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GUIDELINES ON PRINCIPLES OF A SYSTEM OF PRICE AND QUANTITY STATISTICS

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NOTE

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Preface

This publication is part of continuing work in the area of price and quantity statistics undertaken at the request of the Statistical Commission, covering both index numbers and the series of price and quantity data required to compile them. It stems from the discussion of price and quantity comparisons in *A System of National Accounts* (SNA),[1] the report that was adopted by the Statistical Commission in 1966. Subsequent work has explored both the theoretical properties and the practical problems of application of such statistics. Starting from the requirements of a consistent set of price and quantity statistics within the context of the deflation of national accounts, the scope of the work has gradually been extended. These guidelines discuss an interrelated framework within which most work on the collection and compilation of all kinds of elementary series, aggregates and index numbers of prices and quantities may take place. The object of these guidelines is to show how the different kinds of price and quantity statistics and indexes that are required for different uses are related to one another and to suggest methods of ensuring their consistency.

The framework discussed here is comprehensive; of necessity the treatment of particular kinds of data and types of indexes is brief and the discussion of methodology and of sources of data very limited. It is intended to supplement these over-all guidelines with a series of manuals on particular types of price and quantity data, in which considerations of methodology and data sources relevant to each type of series or index will be discussed in much more detail. The first of this projected series deals with the construction of national accounts in constant prices. Later volumes will cover producers' prices and price indexes, prices in external trade and other areas.

Work on these guidelines has benefited from the contributions of a great many organizations and individuals. Earlier drafts and related papers have been discussed on several occasions by the Statistical Commission and the various regional commissions and have profited from the helpful suggestions of many national statistical offices. In particular, mention should be made of the working paper prepared under the auspices of the Economic Commission for Europe (ST/ESA/STAT.73) and of the contribution of an Expert Group which considered an earlier draft. The members of the Expert Group were I. B. Kravis (United States of America), Chairman, L. Drechsler (Hungary), A. Fracchia (Argentina), A. D. Holmes (Canada), E. Krzeczkowska (Poland), D. Kunz (Germany, Federal Republic of), M. Mukherjee (India), J. Popkin (United States of America), and P. Sevaldson (Norway).

The Statistical Commission at its nineteenth session recommended the present guidelines for global use. However, statistics in this field are at different stages of development in different countries; while some countries already compile a large part of the statistics covered by the guidelines or may expect to do so in the relatively near future, for many other countries the implementation of the recommendations constitute a much longer-term objective. Moreover, although much progress has been made in clarifying the nature of both the theoretical problems and the practical difficulties in this field of statistics, the guidelines in this publication must still be regarded as provisional. Problems still remain in several important areas. Some of these problems are inherent in the nature of index numbers; these problems do not allow of best or unique solutions. Other problems arise from practical limitations of the data, some of which may be expected to be reduced in time.

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[1] United Nations publication, Sales No. E.69.XVII.3.

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Chapter I

THE PURPOSE OF GUIDELINES ON PRICE AND QUANTITY STATISTICS

Uses of price and quantity statistics

1. Price and quantity statistics are used for a wide variety of purposes, relating both to the current operation of the economic system and to the formulation of longer-range economic policies as well as to the analysis of economic behaviour. A review of some aspects of the more important uses will be helpful in identifying the characteristics that price and quantity statistics must have in order to serve these purposes.

2. In operational terms, price indexes are increasingly being used for adjusting contracts, wage rates, pensions, taxes and a variety of other transaction flows in the system. In this context, it is apparent that different indexes are needed for different uses. Businessmen making long-term contracts may protect themselves from future rises in materials costs by including in their contracts a provision for adjusting sales prices as materials prices change. For this type of indexing, highly detailed commodity price indexes are required. On a broader level, consumer price indexes are widely used in wage adjustments and collective bargaining negotiations as well as for adjusting various fixed income flows such as pensions and rents. For certain other transaction flows, a more general index relating to the economy as a whole is needed. A few countries are already making use of price indexes for such general adjustments and it is not unlikely that their use will become more widespread, for such purposes as adjusting accounting flows used in computing profits and returns on fixed obligations and equity and for adjusting depreciation and other fixed charges to a current price basis.

3. Apart from the uses in which price indexes are actually incorporated into administrative procedures, both price and quantity indexes are used in the short run by businessmen as an ingredient in their day-to-day decisions and by Governments in monitoring the current performance of the economy. In this context, the interrelationships among the price data, the transactions data and the quantity data are clear: integrated price and quantity statistics and value data are essential to a consistent evaluation of current economic developments. The need for immediacy of reporting, however, precludes comprehensive and representative coverage of the economy as a whole in indexes of this type.

4. On a longer-range basis, price and quantity statistics and constant price estimates of the components of the national accounts are extremely important in the analysis of the behaviour of the economic system. For this use, what is needed is a comprehensive system of price and quantity statistics that can be fully integrated with the national economic accounts and balances. The choice of economic policy by Governments depends heavily upon their understanding of the economic processes that are taking place. Thus a judgement as to whether an expansionary fiscal and monetary policy will exacerbate an inflationary process or lead to increasing output and employment will be an important factor in determining whether or not such a policy is adopted. Knowledge about where price increases are occurring and how they are transmitted is basic to an understanding of the effects of different economic policies. Knowledge of how quantities are changing is crucial to the analysis of growth and of cyclical and seasonal fluctuations and of productivity, capital/output ratios and other technical coefficients. These uses of price and quantity data require a formal and complete system of statistics, not only in terms of coverage of the whole economy but also in terms of the interrelations among the parts.

5. It is apparent, thus, that price and quantity statistics are multipurpose tools, on the one hand serving the needs of Government and enterprises in their day-to-day decision-making, and on the other providing the basis for understanding the behaviour of prices, output and employment and their relation to economic policy. These uses need not be incompatible, although the detailed information on specific industries and commodities that is needed at frequent intervals may not be required for more general analytic purposes and, conversely, complete coverage of all sectors of the economy including those where measurement is difficult may not be necessary for short-run decision making.

The need for guidelines

6. This publication is addressed to the problem of developing a system of price and quantity statistics that will serve all of these varied kinds of needs but will at the same time be ordered and consistent and a true reflection of the underlying economic interrelationships. At the present time, most countries collect and issue price and quantity series for many 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 with one another and cannot easily be used for analytical purposes. The different types of indexes—for consumer prices, for wholesale prices, for industrial production, for imports and exports—were for the most part developed quite independently, even in those instances where one administrative organization was responsible for all of them. In addition, despite the very long history of interest in index number theory, it is only recently that its application to economic analysis has developed much beyond the stage reached by Irving Fisher soon after the turn of the century. Fisher was seeking to identify "the" price level, which he thought of as the central tendency for all prices. He did not consider the possibility of systematic shifts in the structure of prices. He thus did not regard the choice of prices to be observed as of great importance, so long as there were enough of them to eliminate random variations. This

historical interest in collecting all of the available prices without much regard for their relation to one another still influences, in particular, the wholesale price indexes of many countries. It was not until the development of a consistent set of national economic accounts and balances, which led to still another new set of indexes that differed in a number of important ways from the traditional indexes, that concern over the nature of the indexes became focused.

7. The problems most frequently encountered in using the price and quantity indexes commonly available today include: (*a*) different results from indexes answering the same, or virtually the same, question; (*b*) inconsistent results from indexes that should be logically related to one another; (*c*) inability to trace changes in prices and quantities through the stages of production owing to inconsistent classifications; and (*d*) lack of balance between supply and disposition, both of particular commodities or in particular industries and for the gross product as a whole. Although some of these problems arise from the necessary limitations of index numbers, it is possible to eliminate or at least reduce many of them through attention to consistency of definition, classification, sources, formulae etc. But beyond mentioning these precepts, which are essentially those common to good statistical practice in any area, these guidelines are also designed to set out an approach to organizing price and quantity statistics and the indexes based upon them that will lead to an ordered and coherent structure.

8. There are various means for co-ordinating price and quantity statistics but there are obvious advantages in using the national accounts and balances for this purpose. The System of National Accounts (SNA) and the System of Balances of the National Economy (MPS) are used in general as a framework for integrating economic statistics;[1] they are particularly well adapted to serving that function in this area. This is not intended to imply, however, that all index computations should be subordinated to the needs of the national accounts and balances.[2] The accounts are used as an integrating device; the system proposed has room for the traditional varieties of indexes and it will accommodate most of the existing special purpose indexes. In this use, it does not appear that the differences between the accounts of SNA and those of MPS are of crucial importance. For simplicity, most of the discussion will be couched in terms of the structure and classifications of SNA, with references to MPS where needed.

[1] United Nations publications, Sales Nos. E.69.XVII.3 and E.71.XVII.10.

[2] The special needs arising in the construction of constant-price national accounts and a consistent set of price deflators showing their relation to the accounts in current prices are dealt with in detail in the forthcoming *Manual on National Accounts in Constant Prices*, a companion to this publication.

Chapter II

OVER-ALL DESCRIPTION OF THE SYSTEM

9. The output of the economic system (whether gross domestic product in SNA or net material product in MPS) may be viewed as composed of commodities and other goods and services, which in turn may be looked at either in terms of the industries in which they are produced or in terms of the users to whom they go. Price and quantity statistics are relevant both to the origin (commodity and industry) and disposition (final use) sides of the accounts. The basic data that need to be collected on values, prices and quantities can be fitted into a classification framework drawn up in these terms and, from the basic data, indexes can be computed that will serve all the various kinds of needs outlined above. The level of detail, the frequency, the coverage, the type of data collected and the type of index may vary according to use but if the basic data are consistently defined and classified the indexes constructed from them can also be made consistent. Indexes designed for different purposes will differ intentionally, in predictable, meaningful ways, and those designed for the same purpose will fit together in an integrated way.

The role of input-output relationships

10. Producing entities in the economic system make use of inputs—materials and factor services—to produce outputs. Some of the inputs may be purchased from other producers; some (factor services) constitute value added within the producing unit. The outputs, in turn, may be disposed of either to other producing units or to final users—consumers, government etc. These relationships may conveniently be displayed in the form of an input-output table that traces the flow of commodities and other goods and services through the economic system. Input-output relationships may relate either to what is produced (commodities and other goods and services) or to where it is produced (industries and other activities). If each product were produced in only one industry, these two classifications would be identical. The difference arises because this is frequently not the case; producers often produce outputs that are typical of several different industries. The SNA report therefore makes provision for classification both by commodity (what) and by industry (where). Table 2 of the SNA report shows the supply and disposition of commodities and table 3 the gross output and input of industries (SNA annex 8.3). Because interest often attaches specifically to production that occurs outside the typical industry, data are needed on both types of classification.

11. It is, of course, obvious that any actual data collected on prices and quantities will relate to commodities (or other goods and services). It is not possible to observe either the price or the quantity of an industry's activity, so indexes computed for industries or any larger groups must be some sort of aggregation of commodity data. In order to preserve the record of the input-output relationships, each item of data collected should ideally be specified in all three ways: what it is (commodity), where it was produced (producing industry or other activity) and where it was used (purchasing industry or final use).

12. A classification framework embodying this three-way specification of the basic data can be based upon existing standard classification systems. The present guidelines are framed in terms of international standard classifications. Some countries may instead employ their own versions of standard classifications. For internal use, what is important is that the same classification systems be used throughout, although of course for purposes of international comparability adherence to the international standards is desirable. Standard classifications are available for all of the required breakdowns; and it is one of the most important features of the proposed integrated data system that these standard classifications should be used, in order to ensure that common definitions are used throughout. It is only if such standardization is maintained that the various parts of the system can be expected to fit together. This point will be discussed more fully below; however, it should be pointed out that this is a minimum level of specification and that additional specification will be needed in particular uses. There may, for instance, be interest in the region where the commodity is produced or sold, in the size of establishment producing or using it or in various other characteristics.

13. This does not, of course, mean that data should be collected or indexes computed for all possible categories of the standard classifications. Rather, what it does mean is that the specifications of whatever data are collected should be designed to fit into the standard classifications and that whatever indexes are computed should respect the standard classification boundaries. Aggregations of data and grouped indexes should refer to classes that can be defined in terms of components of standard classifications.

14. The standard classifications proposed are, for commodities, the International Standard Classification of All Goods and Services (ICGS) (E/CN.3/493); for industries, the *International Standard Industrial Classification of All Economic Activities* (ISIC);[3] and for final uses of gross product, the classifications specified in the SNA report. ISIC classifies economic activities according to a telescoping four-digit scheme: the first digit identifies the major division; the first and second, the division; the first three, the major group; and all four, the group. Thus it is possible to move easily from quite detailed classifications to very broad ones. ICGS adds four more digits to the industry codes to obtain a classification of goods and services by classes (six digits) and subclasses (eight digits). ISIC is intended to classify the activities of entire establishments or enterprises into the most appropriate industry.

[3] United Nations publication, Sales No. E.68.XVII.8.

ICGS, on the other hand, classifies goods and services into those industries where they are typically produced (without regard to where they are actually produced). The greater detail in ICGS reflects the greater need for detail in this area; interest in commodities is frequently focused at a much more specific level. The final-use breakdowns are specified in tables 5.3, 5.4, 6.1, 6.2 and 6.3 of the SNA report. Since these last classifications are insufficiently detailed for some uses, they will need to be supplemented by ISIC, ICGS or other classifications. In particular, this will be necessary for imports and exports, where the *Standard International Trade Classification* (SITC)[4] will also be useful.

15. The level of classification chosen for the basic data of the system should be at least as detailed as that of the most detailed indexes desired. This is an obvious consideration but one that in practice it is easy to neglect; failure to take it into account in advance will lead to unnecessary duplication of collection effort as well as unintentional and unnecessary inconsistency.

16. Though the classification schemes used are somewhat different, most of what has been said above also applies to MPS. The classifications explicitly included in MPS are on a somewhat less detailed level than those of SNA. As a consequence, no distinction is made between commodity classifications and activity classifications, since at the level specified they are much more likely to coincide than are those of SNA. This tendency may also arise from a higher degree of enterprise specialization in countries using MPS. In practice, however, more detailed classifications are frequently used in these countries and when these more detailed classifications are used the distinction between commodity and activity classification is frequently made. Similarly, although the production boundary in MPS is restricted to material product, flows relating to non-material services are identified in the system and price and quantity indexes relating to them are needed and in fact often compiled.

The design of price and quantity indexes

17. Given the basic data arranged in a standard classification framework, it is conceptually possible to construct indexes for any desired aggregation of either transactions or transactors, as long as the aggregation is not more detailed than the classes for which the basic data are available. Furthermore, many different kinds of indexes are possible. This section will consider what aggregations are useful and what kinds of indexes are appropriate. The discussion will be limited to the structure of the system of indexes, excluding considerations of the nature of the data (which will be covered in chapter III), index formulae (chapter IV) and recommendations for dissemination (chapter V).

18. SNA provides for the recording of flows both at market prices and at approximate basic values. Approximate basic values differ from market prices in that they exclude commodity taxes. They are thus designed to reflect the producer's costs (including profits). Market prices may be either those paid by the purchaser or those received by the seller; the difference is, of course, the trade margin and transport cost. Both price and quantity indexes may be constructed on any of these valuation bases and the system has room for all of them.

[4] United Nations publication, Sales No. E.75.XVII.6.

19. In any integrated system of indexes, the fact of integration means that not all of the index values are independent. Where price times quantity equals value, one of the three variables is redundant and it is necessary to collect independent data for only two of them. Similarly, where intermediate product plus value added equals gross output, one of the three can be derived from the other two. Owing to the exigencies of index number compilation, both of these statements are subject to some qualifications; these are discussed in chapter IV. What is intended here is only to point out the interrelatedness of the system. When the parts fit together, this not only imposes consistency requirements but also permits a significant economy of statistical effort.

20. Utilizing the concept of the flow of commodities through the economic system, where the output of one industry becomes the input of another until it eventually reaches some final use, it is now possible to outline the kinds of indexes it would be desirable to have. At the simplest level are price and quantity indexes for the gross output of individual commodities, where the individual commodities are so specified as to fit within standard classifications. These commodity data are also the basic building blocks for constructing indexes for industries.

21. For industries, however, the questions to which answers are sought are likely to be considerably more complex. These questions divide into two principal categories. One relates to the total output of an industry and a corresponding price index. The second relates to the contribution of an industry to final output and the impact of its behaviour on prices. These are quite different questions and different measures are needed to answer them. They are not to be viewed as alternatives; both types of measures are needed.

22. In the first instance, where interest focuses on the price or output of a particular industry or sector of the economy, gross output has in the past often been used as a measure. But this involves a certain amount of double counting, since the output of one establishment or enterprise may enter into the input of others and be counted again in their output. Thus a simple aggregation of gross outputs of all establishments in an industry or sector will count some kinds of raw materials a number of times on their way through the production process. The broader the industry or sector, the more double counting there will be. What is wanted instead is a measure of that output which moves across the boundaries of the industry or sector being measured, in other words, gross output less the portion of gross output disposed of to users within the same sector or industry. This measure is called net sector output.[5] Net sector output is not an additive concept. Net sector output for a two-digit industry, for example, cannot be obtained by adding up the net sector outputs of all of its constituent three-digit industries. Rather, as the scope of the sector being considered is widened (from three- to two-digit industry, for instance), the proportion of output that is disposed of within the industry also becomes more inclusive. It is this non-additivity which has in the past limited the use in practice of the net sector output concept, since it greatly increases computational complexity. With the general advent of computer data processing, however, this may no longer

[5] It should be noted that the word "net" in this context does not have its usual national accounting meaning; what is netted out is not capital consumption but rather own-product consumption.

be a major constraint and net sector output is gradually being substituted for gross output in uses where it is the theoretically valid concept. This is the case, for instance, in the construction of weighting systems for producers' price indexes. The concept is particularly important at such intermediate levels of aggregation as, for instance, total manufacturing. At a highly disaggregated level, net sector output will be very close to gross output; for four-digit industries, the difference will seldom be statistically significant.

23. For the second kind of use, it is not the total output of a given producing unit that is of interest but rather what the given unit has contributed to that total output—that is, its value added. This is the measure that is needed, for instance, for the derivation of national accounts in constant prices. Value added is the difference between gross outputs and inputs purchased from other producers. The input-output relationships define, for each industry, the commodities that enter into intermediate (purchased) input and gross output. Value added itself, however, is by definition a concept that is not directly measurable. In current prices, it is obtained by subtracting intermediate input from gross output. Consequently, to obtain a measure of deflated value added, gross output and purchased inputs must each be deflated separately. This "double deflation" is required because there is no single deflator that is relevant. A price index that is appropriate for the gross output of the industry will include not only the effects of what has happened within the industry but also the effects of changes in the prices of purchased inputs. A rise in agricultural prices, for instance, will probably affect the prices of the output of the food processing industry, so that observing the change in the price of processed food will not by itself provide any information on changes in the price of food processing. The same, of course, is true of quantity relationships. Observing the quantity of processed food produced gives no information on whether the processing content has increased or decreased relative to the content of raw agricultural inputs. For this reason, it is necessary to approach the measurement of both the price and the quantity of value added in a more indirect way, by constructing separate measures for gross output and intermediate input, each of which consists of an identifiable bundle of commodities. If intermediate input, deflated by an index appropriate to it, is subtracted from gross output, similarly deflated by its own index, the result will be what is known as double-deflated value added. This may then, in turn, be divided into current-price value added to derive an implicit price index for value added; but this price index is a derived figure—there is no way that it can be observed directly. The deflated value-added figures thus obtained are additive, in that they may simply be summed to obtain aggregations for larger industrial groups or for the economy as a whole. For the economy as a whole, the value-added measure and the net sector output measure will of course be identical, except for net exports.[6]

24. In addition to indexes relating to output classified by producing sector, information is also needed on the final uses of output. This includes indexes relating to household consumption by type of goods and services and for various groups of consumers, indexes for government final consumption expenditure by purpose and by type of government entity; indexes of fixed capital formation by type of asset and by purchasing industry; indexes of changes in stocks by type of commodity and by industry where held; and indexes for imports and exports by type of commodity. A number of different kinds of indexes relating to the final uses of gross product are commonly constructed. One major group of indexes consists of those required for the construction of national accounts in constant prices. For this use, relationships that are additive are required: deflated current values or properly weighted quantity indexes for detailed groups must be capable of being added to obtain more summary groups; and the total for the economy as a whole should equal (aside from index number problems and statistical discrepancies) the total derived by summing value added by industrial origin. But there are also other indexes in this end-use family; these often combine parts of the same data in different ways for different purposes. The consumer price index fits here, as do price indexes of imports and exports and of producers' durable goods etc.

25. Table 1 summarizes the structure of the proposed system of price and quantity statistics. This table is intended only to display the structure and does not contain any detailed specifications of types of indexes, levels of classification, priorities, frequencies etc.—questions that are dealt with later. As will be readily apparent, table 1 is merely a skeleton national accounting framework. The items in the skeleton framework are, however, selectively chosen to display those elements to which the price and quantity data relate.

26. Missing from this structure is the third of the usual breakdowns of gross product, that by income components. Indexes of wage cost and wage income are frequently computed; there is increasing interest, too, in indexes for other components of income such as profits and interest as well as in constant-price national income itself. Despite this widespread interest, however, there is very little consensus on appropriate methodology. National income in constant prices is a much more difficult concept to deal with than is gross domestic product in constant prices, since (like value added) it does not in fact relate to any identifiable set of goods and services. To obtain it, another round of double deflation is needed: deflated indirect taxes and capital consumption allowances must be subtracted from deflated gross product. There is at present a great deal of interest in and much ferment with regard to the appropriate pricing of capital consumption allowances, as higher rates of price rise show up the disadvantages of conventional treatments. Most of this concern, however, is directed at a special use, namely, the proper determination of current-period profits. Methods appropriate for this use (even if agreement could be reached on this) would not necessarily also be appropriate for the determination of constant-price national income. By its very nature, the allowance for capital consumption is a money value that is not conceptually divisible into price and quantity components. Indirect taxes also present conceptual problems. It is of course in principle possible to compute what the tax would have been if base-year prices and base-year tax rates had prevailed in the current year. Alternatively, it is possible to apply current-year rates to base-year prices. It is not at all clear, however, that either of these concepts is appropriate for the computation of national income in constant prices.

27. Because of these difficulties in deriving national income in constant prices by adjusting gross product,

[6] For a discussion of special circumstances in which a gross output deflator may appropriately be used as a proxy for deflated value added, see the forthcoming United Nations publication, *Manual on National Accoun* *Constant Prices.*

TABLE 1. STRUCTURE OF THE SYSTEM OF PRICE AND QUANTITY STATISTICS

I. *Sources of output*
(Producers' prices and approximate basic values)

	Commodities	*Activities*			
	Gross output	*Gross output*	*Intermediate consumption*	*Value added*	*Net sector output*
1. Agriculture 2. Mining 3. Manufacturing 4. Electricity, gas and water 5. Construction 6. Distributive trades 7. Transport and communications 8. Finance etc. 9. Services	Basic data and compiled indexes at various levels of aggregation, ICGS classifications	Compiled indexes at various levels of aggregation, ISIC classifications			
Gross domestic product					

II. *Uses of output*
(Purchasers' prices)

1. Consumption of households, by type of household and type of commodity 2. Government consumption, by purpose and type of commodity 3. Consumption of non-profit institutions 4. Gross fixed capital formation, by type of commodity and by purchaser 5. Increase in stocks, by type of commodity and by industry where held 6. Exports, by type of commodity 7. Imports, by type of commodity	Basic data and compiled indexes at various levels of aggregation, SNA and SITC classifications
Gross domestic product	

it is sometimes suggested that it should be built up by adding up income shares. But here the difficulties are even more formidable. Wages may be regarded as either factor income or factor cost and the appropriate deflator will differ depending upon the way in which they are regarded. Viewed as real income, the appropriate deflator will be a measure of what the income can buy: some version of consumer prices. Viewed as an element of cost, however, the appropriate deflator will reflect changes in wage rates adjusted for changes in productivity. Each of these concepts is useful but only the user can decide which is appropriate in any given case. For the net operating surplus, the situation is even more ambiguous. Since the net operating surplus is defined as a residual, it (again like value added) can only be deflated if both the subtrahend and the minuend are known and each is deflated separately. Since the minuend is national income (or value added less capital consumption allowances less indirect taxes), constant-price operating surplus can only be derived if constant-price national income is already known. It follows that this method cannot be used to derive constant-price national income.

28. It is for these reasons that these guidelines do not include recommendations in this area. For the present, it can only be suggested that preference be given to one of the estimates of constant-price gross product rather than national income. To the extent that a need is felt for an estimate of national income and/or its components in constant prices, the only procedure that now appears defensible is the use of a single general deflator, such as for instance the implicit deflator of the gross domestic product, for all components.

Chapter III

THE STRATEGY OF DATA COLLECTION

29. Translating the theoretical structure of the system of price and quantity statistics into a programme for implementation requires substantial elaboration of the discussion above. This chapter will deal with some of the more important considerations that arise in designing and executing a programme of data collection upon which to base price and quantity indexes. It will discuss, first, the choice of the units for which data are to be collected; secondly, the design of a programme of data collection; and finally, special problems that arise in particular instances.

The choice of units of observation

THE DEFINITION OF THE UNIT

30. The precise specification of the elementary units of observation is a fundamental aspect of the selection of the price and quantity indicators to be used to compute indexes of price and quantity. The definition of "*q*" and "*p*" units affects not only the representativeness of the units selected but also the boundary between the quantity and price components, i.e., between those factors that will be reflected in the quantity index and those that will be reflected in the price index.

31. If, for example, the units are defined as automobiles, without any further specification, then the quantity index of automobiles will be proportional to the number of automobiles. In this case, all changes in the quality of the cars that lead to differences in their market value or all changes in the mix of cars of different quality will be regarded as changes in price and reflected in the price index. If, alternatively, the unit is defined as a car with a specific engine capacity (but without any other specification of the quality) then quality changes involving changes in engine capacity will also be treated as quantity changes—an automobile with a larger engine will be counted as more quantity of automobile rather than as a higher priced automobile—but all other quality changes will still be reflected in the price index. The addition of other specifications such as weight, optional extras etc. will, similarly, shift the effect of changes in these elements from price to quantity.

32. The paragraphs below discuss a number of factors that must be considered in the specification of the units of observation. In addition to quality change, these include regional and seasonal differences, price discrimination, unique products and the choice between specification pricing and functional pricing.

Regional differences

33. In many countries, there are regional differences in the prices of certain products. Some differences reflect climate or transport cost. Quite often, also, there are considerable differences between cities, towns and villages or between tourist resorts and industrial regions. In these cases the question arises as to whether, assuming that there are no other differences in the products, the products sold in the different regions at different prices should be considered, for the computation of indexes, as one single product representing the same quantity wherever it is sold or as different products representing different quantities. Is an orange consumed in a subtropical region the same as an orange consumed in a colder climate? Is the orange the unit or are two oranges in different places different products?

34. This question involves the fixing of the borderline between the quantity component and the price component of value. Suppose the same total number of oranges is consumed as in the previous year but that there is a shift in consumption from the warmer to the colder regions; since in the colder regions oranges are more expensive, the value of all oranges consumed in the country increases. Is this a quantity increase or a price increase? If the unit is "an orange", the answer is that the increase has been in prices (since the same quantity was consumed in the two years); but if the orange in warm regions and the orange in cold regions are two different products, then it is quantities that have increased, not prices. For most intertemporal comparisons, the latter approach is more appropriate, since the trade and transport activities that lead to the increase in the value of cold-climate oranges do represent real value added. It should be noted, however, that there are some special purposes for which the first approach is preferable. This is true, for example, for interregional price and quantity comparisons. To compare *per capita* consumption of oranges in warm and cold regions, the concept that is needed is one of oranges meeting certain physical specifications, not one of oranges-plus-transport.

35. These considerations are especially important in the case of food consumed on farms and similar non-marketed output. Treating food consumed on farms as a separate product from marketed food will, of course, result in an increase in the measured quantity of food output as the share that is marketed increases, even if there is no change in the physical quantity.

36. The application of this rule in practice would require that national price indexes be compiled as averages of regional price indexes and not as indexes of national average prices. What this means is that for each regional price observed a price relative would be computed showing the change from one period to the next; these price relatives would then be averaged over the whole country. Thus only the price changes occurring within regions would influence the national average. Shifts in relative consumption of different regions would, in consequence, appear as changes in quantity. This procedure is applied in many countries for consumer or retail price indexes, which are compiled from a large and geographically well distributed sample of prices. The index for the country is obtained as a weighted average of these separate price relatives or regional indexes. In some countries, however, separate indexes can be compiled only for large regions and in

a number of countries no regional breakdown is possible. Whether this lack of regional breakdown is important depends upon the extent of regional variation in prices and its shifts over time. If regional price differences are not large or if their relationship does not change, indexes without regional breakdowns may sufficiently well approximate those taking regional differences into account.

Seasonal differences

37. The problem of compiling annual average indexes where there are important seasonal variations is very similar to that discussed in the preceding subsection, the only important difference being that the dimension here is time and not space. Seasonal variation is often connected with some other characteristic such as, for example, the origin of the product (imported or domestic) or differences in the production process (hothouse or field grown). Here again, the question arises whether a strawberry consumed in winter is the same product as a strawberry consumed in summer. On the basis of similar considerations, the conclusion seems to be that in general strawberries in different seasons should be treated as different products. Treating the same physical product in different seasons as different products means that the effect of shifts in the proportions consumed in the various seasons is to be considered a quantity change and not a price change. The calculation of the index therefore requires in principle that the annual average price index be computed as a weighted average of the price indexes for the various seasons and not as an index based on annual average prices.

38. One problem that arises in more acute form in the seasonal than in the regional case is that of products that disappear in some seasons and reappear in others. This is of course the limiting case of changing quantities and prices, where the quantity becomes zero and the price non-existent. Where seasonal patterns are fixed the method suggested above will accommodate such cases; however, problems arise when seasonal patterns vary. There are two common approaches. One is to continue to carry the item that has temporarily disappeared at the last recorded price. The second is to drop the item from the index in the season when it cannot be observed. Of these, the second is clearly preferable: if strawberries are unobtainable in January, nothing is gained by putting them in the index at the July price.

39. The treatment of seasonal price variations in short-term, month-to-month indexes raises problems of quite a different nature from those being considered here. For the most part, the issues involved are similar to those arising in chained indexes and will be considered below in that context.

Price discrimination

40. The sort of problem considered in the subsections above may be generalized to include any situation in which different prices are charged for the same physical product sold in different markets, however the different markets may be distinguished. Thus a product sold in a small independent shop may be priced differently from the same product sold in a chain supermarket. Or a product sold in small quantities may cost more than the same product sold in large quantities. A product sold individually to consumers may differ in price from the same product sold as intermediate input to producers (for instance, household appliances sold to consumers as opposed to the same products sold to builders). In other cases, there may be differences related to the characteristics of the purchasers, such as lower prices for children, the elderly, the disabled, or differences for certain categories of employees, such as licensed members of a profession, members of a club. In these cases, as in the cases of regional and seasonal variation, the question arises as to what the appropriate unit is. Should it be the product, irrespective of the market in which it is sold, or should it be the product sold in a given market? In the first case, the changes in value caused by shifts between the markets are considered price changes; in the second case, they are treated as quantity changes.

41. There are arguments for both approaches under certain circumstances. For measuring the output of a given producer, there are strong arguments for treating these changes in value as changes in price and not quantity. Selling identical items to different customers at different prices does not involve a change in the quantity or volume of the items produced, and for such purposes as productivity analysis it is the quantity of goods produced that is important. On the other hand, when measuring the disposition of production—the volume of exports and of domestic consumption, for instance—it is more appropriate to use the prices at which the products were actually sold. If these prices are different in the two markets, this means that the products sold in the different markets should be treated as different products and consequently that changes in the shares sold in the different markets will affect quantity, not price.

42. This situation gives rise to a conflict to which there is no ideal solution. If the most appropriate method is to be used for the computation of each type of index, there will be two output indexes that differ because they treat price discrimination differently, the choice between them depending upon the use contemplated. This, in turn, will mean that some method of reconciliation will be needed if the national accounts in constant prices are to balance. One possible method is to introduce a special balancing item into the accounts. Another solution sometimes proposed is the absorption of the difference in the trade sector. In many of the instances where this problem arises, the trade sector is interposed between the producer and the final purchaser so that it is possible to consider that the trade sector buys a single product which it then, as a part of its function, turns into multiple products. Such a treatment, it is apparent, merely obscures the problem without solving it.

43. Fortunately, in actual practice the kinds of consideration raised here may not be of great quantitative significance. True cases of pure price discrimination, in which identical products are sold for different prices in different markets, are very rare. There is almost always some difference between the products involved that prevents their being considered a single product. Cases where the actual differences between similar products are not proportional to the differences between their costs also present an element of price discrimination but in these cases the option of treating them as a single product is not open. Such cases are discussed in the next subsection, as an aspect of quality difference.

Quality differences

44. Although quality differences raise fewer questions of principle than does price discrimination, in practice they are more difficult to deal with. For most

purposes for which price and quantity indexes are needed, it is clear that quality differences ought to be treated as differences in quantity, not in price. In measuring consumption, for example, a better suit should be counted as more quantity of clothing than a poorer one, not as the same quantity of clothing at a higher price. But the application of this principle presents a great many practical problems.

45. In the case of goods, all differences in physical composition, components, size, style, packaging and operating characteristics (for example, capacity, power, speed, durability etc.) should be considered quality differences. Circumstances of sale, such as the net weight or volume of the item bought, customer services, guarantees and terms of payment are also quality characteristics from this point of view; differences of this sort merge by imperceptible degrees into the price discrimination case discussed above. In the case of services, quality characteristics relate to such attributes as the activities constituting the services, the conditions under which the services are rendered, the levels of skill and training of the persons rendering the services and, if feasible, the benefits generally expected from the services.

46. As an exception to the rule stated above, differences in the circumstances of production that do not lead to differences in utilization or function should not generally be considered quality differences. For example, electrical energy having exactly the same utilization characteristics should not be considered of different quality simply because of differences in the production process (thermal energy, hydro-energy or nuclear energy).

47. Quality differences are generally accompanied by price differences when products are sold in the same period in the same market. In fact, in general it is through these price differences that it is easiest to identify and quantify the quality differences. Nevertheless, though the correlation between the quality differences and price differences at a given place and time is relatively very strong, not all quality differences are necessarily accompanied by price differences and not all price differences necessarily correspond to quality differences.

48. While quality differences existing at a single point of time cause some problems, it is in taking account of the changes in quality over time that the most difficult questions arise. The problem of quality change is encountered in all kinds of quantity and price indexes. For the sake of simplicity, the discussion here will concentrate on the consumer price index.

49. When a new product replaces an old one, two questions arise: (1) how will the continuity of the indexes be preserved and (2) how will the validity of the index be affected? When a new product is clearly identifiable as a replacement for a specific old product, the usual method of maintaining continuity is by linking or splicing: the new product is substituted for the old using the ratio between their prices that is actually observed in the market. In many cases, however, old products disappear and new ones appear in circumstances where it is not possible to establish an unambiguous link, so that some element of judgement will always come into play. Often the substitution is not complete; the new product simply adds to the spectrum of choices available but in so adding it may lead to major changes in the function of the old product. An example is the advent of television. While it is clear that the introduction of television had a major impact on both the radio and the motion picture industries, greatly changing the character of both, it is not at all clear that television can be considered a direct substitute for either. The usual practice, in such cases, is to introduce the new product at what is essentially an arbitrary point, after it is well established in the market. Similarly, disappearing old products for which there is no obvious replacement are simply dropped.

50. If no attempt is made to maintain continuity either by splicing or by substitution, it is obvious that the representativeness of the index is reduced. Whether this is a serious danger depends upon the relative importance of the item in question (and the number of items involved). Where there are many comparable products the disappearance of a few old ones may not matter but in other cases the reduction in representativeness may be more important.

51. There is, furthermore, a second problem arising from the changing product mix that is likely to be much more serious than any reduction in representativeness; this is the concealed price change that may be introduced. In all cases where the price difference between the old product and the new is not proportional to the quality difference, the replacement of the old product by the new has the same effect for the consumer as a change in the price. The change may of course be in either direction. Where it occurs in response to demand, i.e., where the new product drives the old out, there is a *prima facie* case that the new product represents more quality for the money. But where the shift reflects supply conditions, i.e., where the old product can no longer be obtained, there is a strong likelihood that quality relative to price will decline. To the extent that such differences in quality can be measured, appropriate adjustments can be made. But the possibilities of measuring quality differences are limited and it must be recognized that such adjustments are often incomplete and to some extent arbitrary.

52. Even in cases where the market prices of the old and new products at a given point in time are used for splicing, there is still a large element of arbitrariness. This arises in the timing of the substitution, since new products often have higher prices when first introduced and falling prices as their production increases. Conversely, the product being phased out is likely to have a rising price, since it will not benefit from technological advances. Thus, throughout the period when both products are on the market the ratio between their prices is likely to be continually shifting, so that the choice of the exact moment for making the splice will affect the outcome. One approach to this problem calls for very early introduction of the new product, with a small weight at first but an increasing weight as its use increases. Correspondingly, the old product is phased out by gradually decreasing its weight. This method captures the price change; however, it introduces other problems relating to shifting weights which are discussed below.

53. Where shifts are not voluntary but are forced by the disappearance of a product formerly available, an additional consideration enters. Even if it is assumed that the difference in price between the old and new products is an accurate reflection of their relative quality, the consumer will have lost something through having been forced to make the change. This, for instance, is the case with mandatory installation of safety equipment or anti-pollution devices in automobiles. The

increase in price may accurately reflect the increase in quality but if consumers would rather not have the new equipment they are worse off. Nevertheless, it is still appropriate to treat the required improvements as increases in quantity, not price. Price and quantity statistics are intended to provide objective measures (in so far as these are possible) of what has happened to output and its price. Measuring the utility or welfare that output yields is beyond their scope. It is, of course, true that the very concept of "output" involves some assumptions about utility; however, certain conventions have been adopted for use in national accounting and it seems preferable to maintain the same conventions here.[7]

54. These difficulties in determining the appropriate level at which to introduce a new product (or, similarly, in valuing a change in quality) have attracted much attention and various methods of handling them have been developed. Four of the methods commonly proposed will be discussed briefly here.

55. In the first place, much attention has been attracted in recent years by the "hedonic" approach. This method is based upon the existence of a correlation between the various quality characteristics of a product and its price. If observations for a number of different models of a product are available, each displaying different combinations of quality attributes and correspondingly different prices, it is possible to estimate a regression equation of price as a function of the various quality indicators. For this method to be effective, a number of conditions must be met. The method can be applied only for commodities like automobiles and houses that are available in a number of variants. But it is precisely in these cases that it is difficult to determine which aspects of the different variants are important and which are not. Furthermore, the importance of a given characteristic may vary from time to time depending upon factors that are not within the set being considered. Thus, for instance, the importance of fuel consumption as a component of the quality of an automobile is highly dependent upon the cost of fuel but the cost of fuel is not a quality characteristic and will not enter into the regression equation. It is, furthermore, only after the fact that the importance of such factors will become apparent, so that they cannot be taken into account in an estimating equation. More important, this method does not solve the basic timing problem. It is still necessary to base the link upon the price relationships among different variants of a product existing at one particular moment of time and very different results may be obtained depending upon the moment chosen.

56. A second approach relies upon cost to serve as the indicator of quality. A product that costs the producer 10 per cent more to make is assumed to represent 10 per cent more quality. For cost to be an accurate reflector of differences in quality, productivity must of course have remained constant. Since technological change is one of the major reasons for the introduction of new products, this method also has short-comings. As is noted in the discussion of concealed price changes above, differences between changes in cost and changes in quality may be in either direction. One special case that is not well handled by this approach is that of cost-free improvements, which are entirely omitted although they occur rather frequently.

57. In some cases there is a third approach where a foreign market can provide some help in determining the relative qualities of two products, if both the old and new products are present and competing in, for example, a neighbouring country. This method may introduce some foreign influence into the national indexes and the result may differ depending on which foreign country is used. Nevertheless, in some situations this approach may prove useful, especially in the case of small countries.

58. Because of the difficulties with all of these essentially market-determined methods of measuring quality differences, some countries follow a fourth approach and employ estimates made by commodity experts. But this method is not entirely free from the same difficulties as the others, since the commodity experts may base their conclusions on a primitive form of hedonic estimate, or on the cost relationships, or on the price relationships in foreign markets or on some combination of all of these. Subjective judgements may also play a role. Nevertheless, the depth of the commodity expert's specialized knowledge and the flexibility of the method may sometimes make its use advantangeous.

59. There is thus no completely satisfactory method of measuring changes in quality or of pricing new products. Relatively arbitrary splicing and substitution are, therefore, likely to continue to be the methods generally employed for dealing with changes in the product mix. For this reason, it is especially important that attention be given to the method of splicing and that it not be left to the casual decision-making of the price collectors. Replacement of the price index of the old product by the price index of the new product should take place at a time when the assumption that the price differences between the two products are proportional to the quality differences is most likely to be true. Too early replacement will underestimate the price change and too late replacement will overestimate it. Decisions on adjustments for quality change must be essentially pragmatic, taking into account the purposes for which a particular index is intended. Distortion resulting from failure to account sufficiently for quality change must be offset against the loss of objectivity that may result from elaborate methods of imputation.

Unique products

60. There are some fields in which the problem of new products is so severe that it takes on an entirely different dimension. In most construction and in some branches of the heavy machinery industry, virtually all products are new, in that each product is unique. In some fields of services the problems are similar: most of the product consists of unique services. Various techniques have been developed to deal with this problem. In some instances, the hedonic approach can be used. Measurements are often based on price movements of inputs of materials and labour, although the implicit assumption of constant productivity inherent in this approach is unlikely to be true over any extended period. In spite of the fact that comparable products are rare, it may be that a price index based on a small number of observations can serve as an adequate indicator for a wider group of products. A variant of this approach is the "standard product" method, where a specific item (house, ship, machine) is specified in great detail and the price of the standard product

[7] These issues are discussed at length in the report of the Secretary-General to the Statistical Commission at its nineteenth session, "The feasibility of welfare-oriented measures to complement the national accounts and balances" (E/CN.3/477).

is then estimated in each period by industry experts; however, here again the "standard" is likely to become obsolete rather quickly. Alternatively, it is often possible to identify relatively homogeneous components of a unique product (the propulsion machinery of a ship, the walls of a house) for which price and quantity data can be obtained. Subject to the limitation inherent in assuming fixed technology, pointed out above, it may then be possible to combine the component indexes into over-all indexes.

Specification versus *functional definition*

61. One final question that needs to be considered in this context is that of how commodities are to be identified. At one extreme, specification pricing identifies commodities by listing in great detail all of their physical characteristics. Thus an article made of metal would not be classed with a similar article made of wood. At the other extreme, only the function of the commodity is considered. A wooden table and a metal table would be classed together if both were used for the same purpose. This question becomes particularly important in the consideration of capital goods, where the only use is for further production and where the physical specifications of products seldom remain unchanged for long. With specification pricing, technological changes that involve altered specifications for a machine would lead to the new machine being considered a different product; this in turn, as pointed out above, would lead to the change in its value being classed as a quantity change rather than a price change. But functional pricing would consider the new machine the same product as the old as long as it performed the same function and so would class its change in value as a change in price. Specification pricing of capital goods, which leads to treatment of improvements in technical characteristics as increases in the quantity of capital goods produced, will locate productivity increases in the capital-goods-producing industries. But functional pricing will treat such improvements as price changes and the measured quantity of capital goods will remain unchanged. Thus the increased productivity of the capital goods will appear as increased productivity of the capital-goods-using industries. Thus the decision as to what pricing method to use will determine whether productivity change is measured as occurring in the industries where the capital goods are produced or in the industries where the capital goods are used. There is no theoretically correct solution to this problem; the choice of pricing method must depend upon the intended use. Decisions will be made on a pragmatic basis, identifying as separate products both capital goods serving different functions and capital goods with significantly different specifications.

THE SELECTION OF UNITS

62. One of the constraints of a consistent system of price and quantity statistics and indexes is that the various parts must fit together. This is, however, also one of its great advantages, since it means that it is not necessary to make separate computations or collect separate data for all the indexes needed.

63. It is common practice to take either the price or the quantity index as the primary measurement and to derive the other from the primary measure together with expenditure data. There are some commodities for which quantities are the natural primary measures; these are found especially in primary industries—agriculture and mining—but they may also occur in some branches of manufacturing and in some services. On the expenditure side and at higher levels of aggregation, however, prices are usually the only feasible measurement. No general recommendation can be made in this respect. The choice will depend in each case upon the possibilities of data collection.

Derivations and approximations

64. Various other kinds of derivations from the data in addition to those mentioned above are also possible. Among the most important are:

(*a*) Activity-type indexes from commodity-type indexes;

(*b*) Approximate basic value indexes from market price indexes combined with information on taxes; and

(*c*) Disposition-type indexes from supply-type indexes or vice versa, taking advantage of input-output relationships.

65. The term "derivation" is used here in a relatively broad sense to mean that different indexes may be based on the same data and that in the calculation of some indexes entire or partial use can be made of the calculations of other indexes. In some cases, the derivation may mean identity (e.g., some activity-type price indexes may be considered to be the same as the corresponding commodity-type indexes); in other cases, the derivation consists of a simple arithmetical operation (dividing price into value to obtain quantity); in still other cases, some reweighting is needed to yield indexes for different purposes.

Kinds of prices

66. In the discussion to this point, it has been tacitly assumed that once a commodity has been identified an unambiguous price can be observed for it. In many cases, however, this is an extreme over-simplification. Quite apart from the problems of sampling variation discussed below, there are many different kinds of prices and for any given index it is necessary to make a choice among them, although the choice may differ for different indexes. Order prices reflect the current market but they relate to output that will be delivered at some time in the future. Contract prices relate to current deliveries but they reflect market conditions at some time in the past. Spot prices relate both to the current market and to current deliveries but they often reflect only a minute proportion of total production and they could be expected to be quite different if their share of the market were larger. Where production extends over a long period of time, particularly for capital goods, there may be progress payments. Prices may vary according to size of order. There are conflicting aims to be met in choosing among this welter of available pricing information. For the purpose of deflating the national accounts, the objective should be to relate the price to the current-value aggregate. In other words, that price should be chosen that most nearly reflects what was paid for the current period's output. This may entail choosing long-term contract prices, even where there are not relevant to current market conditions. These prices, however, are quite inappropriate for forward-looking or predictive uses. For these purposes, order prices are more generally useful and occasionally spot prices are important. Thus it is clear that it may frequently be necessary to consider more than one price for a given commodity.

67. Even when it has been decided which type of price is wanted, a problem may still remain in observ-

ing it. List prices may often differ substantially from the prices at which transactions actually take place. There are many kinds of discounts and special services and, conversely, add-on charges that affect the relationship between transactions prices and list prices. Attempts to adjust list prices for discounts and added charges often do not reach the same result as is obtained from a direct observation of transactions prices. In principle, it is the transactions price that is ordinarily wanted, although for reasons of cost or availability it may be necessary to use the adjusted list price as a proxy.

68. One special case that presents difficulty is that of internal transfer prices. When a producer obtains inputs from a related enterprise—a corporate affiliate or another branch of the same enterprise—the prices that are set may be quite arbitrary. It is, for instance, frequently advantageous for a parent company to concentrate its profits either in a particular industry or in a particular location, often for reasons of tax advantage. Steel manufacturers may shift their profits back to their wholly owned coal-producing subsidiaries, where tax treatment is more favourable, by setting unrealistic purchase prices for the coal they use. By manipulating the prices at which the subsidiaries' products are purchased, profits may be kept in foreign subsidiaries or alternatively transferred home. These problems can be ignored where such internal transfer prices are infrequent but there are some commodities and some activities where they may account for a significant proportion of the total. In such cases, it may be necessary to abandon value as one of the primary measures, instead employing a measure of physical quantity combined with an estimate of what the equivalent market price would have been.

The design of the data-collection programme

Over-all considerations

69. As was pointed out above in the discussion of the uses of price and quantity statistics, different data are needed for different purposes and it is neither feasible nor desirable to ignore these differences. The forward-looking, monitoring or predictive uses require immediacy. Data must be available as soon as possible after the period to which they refer and they must be compiled frequently—for maximum usefulness, monthly or, in some cases, weekly. Since interest in these indexes often centres on particular commodities, especially when the price indexes are used for indexing contracts and similar purposes, very detailed and highly specified data are needed. It is not feasible to expect indexes with comprehensive coverage to be compiled either as frequently or as quickly as are those for predictive uses, nor is there any need for such immediacy. There are some parts of the economic system, such as the service industries and government, where separation of price and quantity is conceptually obscure and measurement provides an approximation at best. The available methods of estimation in these areas are not likely to cast very much light upon short-period variations. Yet for some purposes the need for comprehensive coverage is sufficient to make even approximations acceptable. These sorts of uses—deflation of the national accounts, longer-run analysis of price and output behaviour—are not those where either frequency or immediacy are especially important and less frequent periodicity and a longer delay in compilation do not seriously reduce their usefulness. For other parts of the system, a periodicity more frequent than the length of the production period is of doubtful utility and questionable validity. This is true, for instance, of output indexes for field crops in agriculture and to some extent of those of heavy capital goods with a long gestation period.

70. The strategy of data collection must make allowance for these differences in needs, while at the same time endeavouring to maintain as much representativeness as possible and to make as efficient use as possible of the data collected. The sample design must take into account the prices and quantities for which there is a demand for frequent and quickly available reports as well as those for which less frequent reporting is acceptable. The choice of the specific commodities for which frequent observations are to be made will depend upon a number of factors, including the competing demands of potential users, the ease of collection and the resources available. The relative importance of such factors will necessarily differ from country to country. It is usually easier, in a market economy, to collect prices of relatively homogeneous products for which there are established markets; these tend to be products at early stages of the production process. This is even truer of data on quantities: the number of tons of steel produced in a given week is a relatively easy statistic to collect, whereas determining the quantity of computers or airplanes produced takes much analysis. Such price and quantity information on basic materials and other standardized products is widely collected and widely used for monitoring and forecasting. Beyond this, the information assigned high priority must reflect the most urgent demands, the frequency of observation decreasing as the complexity increases. It may be expected that emphasis will be placed on the most important components of a country's commodity output; in these areas the data gathered to meet the monitoring demands of users of detailed indexes (which may shift from time to time) should be supplemented with enough data gathered on a probability sampling basis to ensure adequate over-all representativeness. High priority will often be attached to quantity indicators of at least trade and transport, if these are easily available (as they may be either from an administrative source such as the tax collector apparatus or from the industry's own records). Finally, some parts of the final-use data, especially consumer prices, may be expected to be emphasized.

71. But this sort of balancing between response to short-term demand and difficulty and cost is an insufficient basis upon which to rest a longer-range collection programme. The collection programme should take into account the nature of price and quantity observations. Probability sampling is based upon the assumption that the observations collected are independent (at least within strata). This, however, is far from a valid assumption for prices, where whole groups may be expected to move in much the same way. Although we no longer expect (as Irving Fisher did) that the behaviour of all prices is similar, the theory of price and value does suggest that there will be groups of prices subject to the same influences that will behave in the same way. Where groups of prices move together, it is not necessary to observe all of them with the same frequency. Some can be checked must less frequently and others can be used as proxies in the interval. The determination of what prices are redundant in a par-

ticular economy is an empirical question that depends upon the analysis of past behaviour.

72. Beyond the data needed at frequent intervals and the more comprehensive data needed on a quarterly or annual basis, the design of an adequate data-collection programme requires intensive (or bench-mark) study at less frequent intervals. Such a bench-mark study should endeavour to cover the total value of gross output, in terms of both its origin and its disposition, in as much detail as possible. What is "possible", both in terms of frequency and in terms of detail of coverage, is a question of the resources available; a relatively complete bench-mark study once every five years is a reasonable objective. Apart from its intrinsic usefulness as an analytical tool, such a bench-mark study is needed to test the validity of the samples used in the periods between the bench-marks.

Sampling problems

73. Even on the most comprehensive bench-mark basis, all collection of price and quantity data inevitably involves the selection of a sample out of all of the commodities and respondents in the economy. This is not the place to discuss technical considerations of sample design but some of the questions that arise will be briefly noted.

74. Prices may move differently in different areas (cities, villages, rural areas), in different establishments producing the same goods or services or in outlets selling them, for different commodities and for different specifications of the same commodity. The sample design should capture all of these differences. The example of consumer price indexes may illustrate the complexity of the sampling problems involved. First, a sample of areas is needed, within which to conduct expenditure surveys and price collection. Within each area, a sample of families or consumer units must be selected from whom data on which to base expenditure weights can be obtained and samples of outlets are needed at each sampling point from which price quotations can be obtained. Furthermore, since it is impossible to price all the thousands of items that consumers buy, it is necessary to select a sample of items for pricing. Finally, pricing is usually done at a specific time of the month or quarter so there is, in effect, a sampling of time.

The selection of areas

75. The selection of cities, villages and rural areas in which the prices will be observed depends on the extent to which price changes differ for different types of agglomerations or different regions and it depends upon the resources available. The kinds of strata that need to be distinguished depend on the types of agglomerations that exist and on the extent of differences in price trends between regions. Where regional price trends do not differ substantially, it is sufficient to distinguish metropolitan areas, other large cities, small cities, villages and rural areas. Where regional differences are important, a good geographical dispersion is also desirable. These are all empirical questions and can be tested. The relatively high cost of price collection does not always allow the following of best principles; in many countries the collection of data is restricted to the capital and a relatively small number of other cities. Even where resources are limited, however, some attention should be given to the problem of ensuring a good geographical dispersion, since ignoring the problem can lead to quite misleading results where a substantial part of the population lives in rural areas. There are some prices that tend to behave more or less similarly throughout even large countries, whereas others, such as rent, may behave quite differently from place to place. A distinction needs to be made also between price levels and price changes. Even where levels differ regionally, changes over time may be similar or may move in predictable ways.

The selection of commodities

76. The problem of selection of commodities arises in connexion with most types of price indexes, since it is never possible to observe the whole universe. There are certain principles that can be used in making the selection. First, as much advantage as possible should be taken of stratification, since the sampling error will be reduced if the dispersion within the strata is smaller than the dispersion in the whole universe. Secondly, the selection of commodities should reflect their importance in the universe being considered. Except as noted below, each commodity should have a probability of being selected in the sample that is proportional to its importance, somehow measured. There are, however, other criteria which should also be taken into account. Commodities differ both in importance and in the accuracy with which they can be observed. A departure from probability sampling to include items selected according to other criteria, such as ease of measurement, does not necessarily involve a bias. The crucial question is whether the items selected measure the price movement as well as would those that would have appeared in a probability sample. This is a question that can only be answered by empirical testing, using comprehensive bench-mark data.

77. It is expedient to make the commodity selection in three stages. The first stage is the commodity group level. For the consumer price index, examples of this level are bakery products, meat, fish, fruit etc. Weights, in the form of money expenditures, can be obtained from consumer expenditure surveys for all of these groups. At this level, coverage can be exhaustive (i.e., all groups can be covered). The second stage is the identification of the commodity or item; this consists of more homogeneous categories within a commodity group, like bananas, apples, oranges. Weights are not always available at the commodity level but they can usually be estimated. At this level, a combination of purposive selection with probability sampling is appropriate, such that the more important items are included in the sample with certainty. The third stage is the specification level, which gives the detailed identification of the particular items to which the prices collected relate, for instance, "banana, yellow variety, best quality, full-sized fruit, such as Cavendish or Gros Michel; fruit should be at least five times as long as it is broad". At this level, weights are seldom available, so that purposive selection is necessary, taking into account the relative importance of the item, the possibility of defining and measuring its quality, the expected stability of its characteristics and other similar aspects.

78. Building up index numbers from the elementary series involves imputing variations in the sampled items to other items. If the sample is efficiently selected, most of the non-sampled commodities should be similar in price movement to the sampled commodities; the degree of similarity can be tested and the amount of error introduced by imputation can be measured by making use of the periodic bench-mark data. In gen-

eral, the imputation of the price trends of sampled commodities to other commodities is to be preferred to the imputation of quantity trends, since in most instances the prices of substitutable commodities with similar production processes are more highly correlated than are the quantities of these commodities. Where commodities are truly substitutable, a very small change in their relative prices may lead to large swings in their relative sale; however, it requires very special conditions of inelastic supply or demand for small changes in quantity to result in large swings in price.

Selection of respondents

79. Methods of selecting respondents (establishments, sales outlets, households) will differ from field to field and also from country to country. In some instances—for example, with the various producer price indexes—it is expedient to select the respondents before selecting commodities, since the classification of establishments may constitute a valuable first step in the selection of commodities and at the same time may facilitate the collection of co-ordinated figures on value, quantity and price. In some countries the production and sale of certain products are highly concentrated in a relatively small number of establishments, so that coverage of establishments can be nearly exhaustive. Some kinds of goods are sold by a variety of types of sales outlets where the prices may move differently; other kinds of goods are sold by only one type of outlet.

80. In the case of business establishments, a basic requirement for making the selection is a list of all establishments or outlets producing and/or selling a given group of commodities. The establishments should be divided into strata by kind of activity, location and possibly other characteristics such as kind of sales outlet (e.g., small shop or supermarket) and by size, determined by some indicator such as gross output or employment. Within strata, probability sampling would yield a given level of accuracy at minimum cost if the observations were independent and the cost of collecting all data items were the same. Since neither of these conditions is normally met, however, some modification of strict probability sampling is usually advantageous. Larger establishments can usually furnish more reliable figures more quickly, so they are likely to be the best source of data for the more frequently compiled indexes. Smaller proportions of smaller establishments can be added to improve representativeness over longer intervals and as resources permit. Provision must also be made for taking into account changes in the mix of producers, such as shifts from smaller to larger firms and the effect that these changes have on the average price paid by purchasers. Finally, consideration must also be given to the amount of information that any one respondent is asked to supply, in order to keep the burden on respondents within acceptable limits.

81. The problems arising in selecting household samples are somewhat different. Here, strict application of probability sampling is appropriate within strata defined according to geographical location, size of place and socio-economic characteristics.

METHODS OF REPORTING

82. There are a number of widely differing approaches to the actual collecting of price and quantity data and the different methods are likely to have both substantially different costs and substantially different validity. The primary difference is between methods that employ direct collection in the market by agents of the statistical office and those that rely upon reporting (sometimes entirely voluntary) by enterprises or by trade associations or other groups. Direct observation is usual for consumer prices but it is much less generally employed for obtaining data from producers. Where reporting is voluntary, its success depends essentially upon the goodwill or self-interest of the reporting units. To keep the results statistically valid, it is necessary to secure the co-operation of at least the major part of the respondents. This, in turn, often necessitates shaping the content of the data collected so that it meets the needs of the respondents being asked to supply it.

Problems arising in specific areas

83. The discussion to this point has been concerned mainly with the problems of price and quantity data in the areas where the separation of price and quantity components of value is relatively straightforward. These areas—agriculture, mining, manufacturing and many commodities purchased by consumers —constitute the bulk of traditional index measurement. But extending price and quantity measurement to other sectors leads to new problems. For the most part, the problems arise because output is hard to identify or because of the difficulty of separating out a price and a quantity component. Some of these special problems will be discussed in this section.

RETAIL AND WHOLESALE TRADE

84. Indexes relating to distributive trade are used both as short-run indicators of economic activity and as components in the construction of national accounts in constant prices.

85. For monitoring short-run changes in the level of economic activity, use is often made of indexes of retail (occasionally wholesale) trade turnover. "Turnover" in this sense is defined as aggregate sales of all enterprises classed as engaging in retail trade. Since this statistic is used primarily as a very short-run indicator, its current value serves the purpose quite well and careful attempts to deflate it are seldom made.

86. On the price side, indexes of both wholesale and retail prices are very common and, again, they are regarded as important indicators of short-run change. In their usual form, however, such indexes seldom have much relation to the distributive trade industry. Wholesale price indexes are among the oldest of compiled statistics, having been computed in some countries for close to a century. They exist in a very wide range of variants;[8] but their intent is usually to reflect producers' prices at fairly early stages in the production process—in agriculture, mining and manufacturing rather than in the distributive trades exclusively. For this purpose, indexes of producers' prices in the designated industries might be expected to serve better. Retail price indexes, similarly, are often of rather heterogeneous composition and therefore of questionable meaning. Forward-looking or monitoring indexes are certainly needed but they should be explicitly formulated to meet the intended use. Since one of the prime requisites of such indexes is speed and ease of reporting, information about the distributive trades is a poor candidate for inclusion.

[8] For a survey of these variants, see "National practices in compiling price and quantity index numbers" (ST/ESA/STAT.74/Rev.1).

87. As components of the national accounts at constant prices, frequency and timeliness are not very important; what is wanted is a true measure of the output of these industries alone and of the deflators appropriate to it. In SNA, the gross output of distributive trade is defined as the gross margin, i.e., the difference between the sales value and the purchase cost of goods sold. Value added is defined as this gross margin minus intermediate consumption, the latter being composed of such items as rent, heat, light and office supplies but excluding the cost of goods sold. The decomposition of the gross output of distributive trade into separate price and quantity components is, in principle, similar to its decomposition for any other activity, but since in this case gross output is expressed in terms of a monetary margin and not in terms of a physical quantity of goods produced it is difficult to find a suitable physical measure of the quantity of services rendered. It is, however, possible to make use of double deflation to solve this problem, deflating sales value and purchase cost separately.

88. In actual practice, the quantity index of the gross output of trade is often computed as a weighted average of the percentage changes in quantities of different goods sold weighted by the gross margins of these different goods in the base year. This method is satisfactory if margins are stable. It should, however, be checked by periodic studies of the actual behaviour of margins.

89. In a technical sense, this approach has the advantage that it provides constant price estimates and indexes for trade flows that are consistent with those for corresponding aggregates in producers' and purchasers' values. However, it does not provide a direct measure of the quantity component of the value of services rendered by trade. The implicit assumption is that the relative trade margins during the base period reflect the amount of trade services involved in the handling of the goods. This assumption often is not valid for individual commodities, since trade margins may vary significantly from product to product for reasons unconnected with the amount of trade services supplied. The method described is, therefore, more acceptable at a somewhat more aggregated level. On the other hand, care should be taken to ensure that important differences in margins that correspond to real differences in the amount of trade services required to handle the goods are taken into account. Stores that deliver, for instance, are performing more service than those that do not. The level of aggregation at which the computations are made will determine the extent to which shifts in sales between goods with different gross margins and between types of shop will appear as quantity or price changes. As was noted in the discussion of price discrimination and quality change above, aggregation will increase the measured price change and disaggregation will increase the measured quantity change.

Transport

90. In the transport industry, the fact that prices are often controlled or regulated simplifies access to the information needed to compile price and quantity indexes. But this advantage is offset by the complexity of transport services; this complexity gives rise to exceptional difficulties in specifying output.

91. The traditional units of measurement of transport performance are the ton-kilometre and the passenger-kilometre. Restricting the measurement to these dimensions, however, omits such characteristics as mode of transport, kind of goods transported, speed, handling of goods, average distance and size of shipment, area and direction of shipment and quality of service. The methodological aspects of this problem have been dealt with above in the discussions of price discrimination and quality differences. The conclusion there drawn was that most of these differences should be regarded as differences in quantities and not in prices. In practice, however, taking all of these differences into account would require a degree of detail that would be likely to raise serious problems; some simplification is necessary. This limitation has important consequences. Changes in prices and quantities can only be measured adequately if the groups for which the measurements are made do not differ significantly with respect to the characteristics not measured. As in all the other areas where this problem arises, it will be necessary to balance validity against cost in order to arrive at an acceptable compromise.

92. It was pointed out above that there are some instances in which it is preferable to regard price indexes as the sources of primary information and others in which it is easier to collect quantities directly. In the case of transport, quantity indexes compiled directly in terms of ton-kilometres or passenger-kilometres may, at least for some modes of transport, be easily obtainable. But generally it is not possible to obtain a sufficiently detailed breakdown to ensure that the groups combined are fully homogeneous and if there are changes over time in their composition the quantity index will not accurately reflect the volume of transport services rendered. Whether preference is given, therefore, to the direct computation of price or of quantity indexes will vary according to circumstance, between countries, between modes of transport and from one situation to another.

The service industries

93. Problems arising in the service industries are of two types. One type of problem, which applies to a broad spectrum both of services sold in the market and those provided by Governments and the non-profit sector, again reflects the difficulty of identifying the unit of output. The second is an additional problem in the case of those services not sold in the market: not only is the quantity of output not readily observable but even its value is difficult to determine.

94. Services of Governments and non-profit institutions not sold in the market are valued in the national accounts at cost, i.e., the total of intermediate consumption, compensation of employees and consumption of fixed capital spent for these services; this procedure is usually followed also in the construction of output indexes and in the measurement of consumption and other end uses. Questions can be raised about this procedure both on the ground that it is not symmetrical with the treatment of marketed services (for which operating surplus and indirect taxes are included) and on the ground that cost does not necessarily represent the users' valuation of the services. Despite these objections, however, there does not seem to be any reasonable alternative to the use of cost as the basis for determining value.[9]

95. The problem of identification of output is in many ways more difficult. In many fields, services are

[9] For a much more extended discussion of this question, see the forthcoming United Nations publication, *Manual on National Accounts in Constant Prices.*

essentially unique or at any rate not sufficiently standard for there to be a meaningful unit of output that can be counted. Although there are some service fields, such as dry-cleaning and hotel rooms, where a good measure of output can be found, there are many others, such as medical care, education and public administration, where there is no obvious unit. In such cases, attempts are usually made to calculate an index with indicators that can be regarded as proxies for movements in the quantity of output.

96. The most frequent solution is to use movements in inputs as a proxy. This, of course, involves the assumption that productivity does not change, an assumption that frequently cannot be defended. The simplest input indicator is number of persons employed. Another indicator sometimes proposed is wages and salaries: this assumes that average wages and average productivity move together, an assumption that is sometimes preferable to assuming zero productivity change; however, it also implicitly assumes that output price does not change, which makes its use for measuring this price change dubious. Sometimes explicit attempts are made to adjust input-type indexes for estimated productivity changes. Various methods are used and to assume some productivity change is in most cases probably better than to assume none; however, at this time there appears to be no sound basis for making the estimates.

97. In some cases, indicators are used that are neither of the input type nor the output type. They may attempt to measure the benefit of a given service, as for instance the number of students achieving a given qualification, or they may show use, as number of hospital bed-days. The crucial question in all these cases is the extent to which the indicator is correlated with what is supposed to be the output of the industry. In line with the principle enunciated above (para. 53), measuring the utility derived from output is beyond the scope of the kinds of indexes under discussion here.

98. Whatever indicator is selected, substantial improvements can be achieved by stratification, by determining independently the changes in the indicators for each stratum and computing the quantity index for the industry as a weighted average. Health services, for example, could be divided according to place of delivery (hospital, clinic, doctor's office, home) or according to type of service (nursing, laboratory services, physician's services). Instead of assuming that there is no productivity change at all, this implies that there are no changes within the categories distinguished. Productivity changes that are due to changes in the relative proportions of the different categories are taken into account. This is especially important where employment is used as a proxy, since it is only in this way that any allowance can be made for changes in the mix of labour employed.

Construction

99. The main source of difficulty in compiling indexes for the construction industry lies in the fact that construction products as a general rule are unique. This basic difficulty is aggravated by the relatively long production process, so that at the end of each accounting period the proportion of work in progress is high.

100. The variety of methods used by different countries for compiling construction indexes is striking. They may be classified roughly into three types: those based on output, those based on input and those based on components.

101. The main difficulty in applying indexes of the output type springs from the uniqueness of products in this industry. If the sample is limited to really comparable products it is likely to be too small and not sufficiently representative; but attempts to increase the size of the sample will make quality differences more important and begin to distort the results. One of the variants of this method involves the selection of a standard building or buildings whose quality characteristics are described in great detail. Then for each consecutive period an estimate is made of the cost or price of the same type of building, using the technology of the base period but current wages, materials costs etc. This variant also suffers, however, from low representativeness and the assumption that technology will be unchanging.

102. A more promising development in output-type indexes is the hedonic approach. The basic principles of this method were described above. So far, experience with this method is too restricted to evaluate its applicability to the construction industry in detail but there can be no doubt that it deserves further attention.

103. Inputs into construction activities can be measured much more easily than can outputs and input-based indexes were widely used at one time. There are various variants in this family. The most common practice is to compile total input indexes covering wages, materials and often also capital consumption. It is difficult to judge to what extent productivity changes distort such indexes but it is clear that the effect may vary from country to country and from period to period. Most countries that use this method seem to consider the effects of productivity changes to be important and efforts have been made to reduce their distorting effect by means of various types of adjustment.

104. Measurements based on the components of production occupy an intermediate position between output-type and input-type indexes. Construction products have a number of components that are not end-products but are more than simple inputs. It is often possible to specify these components quite exactly, as for instance interior wall panels of a particular type. The quantities and prices of these components may be much more readily measurable than those of the finished product as a whole. The component method has a number of advantages. It is less subject to inadequate coverage and to changes in quality than are methods based on output measurement. It is less affected by distortion due to changes in productivity than are input-type measures. If no adjustments are made for changes in productivity, the input method is distorted by both intra-component and intercomponent productivity changes, while the component method is only distorted by intra-component productivity changes.

105. Reviewing the relative advantages and disadvantages of the various possibilities, the hedonic approach and the methods based on components of production are the most promising. Combinations of the various procedures may also be very useful; in the present state of the art there is little advantage in trying to unify the methods and to apply the same procedure in all parts of the construction industry.

Exports and imports

106. Although unit value and quantum indexes of imports and exports have been compiled for many years in practically all countries, not very many coun-

tries are in a position to take full advantage of the detail available in customs records. Often it is only aggregation of these records that are used as the primary input for the compilation of indexes. In such cases, quantities may relate to relatively broad categories, such as the four-digit items of the Standard International Trade Classification. Where this happens the resulting measures may cover insufficiently homogeneous groups of products, so that changes in the observed unit values will be affected not only by actual price changes but by changes in the composition of the groups in question. The use of unit values raises particular problems for manufactured commodities where the most detailed of customs records may conceal substantial price ranges. Even small changes in the composition of such groups may cause considerable distortion.

107. One way of improving the quality of external trade indexes is to define the elementary categories to which the quantity and unit value data relate so as to increase as far as possible the product homogeneity of these categories. This, however, is not always possible within existing procedures. It is likely, therefore, that radical improvement in the quality of external trade indexes can be achieved only by equally radical changes in methods of handling customs records (including improved classification systems and procedures) or perhaps, as is the case in some countries, with the help of additional variables (for example, geographical origin or destination, mode of transport) and by supplementing them with data obtained from special external trade price surveys.

108. The use of data from price surveys in addition to customs records may also have important advantages in obtaining consistency throughout the system of price and quantity statistics. It is desirable that the distinction between the quantity component and the price component in changes in value should be, as far as possible, the same in external trade transactions as in transactions in the same products internally. With the methods now generally used, the unit value bias is usually substantially smaller in the latter. However, price surveys are costly and they may also introduce other kinds of bias in the calculation of trade indexes. In particular, fixed-weight price indexes, especially in this area, may rapidly lose representativeness, whereas a unit-value index will not. This question is discussed further below in connexion with changing weights; it is perhaps sufficient to note here that both types of index have their place.

109. Apart from questions of unit value bias, other problems also arise in the compilation of import and export price and quantity indexes. Prices for the same commodity may differ according to the country from which it is imported or to which it is exported. This question was discussed above in the consideration of price discrimination, where it was pointed out that the various requirements of the system of price and quantity statistics are to some extent in conflict. For use in the deflation of national accounts, the general rule stated above is applicable to exports: changes in value caused by shifts from one market to another are to be treated as changes in quantity and not in price. For imports, the argument is less straightforward. Physically identical inputs obtained from a higher-priced source because the lower-priced source cannot supply a sufficient quantity should be treated as affecting price and not quantity. Also, with external trade indexes, it seems preferable in view of their main functions to consider that identical goods sold or bought in different markets are, in general, one single product and consequently that changes in value caused by shifts from one market to another are price changes and not quantity changes.

Producers' durable goods

110. Problems in the construction of price and quantity indexes for components of the final uses of gross product are in many ways the same as the problems in producing industries but the problems have some special aspects. In the case of producers' durable goods, the main problem arises in the identification of the output. Many items of capital equipment are nearly unique; for these items it may not be possible to obtain a sufficient sample of items with identical specifications in two time periods to assure representativeness. An index based upon items with identical specifications may well not yield an appropriate result. Such an index would be biased to exclude items where rapid technological change is taking place. If, as is likely, technological change and productivity improvement tend to cause prices to increase less rapidly or to fall faster, basing the index only on unchanging items will overstate the increase in the price index and correspondingly understate the increase in the quantity index. An understated quantity index in the capital goods-producing industries will in turn bias productivity estimates both in the capital goods-producing countries and in the industries that use the capital goods, understating it in the former and overstating it in the latter. In this case, it is the complete omission of the items with changing specifications that leads to this result—i.e., to the loss of representativeness. Loss of representativeness is not a consequence of the choice of specification pricing rather than of functional pricing as discussed in paragraph 61 above.

111. Nevertheless, loss of representativeness may be avoided if output of capital goods is identified by the function performed rather than by physical specifications; however, this solution entails a danger of going too far in the opposite direction. A functional approach attributes all productivity increase to the capital goods-producing industries, that of the capital goods-using industries being by definition unchanging. Thus, in terms of the valuation of producers' expenditures on durable goods in constant prices, a specification definition of output will result in a higher price and a lower quantity than will a functional definition. Here again, a pragmatic compromise is necessary; it is not feasible to lay down fixed rules.

Owner-occupied housing

112. The valuation of owner-occupied housing in constant prices is an area where different approaches may lead to quite different conclusions. As with other components of end use that do not pass through the market, it is necessary in this case to establish both the current price value and an appropriate deflator. Current price value is usually based on actual cost of operation, although the rental value of equivalent property is sometimes used. Problems may arise, however, in defining the scope of operating costs, in particular the opportunity cost of the capital involved in the owner's equity. A similar problem arises in constructing an appropriate deflator. The question is whether the increase in the value of the owner's equity should be considered an offset to his operating costs—i.e., as negative depreciation? That procedure has been

proposed and experimentally implemented in some countries. However, in a period of rising prices it leads to falling outlays on owner-occupied housing, a result which is intuitively unacceptable. An approach that would seem to be more in accord with the intent of SNA would treat the increase in value as a capital gain and confine the scope of operating costs to depreciation excluding revaluations.

Changes in stocks

113. The primary interest in changes in stocks, in the context of price and quantity statistics, is in the derivation of an appropriate figure for inclusion in the national accounts at constant prices. This poses a few theoretical problems but a great many practical problems in obtaining data. What is wanted is the change in the physical quantity of inventories from the beginning to the end of the accounting period, valued at the average prices prevailing in the base period. Ordinarily, however, it is not possible to observe the change in the physical quantity of stocks and an indirect approach is needed. Thus, prevailing practices in inventory accounting become important. At any given point in time, an establishment's stocks are likely to include identical (or substantially identical) items purchased at different dates for different prices. When an item from stock is used or sold, it may be valued at any one of these prices. Where the price chosen is the earliest available price, the method is called first-in first-out (FIFO). Where the price chosen is the latest available price, the method is called last-in first-out (LIFO). FIFO is the older method; it was generally used for many years. When prices are rising with some rapidity, however, FIFO may introduce a significant difference between the prices at which materials entering the production stream are costed and the prices that must be paid for current supplies. For this reason, there has been an increasing swing to the use of LIFO.

114. The change in the value of stocks from the beginning to the end of the accounting period reflects a combination of the actual change in quantity of stocks and the change in the distribution of prices applicable to the total stock at the beginning and end of the period. To separate out the change in quantity, the two stock figures must be reduced to a common price base and the latter in turn must be related to average prices in the base period. This is a somewhat easier task where LIFO is the prevailing method, since the beginning and end price distributions will have many more individual prices in common. Correspondingly, the change in the value of inventories will be much closer to the value of the change in inventories (in current prices).

Chapter IV

THE COMPILATION OF INDEXES

Types of index formulae

115. In the early history of index number construction, a great deal of effort was expended in the search for a perfect index formula and a very large number of formulae with different characteristics were devised and analysed. It is now generally recognized, however, that no one index will serve for all purposes. Different indexes, compiled according to different formulae, will be needed in different circumstances. A very large number of formulae are encountered in the literature on index numbers but most of these are of only theoretical interest. This section will consider only those formulations that are actually fairly widely used by national statistical offices in compiling indexes.

116. The formulae most commonly used in compiling price and quantity indexes are the fixed base-weighted Laspeyres and the moving current-weighted Paasche and, occasionally, the cross-weighted Fisher formula. The algebraic definitions of these formulae are set out in table 2. The symbols p and q refer, respectively, to the price and the quantity of individual commodities and P and Q to price and quantity indexes. The subscripts 0 and 1 refer, respectively, to the base period and the current period. A subscript i should also be shown for the individual commodities 1 through n; this has been omitted in order to simplify the presentation. Two versions have been shown for each formula. Laspeyres price index numbers may be expressed either as aggregated indexes of prices weighted by base period quantities or as arithmetical means of base-period-value weighted price relatives. Paasche price index numbers may be expressed either as aggregated prices weighted by current period quantities or as harmonic means of current-period-value weighted price relatives. Quantity indexes similarly may be viewed in either way. Fisher indexes are simply geometrical means of Laspeyres and Paasche indexes. As a general rule, it is the second version of the formulae, with value weights, that is more convenient to use.

TABLE 2. ALTERNATIVE INDEX NUMBER FORMULAE

Type of formula		
Laspeyres ....P^L	$\frac{\Sigma(p_1q_0)}{\Sigma(p_0q_0)} =$	$\frac{\Sigma(p_0q_0(p_1/p_0))}{\Sigma(p_0q_0)}$
Q^L	$\frac{\Sigma(p_0q_1)}{\Sigma(p_1q_0)} =$	$\frac{\Sigma(p_0q_0(q_1/q_0))}{\Sigma(p_0q_0)}$
Paasche .....P^P	$\frac{\Sigma(p_1q_1)}{\Sigma(p_0q_1)} =$	$\frac{\Sigma(p_1q_1)}{\Sigma(p_1q_1(p_0/p_1))}$
Q^P	$\frac{\Sigma(p_1q_1)}{\Sigma(p_1q_0)} =$	$\frac{\Sigma(p_1q_1)}{\Sigma(p_1q_1(q_0/q_1))}$
Fisher .....P^F	$(P^LP^P)^{1/2} = \left(\frac{\Sigma(p_1q_0)}{\Sigma(p_0q_0)} \cdot \frac{\Sigma(p_1q_1)}{\Sigma(p_0q_1)}\right)^{1/2}$	
Q^F	$(Q^LQ^P)^{1/2} = \left(\frac{\Sigma(p_0q_1)}{\Sigma(p_0q_0)} \cdot \frac{\Sigma(p_1q_1)}{\Sigma(p_1q_0)}\right)^{1/2}$	

117. Laspeyres indexes, in the form given above, depend on fixed, base period weights that in time can become unrepresentative. Alternatively, Laspeyres-type indexes may be compiled using moving anterior weights with or without chaining. The appropriate formulae, for price indexes, are set out in table 3. Symmetrical indexes can be constructed for quantities. In like manner, Paasche weights may also be used with or without chaining.

TABLE 3. LASPEYRES PRICE INDEXES

	Comparison of		
Basis	*Period 1 with period 0*	*Period 2 with period 1*	*Period 2 with period 0*
I. Fixed weights	$\frac{\Sigma(p_1q_0)}{\Sigma(p_0q_0)}$	$\frac{\Sigma(p_2q_0)}{\Sigma(p_1q_0)}$	$\frac{\Sigma(p_2q_0)}{\Sigma(p_0q_0)}$
II. Moving weights, without chaining	$\frac{\Sigma(p_1q_0)}{\Sigma(p_0q_0)}$	$\frac{\Sigma(p_2q_1)}{\Sigma(p_1q_1)}$	$\frac{\Sigma(p_2q_0)}{\Sigma(p_0q_0)}$
III. Moving weights, with chaining	$\frac{\Sigma(p_1q_0)}{\Sigma(p_0q_0)}$	$\frac{\Sigma(p_2q_1)}{\Sigma(p_1q_1)}$	$\frac{\Sigma(p_1q_0)}{\Sigma(p_1q_1)} \cdot \frac{\Sigma(p_2q_1)}{\Sigma(p_1q_1)}$

118. Apart from the question of the time period to which they refer, the choice of weights is ordinarily a relatively simple matter that does not raise special theoretical complications, although it frequently entails extensive data collection efforts. In general, the weights are determined by the phenomena to be measured. For example, to construct gross output quantity or price indexes, gross output values should be used as weights. The weights should, of course, relate to the entire class for which a particular observation is standing as proxy, not just to the item specified.

119. A question will sometimes arise as to whether the weights should include imputed values. For example, should the weights of an agricultural production quantity or price index include the imputed values of home-consumed produce? The answer to this question must depend upon the purpose for which the index is to be used. In an agricultural output quantity index, where by definition non-marketed output is included, the weights should also include these non-marketed

values. In a quantity index of sales of agricultural products, on the other hand, the weights should be restricted to products actually sold. In a price index intended for deflation of agricultural output, imputed values should be included in the weights, since they are included in the current value figures that are to be deflated. On the other hand, a price index intended for the analysis of market conditions would be better without the imputed values in the weights. The essential criterion is to match the content of the weights to the content of the value figures being deflated.

Characteristics of the formulae

120. The characteristics of different index formulae are discussed at great length in the literature on index numbers and will not be repeated here. This section will examine only those aspects of the characteristics that have some relevance in determining the formulae and weighting systems in actual use.

Characteristicity of the weights

121. Weights should be characteristic of the periods being compared. Fixed-weight indexes tend to become obsolete as the period for which the same weights are used lengthens. Moreover, where fixed-weight indexes are used to make comparisons between periods neither of which is the base period, the weights may be uncharacteristic of either of the periods being compared. As will be pointed out below, there are some important advantages in keeping the weights constant over some period of time. Nevertheless, in order to avoid a substantial obsolescence the weight base must be revised periodically.

Bias

122. The concept of bias implies divergence from some expected value. In periods of rising prices, a Laspeyres price index will usually be higher than a Paasche price index; this is sometimes expressed as an upward bias in the Laspeyres index and a downward bias in the Paasche index. The difference between the Laspeyres and Paasche formulae is in general greater the more remote the two periods compared are from each other, since as the time lengthens the differences in quantity and price structures may be expected to increase.

123. There is no general rule as to whether using moving-average chained indexes will reduce this difference. If the structural changes are smoothly continuous in one direction, the difference between Laspeyres and Paasche chained indexes will be smaller than the difference between the directly compiled Laspeyres and Paasche indexes. However, in many areas (e.g., fruit, vegetables) the effect of fluctuations is greater than that of continuous trends and in these cases the moving-weighted chained indexes may show a larger difference than the directly compiled indexes.

124. The difference between the Laspeyres and Paasche indexes depends upon the dispersion of the price relatives, the dispersion of the quantity relatives and the correlation between movements in individual prices and their corresponding quantities. A total absence of dispersion among individual price or quantity relatives is unlikely; however, dispersion is often moderate, especially in centrally planned economies where many prices are controlled. As economic theory would lead us to expect, where there is a negative correlation between changes in relative prices and changes in relative quantities, a Laspeyres index will show a larger change in price (and a correspondingly smaller change in quantity) than will a Paasche index.

125. It cannot be assumed that the difference between the Laspeyres and Paasche indexes willl be negligible. Special attention should be paid to the magnitude of the difference in the case of consumer price indexes (where price and quantity changes are strongly inversely correlated) and in the case of certain agricultural products (where dispersion of quantity changes may be considerable) and in periods when structural changes in the economy are important or when price changes are large.

Transitivity

126. A series of index numbers is considered to be transitive if it is consistent from period to period. For three successive periods, the index for the change from the first to the second multiplied by the index for the change from the second to the third must equal the index for the change from the first to the third:

$$\frac{I_3}{I_1} = \frac{I_2}{I_1} \times \frac{I_3}{I_2} .$$

Very great importance is, in general, attached to this requirement and failure to meet it will considerably reduce the usefulness of an index.

127. Whether or not a system of index numbers is transitive depends primarily upon whether the weights are fixed or moving and whether the indexes for nonadjacent periods are compiled directly or chained. Fixed-weight indexes (i.e., Laspeyres) always satisfy the transitivity test, as do chained indexes. But moving-weight indexes without chaining do not.

Internal (structural) consistency

128. Although the need for internal (structural) consistency is often overlooked, there are some purposes for which its importance is overriding. In terms of constant price aggregates, consistency means that the parts should add up to the totals. Self-evident though this requirement seems, some of the methods used in practice do not meet it. Any index with moving weights may fail to meet the internal consistency test. So, also, will the Fisher formula, since additivity is inconsistent with geometric averaging.

129. Where interest is only in over-all indexes without any breakdown, the fact that the method applied does not meet the consistency requirement may be of little importance. But where the analysis of changes in structure is important, as for instance where continuous percentage distributions are published, the violation of the consistency requirement may be very troublesome. In particular, additivity is an essential requirement in the calculation of constant-price national accounts aggregates.

130. It should be noted that there is an inherent conflict between characteristicity, transitivity, and internal consistency; no index formula can satisfy more than two of these three objectives. For transitivity, fixed weights are best; but these lead to difficulty with characteristicity. Transitivity can be obtained without losing characteristicity by the use of chained moving weights; but in this case the internal consistency requirement is not met. Finally, indexes can be constructed which are characteristic and at the same time internally consistent; but in this case transitivity must be abandoned. This

circumstance arises, of course, because of the conflict between geometric and arithmetic averaging and a great deal of the index number literature is devoted to the construction of complex formulae designed to overcome this problem. It is, however, inherently insoluble and the various proposals are all based on compromises of one sort or another.

Factor relations

131. This test (often called the factor reversal test) requires that the product of quantity and price indexes be equal to the ratio of values in current prices. Of the indexes discussed here, only the Fisher type meets this condition. Neither the Laspeyres nor the Paasche index, by itself, will do so.

132. However, a fixed-weight Laspeyres quantity index combined with a Paasche price index will meet the factor relations test. This is shown in the following formula:

Ratio of values		*Laspeyres quantity index*		*Paasche price index*
$\frac{\Sigma p_1 q_1}{\Sigma p_0 q_0}$	=	$\frac{\Sigma p_0 q_1}{\Sigma p_0 q_0}$	×	$\frac{\Sigma p_1 q_1}{\Sigma p_0 q_1}$

Thus, to obtain constant-price national accounting aggregates (quantities) of true Laspeyres form, the deflators used in deriving them from current-price value figures must be of true Paasche form. This will result in price and quantity estimates that meet the factor reversal test for all comparisons involving the base period. For comparisons that do not include the base period, the factor reversal test still will not be met. A chained Laspeyres quantity index combined with a chained Paasche price index (or vice versa) will, however, always meet the factor relations test.

Simplicity of computation and interpretation

133. An additional property worth mentioning is simplicity. Ease of interpretation for the users and ease of computation for the producers are not irrelevant, although in some cases they may be of secondary importance. The Laspeyres and Paasche formulae are relatively easy to interpret, while the economic content of cross-weighted formulae and of chained indexes is less readily apparent. At the same time, cross-weighted, chained and moving-weight indexes are more costly, since they require the determination of new weights for every period.

The choice of index formulae and weighting methods

134. Since no one index formula can satisfy all the requirements of characteristicity, freedom from bias, transitivity, internal consistency, factor relations and simplicity, different formulae and weighting systems will be needed for different purposes and in different circumstances. Still, it is desirable that differences that give rise to inconsistencies in the system of price and quantity indexes should be avoided unless there are good reasons for them.

135. Indexes compiled for purposes other than national accounting, to meet the short-term needs outlined in chapter I, are usually for practical reasons of the Laspeyres type, since moving weights are not feasible over short intervals. However, since characteristicity is of great importance for these uses increasing attention is being given to the advantages of chained indexes, with weights changed as often as is feasible. There is again, an inevitable conflict between short-term analysis requiring up-to-date weights and longer-run analysis requiring additivity and transitivity. If resources permit, one possible solution is the provision of two indexes, one with changing weights for short-period comparisons and one with fixed weights for comparisons over longer periods of years.

136. For national accounting purposes, the need is to express changes in aggregates over a period of years in constant and current prices, so that the quantity indexes and constant price aggregates must meet the additivity and transitivity conditions and the corresponding price indexes must meet the factor reversal test. For a comparison of only two years, these requirements would be met by fixed-weight Laspeyres quantity indexes and the associated Paasche price indexes. If the necessary weights were available, it would be possible to move from Laspeyres price indexes compiled for monitoring and other short-run purposes to the required Paasche price indexes by a detailed reweighting of the basic price data. As a general rule, however, detailed weights are available only for bench-mark years. Furthermore, problems would still arise in comparisons of periods not including the Laspeyres base period. A compromise solution is therefore necessary. A frequent practice is to use Laspeyres price indexes to deflate current price values at the most detailed level for which both prices and values are available. The deflated elements are then added together. This is equivalent to using Paasche-type weights for combining these intermediate components rather than for combining individual commodities. An implicit deflator is then obtained by dividing the current price value by the deflated value. Thus both the price and the quantity indexes obtained are of a hybrid nature but they satisfy most of the required conditions. They are additive and transitive and they meet the factor reversal test. They will, however, lose characteristicity over time.

137. Marked differences between Laspeyres and Paasche indexes or between Laspeyres indexes and implicit deflators point to the need for shifting the weight base of the Laspeyres index to a later year. The frequency with which the base should be changed depends somewhat on how fast structural changes are occurring. Complete reweighting requires bench-mark data, for which a five-year interval was recommended above. At shorter intervals, a number of countries apply an intermediate solution, reweighting the indexes at some intermediate level of classification. This latter procedure may, however, fail to achieve its objective if product substitution takes place mainly within the categories for which revised weights are computed.

Chapter V

DISSEMINATION OF PRICE AND QUANTITY INFORMATION

138. The discussion to this point has been mainly concerned with the design of a programme of data collection and storage and with methods of compiling the data into indexes. There has been little consideration of priorities and none of dissemination. It is the purpose of this chapter to draw a distinction between collection activities, index compilation and a dissemination programme and to suggest priorities for each.

The framework of a data base

139. In the collection of data, it is important that the organization of the data base be such as to provide a place for all price and quantity data for which a need is anticipated. To serve this purpose the framework for the data base must be formally complete and it must accommodate data at the level of detail or disaggregation at which it is collected as well as at various levels of aggregation. It must illuminate the interconnexions among the various parts of the data and the various types of index.

140. The structure of such a framework was discussed generally in chapter II and illustrated in table 1. It is now possible, in view of the further discussion of data collection and index compilation in chapters III and IV, to expand the structure given in table 1. The first step in this expansion is shown in table 4, which presents a framework for the collection and storage of basic price and quantity data. It must be emphasized

TABLE 4. A FRAMEWORK FOR THE COLLECTION AND STORAGE OF PRICE AND QUANTITY DATA

Reporter and reference item	*Classification system*	*Valuation base*	*Basic data*
I. *Producers*			
(*a*) Gross output of domestic producers	ICGS subclasses (8-digit) of commodities within ISIC groups (4-digit) of producers	Approximate basic values Producers' prices	Prices Current values Some physical quantities Bench-mark weights
(*b*) Imports	SITC items (5-digit) ICGS subclasses of commodities (8-digit)	C.i.f. plus import duties	Prices Current values Units
II. *Purchasers*			
(*a*) Intermediate inputs of domestic producers	ICGS subclasses of commodities within ISIC groups of producers	Purchasers' prices	Prices Current values Some physical quantities Bench-mark weights
(*b*) Domestic final users	SNA categories ICGS subclasses (8-digit) where possible	Purchasers' prices	Prices Current values Physical quantity indicators
(*c*) Exports	SITC items (5-digit) ICGS subclasses (8-digit) where possible	F.o.b.	Prices Current values Units

Notes: Where cross-classifications are important, i.e., where producers' prices vary with the purchaser, or where purchasers' prices vary with the source of supply, identification of both producer and purchaser should be preserved.

Additional classifications, e.g., region, size of establishment, socio-economic class of purchaser etc., can be added as desired.

that this table does not represent a proposed programme for data collection. It is, rather, a presentation of the structure of a data system. In other words, it is a framework into which the data that is collected can be fitted. It is intended to provide a niche for any and all basic price and quantity data that are collected; it is not intended to recommend what data should be collected. What part of it countries will find it useful or possible to implement will depend upon their individual circumstances.

141. Such a framework is useful for both developed and developing countries. In developed countries, a substantial part of the data specified will in fact be collected; the framework is essential for putting order into the collection and showing the relationships among the various kinds of price and quantity data. For developing countries, the framework should make possible a more rational choice of priorities in establishing data collection programmes and should promote the maximum efficiency in using what data are collected.

142. Table 4 is divided into two major sections, dealing respectively with producers and purchasers. The first part (I) is further divided into a section dealing with the gross output of domestic producers and one dealing with imports. Within each of these sections, provision is made for valuations according to both market price and approximate basic value. The classification systems proposed are the international standard ones, at their most detailed levels. In addition to the classifications shown in the table, additional characteristics will also often be needed to identify region, size of establishment etc. The second part (II) of table 4 is subdivided into purchases of intermediate inputs by domestic producers, purchases by domestic final users and exports. The valuation base is purchasers' prices; classification systems proposed are designed to make it possible to trace the progress of commodities through the economic process from producer to final user as well as to yield aggregations needed for oher analytical purposes. Where cross-classifications are important, i.e., where producers' prices vary with the purchaser or where purchasers' prices vary with the source of supply, identification of both producer and purchaser should be preserved.

143. As noted in chapter II, the framework does not include data on factor costs or returns or other components of income. Further work is required before this third breakdown of gross domestic product can be added.[10]

The compilation of indexes

144. Corresponding to the structure of basic data on prices and quantities, there is a similar structure of compiled indexes. Different types of indexes will be wanted for different purposes—Laspeyres price indexes for monitoring, Paasche (or Paaschized) indexes for deflation etc. They all can (indeed, perforce, must if duplication of effort is to be avoided) be based upon the same basic data. Collecting and storing the data in a systematic way will facilitate recompilation into the different forms required, thus making the most efficient possible use of the data.

145. Indexes that will generally be found useful will follow the pattern of table 1. At the most detailed level, producers' price indexes of gross output of commodities will be wanted: these are the building blocks from which higher-level aggregations are built. Making use of input-output relationships for the derivation of appropriate weights, these building blocks can be used to construct producers' price indexes for activities: gross output, intermediate consumption, value added, net sector output. Such producers' price indexes for industries can be compiled at various levels of aggregation. For gross output, intermediate consumption and value added, interest is likely to focus on rather detailed levels, since the primary uses of these indexes are for the monitoring of developments in detailed sectors and for the deflation of detailed components of gross product. For net sector output, however, it is chiefly intermediate levels of aggregation that are of interest. As noted above, at the four-digit industry level net sector output does not differ significantly from gross output. At the two-digit industry level, however, the differences can be quite significant and net sector output gives a much more valid picture of the behaviour of the industry as a whole. This is even more important at levels such as all of manufacturing or the aggregation of manufacturing, mining, electricity and gas. An index for this aggregation, together with a separate index for agriculture, may be recommended as a replacement for the traditional wholesale price index.

146. Purchasers' price indexes will be needed that correspond to the components of the final uses of gross domestic product. The most commonly used of these is the consumer price index, which may be compiled at various levels of aggregation, both of types of goods and services and of groups of consumers. Arrangement of the basic data according to the framework outlined in table 4 will facilitate the compilation of indexes for various groupings—though it should be recognized, of course, that indexes can only be compiled for groups for which the basic data have been collected. Thus, if prices are collected only for purchases of factory workers in the capital city, it will not be possible to compile an index appropriate for the rural population or for special groups such as the aged, except to the extent that it has been determined that the purchases of the various groups overlap.

147. Purchasers' price indexes for the remaining components of the final uses of GDP are less frequently compiled but they have been found to be extremely useful where they have been made. Interest is likely to attach first to exports and imports, where both carefully constructed unit values and true price indexes are useful. Increasingly, purchasers' price indexes are also being sought for capital formation and for government and non-profit institution consumption.

148. Quantity indexes are most commonly compiled for the gross output of detailed commodities. Like the corresponding price indexes, these are essential building blocks in the construction of higher-level aggregates and in particular in the construction of constant-price national accounts. The latter require an exhaustive coverage of all components of gross domestic product by industry of origin and by final disposition. As is noted above, what are wanted for deflation are current-weighted price indexes but these are usually unobtainable. Their lack can to some extent be overcome by working at as fine a level of detail as is possible. Changes in weights within classes will then be minimized and the classes themselves can be combined with current weights. The national accounts in constant prices, combined with the values in current prices, will in turn yield implicit deflators.

[10] For a more extended discussion of this topic see the forthcoming United Nations publication, *Manual on National Accounts in Constant Prices.*

Content of a dissemination programme

149. A programme of dissemination of price and quantity statistics should include more than printed publications. At the most detailed level, it is not necessary to publish all of the input and output indexes for all commodity and activity classes or all of the detailed import and export categories, though some countries do in fact publish all of the detail that is compiled. While such microcomponents are necessary ingredients in the compilation of more aggregative indexes, very few users wish to have all of the very detailed results. Selected indexes at the most basic level are needed for monitoring purposes and their publication will evoke widespread interest. But the number of indexes needed for this purpose is limited: general users do not want and cannot assimilate large volumes of data. On the other hand, individual users will want a large variety of specific detailed indexes. To meet this need, channels must be established to allow access by individual users to the detail in the data base, within the limits of restrictions that may be imposed by confidentiality requirements. Some countries find that the simplest way to allow such access is to publish all of the available detail. As a general rule, however, this is likely to be excessively expensive and also counterproductive for most users.

150. The choice of indexes for publication and the decision on the frequency with which they are published must reflect a balance between the interests of users and the resources available. In detail and at the margin, the choice will vary from country to country. There are, however, some common elements of a publication programme that nearly all countries will find desirable. On the output or product-originating side, first priority should undoubtedly be given to indexes of producers' prices (replacing the traditional wholesale price index).

TABLE 5. A PROPOSED PUBLICATION PROGRAMME FOR PRICE AND QUANTITY INDEXES

Reference item	*Classification system*	*Type of index*	
		Price	*Quantity*
1. Gross output of key commodities	Selected ICGS subclasses (8-digit)	Laspeyres producers' price	Laspeyres
2. Gross output of domestic producers..	ISIC groups (4-digit)	Laspeyres producers' price	Laspeyres
3. Net sector output of domestic producers..	ISIC divisions (2-digit) ISIC major divisions (1-digit) All industry (ISIC divisions 3+4+5)	Laspeyres producers' price	Laspeyres
4. Gross domestic product originating (value added)	ISIC major groups (3-digit) ISIC divisions (2-digit) ISIC major divisions (1-digit) All domestic producers	Implicit deflator	Deflated values
5. Final uses of gross domestic product			
(*a*) Domestic purchasers ..... (i) Consumption of households (ii) Government consumption (iii) Other domestic purchasers	SNA categories	Implicit deflator Laspeyres purchasers' prices	Deflated values
(*b*) Exports and imports	SNA categories	Implicit deflator	Deflated values
	ICGS classes (6-digit)	Laspeyres	Laspeyres
	SITC items (5-digit)	Unit value	Quantum
(*c*) Total gross domestic product		Implicit deflator	Deflated values

The commodities and industries for which indexes should be published should be those important to the country. For most countries such indexes may be expected to include those for key commodities (by individual commodity), agriculture and industry (including manufacturing, mining, electricity and gas) and, at a later stage of statistical development, construction, transport, trade and services. Primary interest, from the point of view of publication, is likely to attach to the indexes relating to gross output of key commodities and net sector output of the larger sectors. In addition to price indexes, there is also much interest in quantity indexes in certain of these areas, notably agriculture and industry. For the distributive trades, there is interest in turnover as well as in margins. For gross domestic product as a whole, what is needed is of course a measure of value added and interest will attach primarily to constant-price estimates of the components of gross domestic product originating by industry and the deflators relating to them.

151. In terms of the uses of gross domestic product, first priority will go to the consumer price index. To the extent that resources are available, variants of this index applicable to specific socio-economic groups or to specific regions will also be of interest, as will its components by type of commodity. Great interest will also attach to price and quantity indexes for imports and exports. For all of the final uses of gross domestic product, estimates of the components of the final uses of gross domestic product in constant prices with their accompanying deflators will be needed.

152. Table 5 sets out such a publication programme in tabular form. It suggests appropriate classifications and levels of detail. The table does not contain priorities but the whole table is, in a sense, a list of priority concerns.

153. It should be emphasized that the system as a whole is an integrated structure. Valid indexes at the aggregative levels suggested for publication cannot be derived without the underpinning of collection of data on a much more detailed level. To obtain the greatest benefit from the effort put into data collection, furthermore, attention must be devoted to uses beyond the compilation of the indexes that are published. Methods of storing and retrieving the basic data must be devised that will lend the greatest possible flexibility to their use.

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