sigma p_o q_1}\right]^{1/2}$$

$$Q^F = \sqrt{Q^L Q^P} = \left[\frac{\Sigma p_o q_1}{\Sigma p_o q_o} \cdot \frac{\Sigma p_1 q_1}{\Sigma p_1 q_o}\right]^{1/2}$$

93. In each of these formulae, the symbols p and q refer to the price and quantity, respectively, of individual commodities; the subscript o refers to the base year and the subscript 1 to the year following the base year. A subscript i should also be shown in the case of the p's and q's in respect of the individual commodities, 1 through n; these subscripts have been omitted in order to simplify the presentation. The capital letters P and Q indicate whether an index number is a price or quantity index, respectively.

94. Laspeyres index numbers consist of arithmetic means of base-weighted relatives; Paasche index numbers are harmonic means of current-year weighted relatives. Fisher index numbers are the geometric means of Laspeyres and Paasche index numbers; Edgeworth-Marshall index numbers are the arithmetic mean of Laspeyres and Paasche index numbers.

2. Some properties of the formulae

95. It is useful to discuss the properties of the formulae listed above in terms of technical tests and in terms of certain other conditions that the index numbers should satisfy.

96. The important technical tests that are applied here, and have generally been used, are set out below.

(i) The product of the quantity and price index should be equal to the value index. This is the factor reversal test.

(ii) The product of the indexes, say relating period 1 to period 0 and period 2 to period 1, should be equal to the index relating period 2 to period 0. This is the circular test.

(iii) It should be possible to compile constant-price data which are consistent with the quantity indexes at all levels of aggregation.

(iv) The index numbers or aggregates at different levels of aggregation should be consistent, one with the other. This is sometimes called the average test.

(v) The results obtained by means of the index number formula should be relatively free of bias.

97. The additional important conditions are the following:

(i) The meaning of the index numbers or the aggregates in constant prices should be easily understood.

(ii) It should not be too difficult to compute the index numbers or the aggregates.

98. The properties of the various formulae, in the case of unchained and chained series of index numbers and aggregates, are discussed in the light of the criteria set out above. When moving weights are used or when the weight base is shifted every five, ten, etc. years, it is of course necessary to chain the series in order to compare the index numbers or aggregates with differing weights.

99. Neither the Laspeyres formula nor the Paasche formula satisfy the factor reversal test but a combination of a Laspeyres quantity index or aggregate and a Paasche price index do meet this test. This is so in the case of unchained series or chained series with moving weights. The test is also satisfied by Fisher index numbers, whether unchained or chained. While it is essential that the factor reversal test should be satisfied by the quantity and price series used in national accounting and input-output analysis, this is not as necessary in the case of most other uses of quantity and price index numbers.

100. As only the members of an unchained series of index numbers with fixed weights may be directly compared, one with the other, unchained index numbers, excepting Laspeyres', do not meet the circular test. Chaining the members of a series should lead to meeting the circular test if the period involved is not too long. The portrayal and analysis of trends and fluctuations in a series over time is greatly facilitated by the ability to make direct comparisons between each member of the series. In publishing series which do not satisfy the circular test, it is important to call attention to the limited direct comparisons that may be made between the members of the series.

101. The constant-price aggregates and the corresponding quantity index numbers are consistent, one with the other, when the Laspeyres formula is used in respect of quantities and prices or when the Paasche formula replaces Laspeyres' in the case of prices. The constant-price aggregates at a given level of classification also sum up to the corresponding aggregates at broader levels of classification, that is, satisfy the average test. While the criteria of consistency between aggregates and the corresponding index numbers is satisfied in the case of two consecutive periods when Fisher or Edgeworth-Marshall formulae are employed in unchained or chained series if the appropriate price cross-weights are used, the average test is not strictly met by the Fisher formula. It is, in general, essential that both tests should be met in the case of most analytical and instrumental uses.

102. The extent to which the results of applying a given formula may be biased depends primarily on the degree of correlation between the relative changes in the weighted prices and the relative changes in the weighted quantities of the elements of a flow, for example the categories of commodities or of industries into which gross output may be divided. The bias generally increases as the absolute magnitude of the degree of correlation increases. A high degree of correlation usually indicates that the relative actual contributions of the elements to the flow during the weight-base period and the other period in question, differ substantially. The consequence is that the index numbers or aggregates in respect of the two periods yield a biased picture of the relative actual situation.

103. Thus, if the degree of correlation is negative or positive and high, the Laspeyres formula often overstates the actual increases in the quantum and price of gross output and the Paasche formula often understates the actual increases. However, this would not be so if in the case of the various elements of the flow in question, the products of the relative changes in prices and the relative changes in quantities approximated the figure "one"; or the relative changes in prices and in quantities were similar. As the Fisher and Edgeworth-Marshall formulae are cross-weighted, they will yield index numbers that fall between Laspeyres index and the Paasche index.

104. The biases in series compiled according to the Laspeyres or Paasche formulae reflect the changes in the structures of the production of, and demand for, commodities and the consequent changes in the structure of the prices of these commodities. Therefore, as the time between the weight-base period and the period paired lengthens, the likelihood of introducing bias in the series increases. Cyclical or random changes in the production of, and demand for, commodities are unlikely to result in significant bias in series computed according to the Laspeyres or Paasche formulae.

105. Difficulties do not arise in appreciating the meaning of index numbers or aggregates of prices and quantities computed according to the Laspeyres or Paasche formulae. In each case the weights used may be linked with the actual dimensions of the flow during the weight-base period. In the case of the Fisher or Edgeworth-Marshall formulae however, the weights used relate to the average dimensions of the flow during two periods. It is in general more practical to use the Laspeyres formula than the other formulae, in particular, in the case of monthly, quarterly or preliminary annual series of index numbers. The data required to use the Laspeyres formula are much more likely to be available in respect of a past weight base than in respect of a current weight base. However, the introduction of data on new

commodities is much simpler when the Paasche formula is used. The computations involved in the case of the Laspeyres and Paasche formulae are less complex than those involved in the case of the Fisher or Edgeworth-Marshall formulae.

3. Choice of formulae and weight base

106. The considerations outlined above lead to the recommendation that in compiling aggregates and index numbers in national accounting and input-output analysis, the Laspeyres formula should be used in the case of quantity series and the Paasche formula should be used in the case of price series. This will result in quantity series which meet the factor reversal, circular and consistency tests, which may be easily understood and which are more practicable to compile than series based on other formulae. The use of the Paasche formula in the case of the price index numbers does not result in the most useful series for purposes of portraying trends and may complicate the computation of the index numbers somewhat, but as a result, the factor reversal test is satisfied. It is essential that the quantity and price series meet the factor reversal test for purposes of a number of the analytical and instrumental uses of national accounting and input-output data.

107. However, for purposes of other analytical uses of annual and more frequent index numbers of prices, the price series shown in table 2 should be computed with the Laspeyres formula. In addition to their usefulness in describing and analysing trends in prices, Laspeyres price index numbers are valuable for purposes of studying the flexibility of prices and the changes in the structure of prices. The index numbers are also more easily interpreted than Paasche price index numbers. The Laspeyres series of price index numbers satisfies the circular and consistency tests; and the use of the Laspeyres formula will make it possible to compile monthly, quarterly and annual price index numbers in the absence of data on current-period values.

108. In order to assess the extent of the bias, if any, resulting from the use of the Laspeyres formula in the case of annual quantity series and the Paasche formula in the case of annual price series, it will be useful to compare these series with annual series compiled according to the Paasche formula in the case of quantities and according to the Laspeyres formula in the case of prices. Marked differences between the Laspeyres and Paasche quantity or price series, point to the need to shift the weight base of the Laspeyres series and the comparison base of both the Laspeyres and Paasche series to a later period. In general, this weight base should be changed at least once every ten years and preferably once every five years. Care should be taken not to select a weight and comparison base period marked by unusual economic conditions.

109. There are certain advantages to using moving year-to-year base weights in Laspeyres index numbers and chaining the index numbers to a common comparison base in the more distant past. This would keep the likelihood of bias in the index numbers to a practicable minimum and ease the problems of dealing with new and disappearing commodities in the market. However, only the index numbers for pairs of consecutive years in the chained series would be the result of direct comparisons; comparative levels of the index numbers for other years would reflect the accumulated errors in computing the index numbers for all the intervening years. Furthermore, the meaning of quantity aggregates computed in this fashion would be unclear because in the case of practically all of the series, the weights at the level of classification at which they are linked backward or forward would differ from the weights at more detailed levels of classification.

4. Linking in weight base shifts

110. In shifting the weight base of a series of index numbers, some countries have compiled index numbers which are cross-weighted, for example Fisher indexes, in terms of the new and old weight base in the case of the two bases and the intervening periods. While this procedure has advantage, as is indicated in the discussion above of the properties of the formulae, cross-weighted series, in particular aggregates, are difficult to explain and interpret. Moreover, the series resulting from the use of the cross-weighted formula will differ from the old and new series, which are computed according to the Laspeyres or Paasche formulae.

111. A number of countries simply link the new series to the old series at the point of the new weight base. This procedure avoids a considerable amount of work and publication of revised series in respect of the old weight base and the intervening periods between it and the new weight base. It also maintains consistent weighting at all levels of classification of the index numbers. It is however, not possible to follow this procedure in the case of constant-price aggregates. It is necessary to either show the two aggregates - one weighted in prices of the old weight base and the other in prices of the new weight base - or to introduce the old weight-base or new weight-base prices at some point in the classification of flows. A moderately detailed level of classification would be desirable in order to attain consistency at least in the published constant-price series.

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