UNITED NATIONS

ECONOMIC
AND
SOCIAL COUNCIL

STATISTICAL COMMISSION
Tenth session
Item 8(c) of the agenda

A SYSTEM OF PRICE AND QUANTITY INDEXES FOR NATIONAL ACCOUNTS

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57-35489A

FOREWORD

(i)   At its ninth session in April 1955 the Statistical Commission of the
United Nations (having before it document E/CN.3/206 of 14 March 1956)
requested the Secretary-General to prepare a technical report on a system
of price and quantity indexes for national accounts and to circulate this
study to the Governments of Member States and interested international
organizations for their comment. The present report is in response to
that request.

(ii)   In preparing the report, which is concerned with questions of both
concept and method, close attention has been paid to the procedures adopted
in both official and unofficial country studies. On many aspects of this
subject, however, there is not yet a consensus. There are substantial
differences in the scope and accounting framework of the index systems
published by various countries; and, of perhaps more importance, methods
of estimation vary greatly in detail and accuracy and their effectiveness is
sometimes debatable.

(iii) The present report is therefore tentative and exploratory in character.
In dealing with the form and concepts of price and quantity indexes, it
describes a system of indexes drawn up within an abridged framework derived
from the national accounts in current money terms set forth in the United
Nations report A System of National Accounts and Supporting Tables.[1] This
system of indexes extends beyond prevailing practices, and represents an
attempt to define a system of quantity indexes drawn up within a comprehensive
balancing set of accounts in real terms, and a more restricted but related
system of price indexes. The description of methods undertaken in the report
is governed largely by the methods used in country statistics. These methods
are of course subject to the improvisions and limitations imposed by deficiencies

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[1] United Nations: Studies in Methods, Series F, No. 2, New York, 1953.

in the basic statistics of price and quantity commonly available, and by the manner in which this information has been used to date for the production of conventional sector indexes of price and quantity. Additional experience is needed in the application of certain of these methods before a full estimate can be made of their usefulness.

(iv)   The Statistical Commission also requested at its ninth session that circulation of the present technical report should be followed by the preparation of a more conclusive report on the subject which would take into account comments on the interim technical report received from the Governments of Member States and international organizations. The present report may be regarded therefore as a basis for the detailed technical discussion of any aspects of this subject which are of particular interest.

(v)   It may be noted that the International Association for Research in Income and Wealth decided at De Pietersberg in August 1957 to make the subject "Deflation of National Accounts" one of the major topics for study at a meeting of the Association scheduled for the summer of 1959. Experts will be asked to prepare papers on various aspects of the subject for this meeting.

CHAPTER 1

INTRODUCTION

Systems of Accounts

1.   In the last two decades there has been a rapid development in the
presentation of economic statistics in social accounting forms,[2/] reflecting
the widening needs of economists, governments, and businessmen for comprehensive
empirical descriptions of economic functions and relationships.   These
developments have taken the form of a number of separate but complementary
accounting systems, including national accounts dealing with production, income
and expenditure in current money terms; input-output tables which analyse the
structure of inter-industry relationships; flow-of-funds systems of national
accounts which trace the movement of funds through the sectors of an economy;
and national balance sheets which describe the asset holdings of a country.

2.   The system of national accounts in current money terms, as a general purpose
system, is in widest use by countries.   In response to the need for established
standards in this field a Committee on National Income Experts convened by the
United Nations met at New York in 1952 to prepare recommendations for a system
of national accounts which would "provide a framework for reporting national
income and product statistics which is of general applicability".   The report
of the Committee[3/] (hereafter referred to as the UN report) set out a comprehensive
and integrated system of accounts in current money terms; it also foreshadowed
the preparation of a related system of price and quantity indexes in the following
terms:

> "the major step that can be taken in this direction (to make comparisons
> over time in terms of constant prices) is the preparation of measures
> of the physical volume of the national product. This task can be
> approached in two different ways which in principle should yield identical
> results. Index numbers of production originating in the various industries
> can be aggregated to yield measures of total production. Alternatively
> index numbers of the real volume of expenditures on final products can be
> aggregated to yield the same total".

2/ For a survey of developments in this period, see Milton Gilbert and
    Richard Stone, "Recent Developments in National Income and Social Accounting",
    Bulletin de l'Institut International de Statistique, Tome XXXIV, 2ème
    Livraison, Rome 1954.

3/ Published in 1953 as United Nations: A System of National Accounts and
    Supporting Tables, Studies in Methods, Series F, No. 2, New York.

The purpose of the present paper is to continue this work by examining the form
of a system of price and quantity indexes[4] drawn up within the framework of the
accounts defined in the UN report; and in later sections to examine some of the
practical problems of method met in computing these indexes.

The Present Status of Accounts in Constant Prices

3.   Many countries are now producing measures of real production and real
expenditure in substantially the form described in the UN report, or measures which
may be regarded as components of this system, such as indexes of industrial
production, indexes of agricultural production and indexes of exports and imports.
In the United Nations publication Statistics of National Income and Expenditure,[5]
national estimates in constant prices of both final expenditure on goods and
services and production originating in industry are reproduced for thirteen
countries, namely Argentina, Austria, Belgian Congo, Belgium, Chile, Denmark,
Western Germany, Greece, Italy, Luxembourg, Norway, Portugal, and the United
Kingdom. This publication also contains tables of either real production or real
expenditure aggregates and their components for an additional eighteen countries.
The statistical publications of the ECE, OEEC, ECLA, ECAFE[6] and other international
agencies also make extensive use of national accounts data expressed in constant
prices, and the studies found in national and regional economic surveys of many
national and international agencies now rely heavily on these data.

4.   The preparation of accounts in constant prices differs sharply in scope and
quality between countries. Some countries restrict their efforts to the
preparation of a single aggregate series in real terms, either deflating a national
product or expenditure aggregate by a conventional[7] wholesale or retail price

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4/   In the following pages the terms "quantity indexes" and "accounting flows in
      constant prices" are used interchangeably.

5/   United Nations, Statistical Papers, Series H, No. 10, 1957.

6/   Economic Commission for Europe; Organization for European Economic Co-operation;
      Economic Commission for Latin America; Economic Commission for Asia and the
      Far East.

7/   This term is intended to refer to the group of customary indexes such as
      retail and wholesale price indexes which have been defined without reference to
      the flows of a system of accounts.

index, or extrapolating a base year aggregate by a single production index. It
has been mentioned, on the other hand, that a number of countries now go so far as
to produce detailed component series in constant prices of both the expenditure and
product aggregates, reconciled within an accounting framework. The principle of
preparing systems of price and quantity indexes within the framework of an
accounting system has been widely accepted for some years. Beyond this, however,
questions arise (a) as to the extent to which entries of a system of accounts in
current money terms may be converted into constant prices, and (b) as to the
appropriate forms and concepts which should be adopted for those indexes which
it is decided to produce. In considering these questions, account has been taken
of the various systems of price and quantity indexes available or in process of
development by countries. In addition, every effort has been made to reconcile
the system described here with the definitions governing the collection of
basic statistics and the preparation of intermediate studies, such as sector
production indexes and wholesale or retail price indexes already developed by the
United Nations, the specialized agencies and other inter-governmental
organizations.[8]

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[8] The intention to develop the system of price and quantity indexes within the
     accounting framework of the United Nations report A System of National Accounts
     and Supporting Tables has already been mentioned. (This report in turn follows
     very closely the classifications given in the International Standard Industrial
     Classification of All Economic Activities (Statistical Office of the United
     Nations, Statistical Papers, Series M, No. 4, New York, 1956), in the
     Commodity Indexes for the Standard International Trade Classification
     (Statistical Office of the United Nations, Statistical Papers, Series M, No. 10,
     Indexed Edition, New York, 1953), and in the Balance of Payments Manual
     (International Monetary Fund, Washington, D.C., October 1950). Except for a
     small number of marginal items the report is also consistent with the
     United Nations report Concepts and Definitions of Capital Formation, (Studies
     in Methods, Series F, No. 3, New York 1953), and the OEEC report A Standardized
     System of National Accounts, Paris, 1952). Other technical papers and reports
     of the United Nations and specialized agencies concerned with specific sectors
     or sector indexes include the following:

     Index Numbers of Industrial Production, Studies in Methods No. 1, New York,
     15 September 1950;
     Index Numbers of Wholesale Prices, Memorandum submitted by the Secretary-General
     to the Ninth Session of the Statistical Commission, document E/CN.3/204,
     6 December 1955.

(footnote continued on following page)

Scope and Objectives

5.   The problems of construction of price and quantity indexes dealt with in
this paper are considered only in relation to national accounting. There is an
extensive literature on all aspects of the construction of wholesale and retail
price index numbers as well as on the estimation of the volume of imports,
exports and production of goods. This work will be drawn on as required.
Problems of price and volume in national accounting, however, go far beyond the
traditional problems of index number making; they extend to items outside the
money economy, to services, taxes, subsidies etc., and, in a certain degree, the
generally accepted ideas, in so far as they apply, may require adaptation or
even modification. In the paper the time period contemplated is typically the
year[9/] whereas for most of the existing price and quantity indexes the period
is the month or the quarter.

6.   The early sections of the paper identify entries in the accounts of the
UN report relating, for example, to production by industry and expenditure on
final product, and certain adjusting entries, which may be expressed meaningfully
in constant prices. In subsequent sections the development of appropriate
concepts, terminology and accounting relationships and supporting tables for
the systems of price and quantity indexes described herein is examined before
passing to the important questions of method.

8/ (continued)

Indexes of Quantum and Unit Value for External Trade, Memorandum submitted
by the Secretary-General to the Ninth Session of the Statistical Commission,
document E/CN.3/200, 17 January 1956.

Recommendations concerned with international standards for cost of living
indexes adopted by the Second and Sixth International Conferences of Labour
Statisticians, reported in The Sixth International Conference of Labour
Statisticians, Studies and Reports, New Series No. 7, Part 4, International
Labour Office, Geneva.

Recommendations concerned with indexes of quantum in international trade
reported in Report of the Statistical Commission (Fourth Session) to the
Economic and Social Council, paragraph 92, document E/1312, and in Report of
the Statistical Commission (Eighth Session) to the Economic and Social Council,
paragraph 19, document E/2569.

9/ See, however, Chapter 4, paragraph 73.

7.   This paper concerns itself only very incidentally with the problem of the
formulae to be used for the construction of price and quantity index numbers,
i.e. whether Laspeyres, Paasche etc., and their well-known properties. It is
assumed generally that the indexes are such that $P.Q = V$ where, to base unity,
P, Q and V represent price, quantity and value index numbers, an assumption which
is taken to justify the use of the term "factorisation" in relation to the
derivation of P and Q from V. Most frequently the quantity index number is
merely implicit, that which is explicit being usually value of the aggregate at
fixed prices, sometimes termed "real" value or "deflated" value, the latter
implying that it has been derived as the quotient of a current value by a price
index number. The quantity index number, if desired, can, of course, be computed
as the quotient of the current real value by the base year real value - i.e. the
quantity of each constituent item in each aggregate is deemed valued at the
same price, usually that of either the current year or the base year.

8.   A major advantage of the national accounts in current money terms has been
the manner in which they set out the economically significant groups of
transactions concerned with production, income distribution and expenditure and
demonstrated their relationships; it is of some importance to consider whether
the accounts perform a similar function in indicating the accounting flows and
relationships which are significant for the development of price indexes and
quantity indexes. This question is one which must be constantly regarded in
seeking answers to the conceptual problems raised in the following sections.

CHAPTER 2

BALANCING OF A SYSTEM OF NATIONAL ACCOUNTS IN REAL TERMS

9.   At one time it was more or less taken for granted that when the items
expressed in actual values in the "current" year in a system of balanced accounts
were deflated (i.e. expressed in base year prices) the deflating price indexes
should be such that the deflated items should also form a balancing system. It
seemed generally agreed, at any rate, that one very simple account, namely:

$$\text{Gross output} = \text{input} + \text{added value}$$

in current values also held good in real terms, in the sense that added value in
real terms could meaningfully be computed as the difference between output and
input, each deflated by suitable price index numbers.[10] Then, as regards the
wider aspects of the problem, certain formidable difficulties, both conceptual
and operational, became apparent[11] and interest in this "real balancing" problem
receded. Amongst these difficulties was that associated with the External
transactions (rest of the world) account. In actual money terms this account in its
simplest form is:

$$\text{Current exports} = \text{current imports} + \text{surplus}$$

of the nation on current account.

Suppose that exports exceed imports so that the last term is positive. When,
however, exports and imports are deflated by unambiguously defined export and
import price index numbers, a disparate trend in these indexes might result in
real imports exceeding real exports so that the difference, "real surplus on
current account", becomes negative. Since at current values a positive surplus
results in the nation's acquiring real property (e.g. external industrial shares),
such a result would be at variance with common sense. Scarcely less serious
difficulties arose for the fact that certain items in current value terms in the
accounts could reasonably be deflated by more than one price index number: the
deflating price index system is not uniquely determined. And, as regards some
other items (e.g. certain transfers), it was difficult to conceive that the terms
"price" and "quantity" had any meaning at all.

10/ Refs. 7, 12, 27, 28. (See annex I for List of References)

11/ Ref. 17. (See annex I for List of References)

10. Recent interesting work[12]/ prompts the suggestion that this problem of constructing real balancing accounts should be reconsidered. The solutions to the problems of deflating the key entries of a system of national accounts put forward in the studies referred to here and in other studies, and in the national accounts publications of a number of countries, the O.E.E.C., E.C.L.A. and the United Nations Statistical Office, provide adequate but not unique answers to almost all the relevant questions. In private studies in the United States, for example, in dealing with the deflation of the final expenditure components of gross national product, and specifically with the item "net foreign investment", the need to allow for the effect of changes in the terms of trade has been recognized; it has been proposed that the net foreign investment item should be deflated directly by an implicit price index for the gross national product or some related aggregate to arrive at the real foreign balance, rather than by the procedure sometimes adopted of taking the difference between real exports and imports. A recent O.E.E.C.[13]/ study has examined the usefulness of deflating the balance of imports when there is an import surplus; the O.E.E.C. and E.C.L.A.[14]/ have also indicated that a "gain from changes in the terms of trade" entry, regarded as an addition to the real domestic product of a nation in computing real national income, should be computed consistently by appropriate adjustment to the export aggregate, irrespective of whether the country has an export or an import surplus. In the prevailing climate of opinion it should not be difficult to secure agreement on the form of a balancing external account in real terms and from there it would be but a step to a full double-entry set of real accounts. This matter is discussed in detail later.

11. In what follows in this section of the paper the object is therefore to try to establish a prima facie case for a re-examination of this problem, not solely or mainly because a balancing system of real items is aesthetically satisfying but because development of such a system seems to represent a prerequisite to a satisfactory solution of the important practical problem of deflating the principal aggregates (e.g. gross domestic product, national income, domestic capital formation), which appear as the balancing totals in the accounts in current money terms. Furthermore it may well be found that, as the balancing of

12/ Refs. 10, 17, 29, 31, 32. (See annex I)

13/ Ref. 32 (annex I)

14/ Refs. 10 and 33 respectively. (annex I)

the system of accounts in current values describes, if in very general terms, how the economic system works, it also goes a certain distance towards defining the best or most reasonable price deflators of the constituent items in cases in which these might otherwise be in doubt.

12. Consider a simple closed system of four accounts (i.e. with external transactions nil) expressed in current values in which the items are production ($\underline{P}$), consumption ($\underline{C}$), fixed capital formation ($\underline{F}$), savings ($\underline{S}$), and income ($\underline{I}$). The four accounts are then:

$$
\begin{array}{rcl}
P &=& C + F \\
C + S &=& I \\
F &=& S \\
I &=& P
\end{array}
\qquad (1)
$$

in which each item occurs twice, once on the left and once on the right of the identities so that the double-entry principle is satisfied. Regarded as equations, however, only three of the four are independent: for example, the fourth is found by adding the two sides of the first three. As there are three independent equations between five variables, knowing a particular two variables the other three can be determined. Suppose now that it is desired to construct a set of relations between items in real terms of precisely the same form as that set out above, the question arises: how should the two items (i.e. the "independent variables") be selected from which the other three items will be found? It would appear that savings ($\underline{S}$) can be eliminated as one of the two independent variables, for savings can be regarded as consumption deferred or equated with real capital formation so that the choice of at least two price deflators presents itself. Rather similar considerations apply to income ($\underline{I}$). On the other hand on the right side of the first equation there are only goods and services which can be quantified (in the production context) in an unambiguous manner. Accordingly consumption ($\underline{C}$) and fixed capital formation ($\underline{F}$) are selected for deflation. The other variables production ($\underline{P}$), savings ($\underline{S}$), and income ($\underline{I}$) are determined from the first three equations. It would therefore appear that in a closed economy described in current values by the four accounts indicated, the items can be expressed in real terms so that the accounts still balance. The accounts would, in fact, be as follows:

$$(2) \quad \begin{cases} P/p_P = C/p_C + F/p_F, \\ C/p_C + S/p_S = I/p_I, \\ F/p_F = S/p_S, \\ I/p_I = P/p_P, \end{cases}$$

where the p's with various subscripts indicate price index numbers to base unity.
Once p_C and p_F are known the other three price index numbers are determinable and
clearly (2) has the balancing and double-entry properties of (1); and if, in (2),
P' be written for P/p_C, C' for C/p_C etc. so that the primed symbols represent
items in real terms, it will be seen that the accounts in real terms have
identically the same form as those in actual values.

13. If, however, the system is an open one the situation, as regards the present
problem, is radically different. Pro forma deflation item by item as in the case
of a closed system does not yield a reasonable set of balanced accounts. This will
be evident from the observation about quanta of imports and exports in paragraph 1.
Suppose that a country has identical consumption, domestic capital formation,
imports and exports, all in real terms, in base and current year. Suppose further
that imports equal exports in the base year and that all prices are the same in
the two years except export prices which have increased. Conventional deflation
item by item would indicate unchanged domestic product and national product.
Yet it is evident that the nation in the current year is better off than in the
base year to the extent of the external assets (which are real) acquired in the
current year. To yield a commonsense accounting result (in real terms), the
External transactions (rest of the world) account must be adapted in such a way
that the export (or import) surplus appears explicitly in this account. And to
balance the account an additional item must be introduced on the other side.

14. Let imports and exports of commodities and non-factor services in the current
year be valued at M and E respectively. Suppose that factor services (imported
and exported) are nil. The external account is then:

$$(3) \quad E = M + N,$$

where N is the surplus of the nation on current account. If E and M can be
unambiguously deflated by price index numbers p_E and p_M respectively, this is not

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true about $\underline{N}$. If $\underline{N}$ is converted into external industrial shares, one kind of price index number might be considered appropriate, if into house property abroad one might use another index number; alternatively, the surplus might be regarded as imports foregone and deflated by the import price index. It might be reasonably argued, however, that such considerations are irrelevant since they presume knowledge not contained in identity (3), namely of what use the sum $\underline{N}$ is or might be put to. It is difficult to go further than to state that, if positive, $\underline{N}$ is part of $\underline{E}$, namely that part not required to pay for imports, in which case the deflator is p_E.[15] Then the real content of the left side of (3) is E/p_E while the right side if $(M/p_M \neq N/p_E)$; and the two sides are equal only in the trivial case of $p_M = p_E$. To balance the external account in real terms it is necessary to introduce a term T' on the left side so that the real external account becomes:

$$(4) \qquad E/p_E \neq T' = M/p_M \neq N/p_E,$$

where --
$$N = E - M$$
so that --
$$(5) \qquad T' = M\left(\frac{1}{p_M} - \frac{1}{p_E}\right)$$

The interesting form of T' (which is positive when p_E exceeds p_M and negative in the contrary case) suggests that it might be termed the "real import (or export) trading gain."[16] What identity or account (4) then states is that "exports plus trading gains are exchanged for imports plus surplus." If current imports exceed current exports, the deflating index of the surplus would analogously be the import price index; while account 5 would then read $T' = E\left(\frac{1}{p_M} - \frac{1}{p_E}\right)$. The development in the text has started with the deflation of the surplus $\underline{N}$, to give N'. To other minds, it might be more convincing first to compute the adjustment for the trading gain. Per unit the gain would be $\left(1 - p_M/p_E\right)$; when

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15/ The presentation of information concerning the subsequent uses of the surplus (deficit) in payment of transfers, investment and for other purposes might then be the object of a separate account. To balance this account in real terms, it might be necessary to introduce an additional real component, as is proposed here to balance the external transactions current account. This additional component might well be economically significant.

16/ This form of words has been evolved from formula (5). There are, of course, many aspects of the gain from the terms of trade of which this is only one. The word "real" emphasizes one essential feature, namely that it is valued at base year prices.

exports exceed imports in current value, it might seem appropriate to multiply this per unit gain by the real value of $\underline{M}$; conversely, when imports exceed exports in current values, the per unit gain might be multiplied by the real value of $\underline{E}$. The choice of the lower of the import and export values is dictated by the prudent statistical policy of not counting one's chickens before they are hatched. For example, it may be deduced from a rise in export prices relative to import prices that a country has improved its position in this regardin international trade; but only, it is suggested here, to the extent that exports have actually been exchanged against imports. The relative price rise for the goods comprising the export surplus of the country represents only a contingent trading gain, which may not be realized because of subsequent changes in export-import price relationships or persistent commodity trade imbalance. Considerations of this kind dictate a conservative attitude towards the computation of the T' constituent in real national income. Of course, if T' be determined in this way, the surplus is quantified as the quotient of the actual value by the export price index.

15. Admittedly the foregoing argument does not establish p_E (or p_M) as the unique deflator for the value of surplus. All that is stated is that it seems a reasonable choice, a point in its favour being the form of T', given by (5). Too much reliance should not be placed on the latter argument since if, for example, p_M is used to deflate $\underline{N}$ in (4), the balancing item T' becomes:

$$(5') \qquad T'_1 = E\left(\frac{1}{p_M} - \frac{1}{p_E}\right),$$

which is of the same form as T', except that $\underline{E}$ is substituted for $\underline{M}$. In fact any deflator of $\underline{N}$ of the form:

$$\alpha p_M + (1 - \alpha)p_E, \text{ where } 0 \leqslant \alpha \leqslant 1,$$

i.e. a weighted mean of the price indexes of imports and exports, would appear to give a reasonable value of the real balance T'. However, the case stands that the surplus $\underline{N}$ (if positive) is part of exports $\underline{E}$ which does seem to accord a primacy as a deflator to p_E.

16. If imports exceed exports in value in the current year the deflator of the surplus becomes p_M. In a "world" with only two trading partners the treatment is accordingly quite consistent, in the sense that the surplus and the trading gain of one country become respectively the deficit and the trading loss of the other.

17. The simplest set of double-entry balancing accounts in current money terms for an open economy - analogous to (1) for the closed system - is as follows:

$$(6) \quad \begin{cases} P_1 = C + F + E - M \\ P_2 = P_1 \\ C + S = I \\ E - M = N \\ F + N = S \\ I = P_2 \end{cases}$$

P_1 and P_2 are respectively domestic product and national product. In this system of accounts the domestic and national product aggregates are presented gross and at market prices; it follows that the income aggregate also includes indirect taxes net of subsidies and the provisions for consumption of fixed capital. Further, the system makes no allowance for the entry of net factor income payments from the rest of the world, which is needed to relate the domestic and national product totals. In the accounts of the UN report A System of National Accounts and Supporting Tables these adjusting entries are given separately within a more detailed system of relationships; the system shown here represents in the above respects a considerable consolidation of the accounts described in the UN report, and has only been adopted to simplify the discussion of problems encountered in this section.

18. In real terms the accounts would be as follows:

$$(7) \quad \begin{cases} P'_1 = C' + F' + E' - M' \\ P'_2 = P'_1 + T' \\ C' + S' = I' \\ E' - M' + T' = N' \\ F' + N' = S' \\ I' = P'_2 \end{cases}$$

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Always assuming that the balancing principle obtains, the only question which arises is the assignment of T' to the second equation: it would appear, at any rate, that choice is limited to the right sides of the first or second equation. It seems preferable to preserve real domestic product P_1' simple as a measure of the physical output of domestic producers, and therefore suitable as a basis for productivity studies, in which case T', as a measure of the real increase or decrease in the benefit derived by a country from price movements in foreign trade, would be part of national product P_2'. In a fully developed system national product, P_2', would represent the sum of P_1', the trading gain and net factor income payments to the nation, and would therefore be suitable for studies of economic welfare. It has been observed in a number of studies that changes in a country's terms of trade (for example a relative rise in expert prices) may tend simply to reflect a corresponding change in its real costs of production; the aggregate of P_2' would provide an estimate of production in which account is taken of both developments.

19. Accounts (7) differ from (6) only in the introduction of T', the trading gain, in the second and fourth accounts. T', of course, is zero in the base year. Accounts (7) may be regarded as a system of six equations between ten variables. Since each primed (i.e. real) symbol occurs twice, once on the left and once on the right side of the set of relations, one equation is redundant, so that the system is equivalent to five equations between ten variables. Accordingly, knowing a particular set of five of the variables the remaining five can be determined. From what has gone before, the most reasonable selection of independent variables, i.e. those for the calculation of which suitable price deflators should be computed, appears to be C', F', E', M', and N', four of which occur in the first equation. It will be noted that, of these, all except perhaps N' can be regarded as unambiguously defined. The actual procedure would be as follows: C', F' etc. would be taken as C/p_C, F/p_F etc. The five equations would be solved for P_1', P_2', S', I' and T', the dependent variables. If required, the appropriate price indexes of the first four would be found as $p_{P_1} = P_1/P_1'$, $p_{P_2} = P_2/P_2'$ etc. The variable T' is, of course, to be deemed expressed in base year prices.

20. As previously noted, an estimate of the gain or loss from changes in the terms of trade has appeared as an entry in the national accounts of a number of countries, and in the national estimates published periodically by the O.E.E.C., E.C.L.A. and the United Nations Statistical Office. The entry has been shown

generally as an adjusting item introduced to convert a national product aggregate
to a gross income aggregate, rather than as an integral part of a balancing
system of accounts; this treatment has permitted considerable freedom in the
definition and computation of the trading gain entry, and some diversity in these
matters may be observed in country studies.

21. In the present study the trading gain is incorporated within the accounting
system.   This has been done by regarding the item on the one hand as an element
in the external transactions current account (which in turn affects the definition
of the real surplus of this account), and on the other hand as an entry in the
appropriation account which is needed, in addition to the item net factor income
payments from abroad, in converting a domestic product to a national product
aggregate.

22. Only the simplest set of accounts has been examined and, even in this set,
there might not be general agreement as to the uniqueness of the price deflators
used.   No mention has been made of the problems of deflation of such items as
indirect taxes, subsidies, and net factor income payments from the rest of the
world, or of problems associated with the treatment of capital consumption
allowances.   It remains to be seen whether such items as net indirect taxes and
net factor income payments from the rest of the world can be introduced into
a real double entry balancing system of accounts without too great a strain

on verisimilitude.[17/] Items in which conceptual difficulties of deflation might arise are relatively small in magnitude for most countries and it is suggested that it would be a pity if the project of evolving a system of real accounts (furnishing, amongst other things, consistent real aggregates of gross national product and other balancing totals with their concomitant price index numbers), were to be abandoned because of conceptual or practical difficulties in the case of unimportant constituents.   If items dubiously deflated are small, the deflated values may be concealed by amalgamation with larger items.

23. Of course, many problems, other than those already mentioned, remain to be solved in connexion with the quantification of accounts in a fully developed balancing system.   Two of these problems are as follows:

17/   In brief, as regards deflation of the net factor income payments, this might be undertaken by computing the commodity equivalent of the   ^ income, rather than by attempting to quantify the flow in terms of factor inputs.   In choosing deflators, four basic situations may be distinguished to demonstrate this approach:
      (a) An import surplus and a smaller positive net factor
         income payments flow from the rest of the world;
      (b) An export surplus and a smaller negative net income flow;
      (c) An import surplus and a negative net income flow;
      (d) An export surplus and a positive net income flow.
      Here "imports" and "exports" relate to goods and non-factor services. In case (a) it would seem reasonable to deflate the net income flow by a general import price index to measure the volume of imports financed by this flow.   Conversely, in case (b) net income payments to abroad might be offset against the commodity export surplus, and the income flow deflated by an export price index.   In cases (c) and (d) the commodity equivalents of the income flows are represented by their import and export equivalents respectively.   In the last two instances the net income flows have the same sign as the commodity trade balance and reduce (add to) the foreign asset holdings of the country under review; it is suggested nevertheless that deflation of the flows by an assets price index rather than by the proposed import (export) price indexes would be inappropriate, for reasons already given above in considering the deflation of the surplus of the external transactions account.   The deflating procedures for the net factor income payment from the rest of the world item described herein would preserve the balancing character of the system of accounts in real terms described in this paper; in each case the proposed procedures are complementary with those suggested earlier for deflation of the surplus of the external transactions account, which is the entry on the opposite side of the account affected by inclusion of the net income entry.

      (i)   calculation of real factor incomes in the categories

          (a)   compensation of employees and

          (b)   rest of national product;

     (ii)   aggregation of surpluses and gains from terms of trade in space and time.

Problem (i) is essentially that of sub-dividing the left side of the sixth equation in series (7) into its main constituents. Problem (ii) arises through the fact that the sum of the surpluses and gains from terms of trade for individual countries in a region, for economic sectors within a country and for periods (say calendar quarters) is not necessarily equivalent to the corresponding items for the region, for the nation or for the total time period of reference (say a year), respectively.

24. As to (i), discussion will be confined in a few remarks about the deflation of compensation of employees in current values. The two most obvious deflators of employee compensation are (a) a suitable index of earnings and (b) a consumer price index appropriate to this group. The deflated values might be described respectively as "employee input" (man hours valued at base period rates) and "employee reward", the latter less the former representing "employee increment", which may, of course, be positive or negative (i.e. a decrement). It might appear therefore that a new term should be introduced into the accounts, namely "employee increment". Apart from possible uses in economic analysis, there can be no doubt that this element has implicitly been much to the fore in recent years in the formulation of wage policy and general economic policy. It might be useful to make it explicit in the real accounts. The data on the right hand side of the consolidated appropriation account, where domestic product (including any increase in product due to increases in factor productivity), net factor income payments from the rest of the world and the gain from terms of trade are presented and aggregated to yield real national product, equals real national income, would provide summary information concerning the source of the increment.

25. Unfortunately there does not appear to be any possibility of distinguishing in real terms input from increment in the case of profits and other property income (i.e. the rest of national product). It would therefore seem that only

one other real constituent can appear on the left side of the sixth equation of (7), namely "real property income". The three terms would accordingly be:

Real employee input,
Real employee increment and
Real property income.

26. So far, therefore, the quantification of accounts has involved the introduction of two terms in addition to those in the accounts in current value terms, namely (1) gain from terms of trade and (2) employee increment. To give effect to the double-entry principle it might be necessary to add one or two more equations to system (7). Until a consensus of views has been obtained, however, on the validity of this system and of the concept of real employee remuneration, there does not seem to be much point in pursuing the subject further in the direction of account-making.

27. It is necessary to reconcile the viewpoint of Mr. Richard Stone[18] and the position assumed in this chapter. Mr. Stone's conclusion that "it is impossible to find a unique set of deflated values of the non-commodity transactions in an accounting system such that the accounts continue to balance in real terms" is correct, given his premises. He points out that if the number of unknown price index numbers is less than the number of accounts (minus one) - i.e. the number of equations - then, in general, the accounts cannot be made to balance in real terms. This is theoretically true but, as indicated above, the difficulty can be by-passed in a number of ways in practice. For example (1) the number of accounts can be reduced by consolidation and (2) economically significant new variables can be introduced as required. The number of unknowns and the number of equations can be thereby brought to equality. As regards (2) the introduction of a new variable T' the (real) trading gain seems essential, a procedure which balances the external account; and, much more tentatively, the introduction of a (real) increment, the difference between real input and reward of labour as a second "new" variable, has been suggested as a means of dealing with the case in which more than one "price" index is conceivable for deflating a flow. Mr. Stone's position is correct if regard is had only to the variables already in the accounts in current values, and if the number of unknown price index numbers and the number of accounts is assumed predetermined and immutable. When these conditions are relaxed it would appear that a consistent balancing system can be produced.

18/ See Ref. 17, pp. 90-93. (See Annex I).

28. As regards (ii) (paragraph 23), the aggregation problem assumes significance for individual countries when it arises in connexion with trading between different sectors of the economy. For simplicity consider two internal sectors only (1) agriculture and (2) non-agriculture. It would appear that, if it could be established, an "export-import" account in real terms for the agricultural sector[19] would have considerable interest and even importance from the political point of view.[20] For this purpose, agriculture would be regarded as a single unit, transactions internal to the sector being ignored. "Imports" into the sector would comprise purchases of current goods and services (including those for household consumption) as well as capital goods and "exports" would comprise all sales. Here again aggregation of surpluses and trading gains for the two sectors of the nation will not necessarily coincide with those for the nation as a whole. However, the problem of reconciliation, with a little "forcing",[21] might not prove too recalcitrant in practice; nor probably will the discrepancy between the real surpluses for say, individual calendar months or quarters and that for the whole of the year.

29. Throughout this paper, explicit and separate measurement of the changes in the aggregate of real product and its elements attributable to changes in factor productivity, as distinct from changes due to an increase in the quantity of factors employed, has not been considered. In the sense in which the term is

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19/ Ref. 29. (Annex I).

20/ "In the ECAFE countries generally, the predominance of the agricultural sector poses special questions in regard to the development and use of inter-industry relationship tables and commodity balances. The distinction between the 'household' and the 'firm' in the agricultural sector is not clear-cut, and this complicates the classification of 'inputs' and 'final consumption' in the manner possible in respect of manufacturing industries. Apart from this technical difficulty, the Working Party considered it a matter of crucial importance for countries in the ECAFE region to have a more illuminating framework than has been hitherto possible for depicting the magnitude and terms of trade between the agricultural and industrial (or non-agricultural) sector. This would be necessary for arriving at conclusions regarding the relative importance of raising agricultural productivity in any scheme of development." United Nations: Economic Development and Planning in Asia and the Far East, Economic Bulletin for Asia and the Far East, Vol. VI, No. 3, November 1955.

21. Formal equality of the national real surplus (and therefore of the real gain) with the sum of sectoral real surpluses could be achieved, for example, by using a price deflator of the form suggested in paragraph 15, on suitable choice of the constant α.

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used here "productivity" goes beyond the usual connotation "output per man hour".
It means the quotient of real gross domestic product divided by real factor input,
real factor input being conceived as an amalgam, expressed in some suitable
common unit of the contributions of labour, management, land, other fixed capital
and working capital. If the common unit is such the amalgam equals domestic
product in the base year, productivity is unity in the base year and may therefore
be regarded as an index in the current year. It may be stated at once that, in
the present stage of development, this concept is not statistically realisable.
Theoretically, at any rate, current real domestic product can be conceived as
factorisable into (a) a productivity index and (b) factor input, the productivity
index being assigned a role vis-à-vis real product analogous to that of the price
index in relation to product in current values. In other terms, current real
product may be regarded as the sum of factor input and a component due to change
in productivity. Increases in the productivity component may come about in
two principal ways (1) transfers of factors of production from activities of
lower productivity to those of higher or (2) increased productivity within each
branch of economic activity, or the two ways may be operating simultaneously.
If the measurement of the productivity concept roughly described here were
feasible (and this important problem should be the object of continuing study)
then the set of accounts described herein might also constitute a framework for
the generalized but supplementary treatment of productivity estimates for the
whole economy and its constituent sectors, including the external sector. For
example, if a productivity index in the sense indicated were realisable, terms
allowing for changes in domestic productivity compared with that of the rest of
the world would have to be introduced into a supplementary external account to
provide an estimate of the trading gain entry expressed, along with the other
elements of the account, in units of constant factor input.

30. To summarize this chapter: the problem of quantifying the elements in
national accounts in such a way that the resulting accounts form a balancing
system is worthy of exhaustive examination. A study of the simplest sets of
accounts suggests that the accounts give some guidance as to the choice of
deflating price index numbers in cases where this might otherwise be doubtfu.
Of course, it is recognized that the establishment of a system of real balancing
accounts will involve a measure of consolidation of both accounts and items

compared with the system in current values.   Imposition of the balancing
principle on the real accounts should not only result in consistent estimates
of large aggregates like real national income but, by regarding the accounts
as so many equations, renders it possible to place all the unambiguously known
real items amongst the independent variables, the remaining items being then
uniquely and consistently determined.   The fact of balancing restricts the degree
of indeterminacy, i.e. of those items for which there is no single-clear-cut
price-deflating index;   for instance in the real system (7) there are ten deflated
items but for only one of these, the real surplus (N') in the external account,
could there be any doubt as to the appropriate deflating price index.   If and
when consistent integrated systems of accounts in actual and real terms become
available a complete system of concomitant price index numbers can be computed.

CHAPTER 3

THE BASIC CONCEPTS OF A SYSTEM OF PRICE AND QUANTITY INDEXES

31. The delineation of those entries in a system of national accounts which may be revalued appropriately at constant prices and the development of a compatible system of price indexes have been carried out so far in simple accounting terms, without any attempt at definition. The present chapter translates these terms into the more precise concepts which are needed to provide the basis of operative systems of price and quantity indexes.

(a) The Concept of Production

32. The definition of the production boundary given in the UN report is also adopted for the system of quantity indexes given in this paper. But to meet some of the controversial aspects of this definition, it is considered that a division should be made in the accounts, at least in countries where non-marketed production is significant, to distinguish between transactions that are conducted in the market economy and transactions that must be imputed, for example subsistence production.[22/] This would permit of the preparation of quantity indexes (a) to show separately the production of industries in the market and non-market sectors, and (b) to provide separate estimates of actual and imputed expenditures on final product (consumption and capital formation).

33. Intermediate and final flows: In defining production, the distinction between final product flows and intermediate product flows drawn in the UN report and adopted in this paper is based on the distinction between flows "which appear

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22/ A division of the real value added estimates into their marketed and non-marketed components would often provide information of considerable value, particularly where the non-marketed production is of some magnitude. Policies which affect market transactions and the means of their execution are frequently dissimilar from those needed to influence production in the subsistence or other non-market areas of the economy, and might usefully be supported by separate measures of production in these areas; in addition, basic differences in the institutional nature of some subsistence activities and a tendency in practice to undervalue imputed transactions warrant the preparation of separate estimates. These factors also justify the separate measurement of actual and imputed consumption and capital formation expenditures where there are large imputed components in these entries.

positively as the output of one producer and negatively as the input of another producer", and flows which cross the production boundary and "make up the constituents of final product", respectively. It is particularly difficult to make this distinction in the case of certain government services supplied without charge. In country estimates of real production, services of this order, "... designed to facilitate the output of goods and services which are covered by the figures for 'ordinary' industries"[23], have been classified on occasion as intermediate rather than as final services. One of the criticisms of this latter procedure is that there may be difficulty in allocating the government services between industries to reflect the relative amounts of assistance which they have received. The procedure also fails to allow for a possible time lag between the giving of the free service and the resulting increase in output of the consuming industry; further, estimates of this sort do not provide separate figures for the products of the government services concerned.

34. As in the UN report, the treatment recommended in this paper for government services rendered to industry without charge is that all such services should be considered as final products of general government. In computing quantity indexes relating to the product of government service industries it would then be necessary to allocate separate base year weights to the various government services and to provide quantity indicators or other measures of year to year change in their volume; similarly, in deflating final expenditure flows, these services would appear as components of general government consumption expenditure.

35. Gross and net concepts: In the UN system of national accounts both the gross and net concepts of production are represented in the standard accounts, and the value of the net concept in certain forms of analysis is widely recognized. For statistical reasons, however, it seems necessary to depart from the recommendations of the UN report and to restrict the aggregates of the system defined here to gross concepts. Further improvement in methods of measuring capital consumption might make it generally feasible at a later period to compute real national product and related aggregates on a net basis. The problem will have to be faced in due course in connexion with the estimation of real wealth.

23/ Ref. 5, p. 439 (annex I).

36. <u>National and domestic concepts</u>: In preparing estimates in constant prices the
aggregate of domestic product measures the physical production of domestic
producers valued at the prices of the weight base year; the concept does not include
net factor income payments from abroad of any allowance for the gain or loss from
changes in the terms of trade. The aggregate of "real" domestic product is
therefore valuable in measuring changes in the productivity of domestic industries.
It is also most practicable from the viewpoint of data requirements, as the available
statistics of the values, quantities and prices required in estimating the real
value added by industry tend to relate to domestic activities.[24]/

37. The aggregate of national product which is also presented in the system of
quantity indexes described here has its particular uses in analysis and policy-
making studies, especially in studies related to economic welfare. In considering
the relationship of this aggregate to the aggregate of domestic product, it is
suggested in chapter 2 that in addition to net factor income payments from abroad,
the import (or export) trading gain (or loss) from changes in the terms of trade
should be taken into account as an additional element in converting real domestic
to real national product. This element measures the gain (or loss), by comparison with
with the situation in the base year, accruing to a country from relative price
changes in exports and imports. The inclusion of this item in the national product
aggregate is needed to maintain in the estimates in "real terms" the conceptual
equality of the product, income and expenditure aggregates found in accounts in
current money terms. It seems valid on several grounds to regard this element as
production. However, the especial nature of the production which it represents is
evident, and should be taken into account in interpreting the meaning of the national
product aggregate in constant prices. Since the estimates in real terms would
normally contain separate entries for the items of net factor income payments from
abroad and the gain or loss from changes in the terms of trade, which provide the
transition from a domestic product to a national product aggregate in constant
prices, the matter of a proper interpretation should present few difficulties.

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24/   The estimate of net factor income payments from the rest of the world required
      in converting the aggregate of domestic product to national product need only
      be prepared in the aggregate.

38. Market prices and factor costs: It has been proposed in a number of studies
on this subject[25] that the system of values adopted for the purpose of constructing
indexes of production by industries should be net of indirect taxes less subsidies;
that is, at factor cost.[26] The factor cost basis of valuation is also adopted in
this memorandum for the system of production indexes described in detail in later
sections. The use of factor costs as weighting coefficients seems to rest on the
ground that the factor costs of production represent, in approximate degree, the
relative marginal productivities of the factors engaged in their production.

39. Different considerations affect the choice of a system of weights for the final
expenditure indexes. These expenditure flows measure the end results of economic
activity, and may therefore be interpreted as indexes of economic welfare. In
welfare studies it is the actual prices paid for the final products which may be
taken to indicate the relative contributions of the products to the welfare of the
individual or group. On this ground it is generally considered appropriate to
construct the final expenditure indexes by using the market prices of the final
products as the basis of a weighting system, rather than their factor costs, and
this procedure has also been adopted here.

40. The decision to value the industrial product and the final expenditure estimates
at factor costs and market prices respectively gives rise to certain difficulties
in the reconciliation of the accounts; the valuation of the domestic product
aggregate at factor cost and the expenditure on domestic product aggregate at market
prices yields aggregates which are initially unequal and which would tend to reflect
different trends in production and expenditure because of differences in the weight
structure. In consequence, it would not be possible to obtain a check on the
accuracy of the calculations by a comparison of the two aggregates computed
independently.

25/ See for example Refs. 1 and 11 and the additional references given therein
     (annex I).

26/ This would mean, for example, in constructing a real production index for a
     given industry by using quantity indicator series to extrapolate a base year
     value added figure, that the value added estimate should be computed by
     deducting both the input and net indirect taxes from output.

41.   This difficulty has been overcome in some country studies by the preparation of separate estimates of expenditure on domestic product at market prices and at factor cost, which involves a somewhat arbitrary allocation of indirect taxes and subsidies between the components of the final expenditure flows, [27] in other studies, adjusting entries of "real" indirect taxes and subsidies have been prepared to provide the estimates needed to reconcile the two aggregates under discussion. Either approach would lead to the construction of comparable estimates of product and expenditure. The direct construction of indexes of indirect taxes and subsidies is suggested in this report; such indexes would have independent value when compared with indirect tax and subsidy series in current values in assisting the determination of tax and subsidy policies.

   (b)   The Principles of Classification

42.   The production boundary has now been drawn and final products have been distinguished from intermediate products. It is necessary as the next step to study the classification of transactions by economic activities and by classes of transactors to obtain accounts and supporting tables which conform to the simple framework described in chapter 2.

43.   Economic activities: The economic activities with which we are principally concerned are those of production, distribution, consumption, and capital formation; in addition, an account is set up for the external transactions. Production and the two basic uses of production, namely consumption and capital formation, have been defined here in the same way as in the UN report. The only change in approach introduced so far concerns the distinction in measuring production between production for the market and imputed production, which has also been extended to the consumption and capital formation flows.

44.   In the system of accounts suggested by the equations of chapter 2, separate accounts are set up to measure each class of activity. The primary account of the system in real terms, and the accounts most widely found in country studies, is the consolidated production account. This account represents two separate measures of the production of an economy:

27/   See Ref. 11 for a discussion of this problem in annex I.

i.   One measure relates to the gross commodity output of producers <u>less</u> their inputs of intermediate commodities (transactions between producers);

ii. A second measure relates to the sum of the final expenditures on goods and services.

As already suggested, these two measures of production should in principle yield identical results, since the transactions of producers in intermediate commodities are included with both inputs and outputs, and cancel out for the whole economy. This conceptual equality between the totals of industrial production on the one hand and the final expenditure flows of consumption, capital formation and net exports on the other, was also expressed in paragraph 18 of chapter 2 in the equation $P_j' = C' + F' + E' - M'$, which sets out the form of the consolidated production account of an economy (real domestic product equals the final product flows of real consumption, real capital formation, and real exports minus imports). Little remains to be added at this juncture concerning the structure of the other accounts. The character of the <u>appropriation</u> account and the external transactions account was described in chapter 2. The remaining accounts of the system are the <u>capital</u> account and the <u>consumers</u> account. The latter account shows the incomes of wage earners and other income receivers, and indicates the disposition of this income between consumption and saving. The <u>capital</u> account simply shows the disposition of real saving among stocks, domestic fixed capital formation and surplus of the nation on current account.

46. <u>Sectors of the economy</u>: A few marginal changes are suggested in the sector classification given in the UN report. Separate statements of marketed and non-marketed production have already been proposed. In some cases it might also be feasible to prepare an additional sub-division of private consumption outlays by socio-economic groups. Consumption indexes which are restricted in coverage to relatively homogeneous groups might be expected to provide much better indexes of economic welfare than global data. Besides a gain in exactness, this detailed information would often be required in policy-making studies, e.g. wage policy studies.

47. The industrial classification of the production of enterprises given in the UN report corresponds in most respects with the International Standard Industrial

Classification.[28] The use of the "establishment" recommended by the ISIC as the unit of classification results in some overlapping between the various industrial categories in the types of goods produced or processes followed.[29] In accounts in current money terms a classification of this order is usually of sufficient precision for the principal uses of the material. In computing estimates of the real product of industries, however, the overlapping of industries may occasionally present obstacles to the preparation of accurate estimates. For example, in an unofficial United Kingdom study in which base year value added estimates for certain industries were extrapolated by selected quantity indicator series, it was stated that "In the main this has meant defining 'industries' in a way that would fit in best with the data on indicators, even if that made the calculation of the weights more difficult; ... we have relied very extensively on the dictum that when you are using 1,000 series moderate changes in weights make little difference to the answer".[30]

48. Classification of price indexes: In defining a system of price indexes within an accounting framework, the basic classification of transactions is in this case between transactions in final goods and services (between industries and final buyers) and transactions in intermediate goods and services (between industries). The intermediate transactions would be recorded in principle (a) as the purchases of domestic industries and (b) as the sales of domestic industries to other domestic industries, plus imports of intermediate goods; in both cases transactions in capital goods would be omitted. This double entry record would permit price indexes relating to the intermediate transactions of an economy to be classified both by industry of the seller and by industry of the buyer. The transactions in final goods and services represent transactions between domestic producers and final buyers, plus direct imports by residents. Again there would be, in principle, a dual record of these transactions which would permit alternative classifications of the price indexes for these flows.

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[28] Statistical Office of the United Nations: Indexes to the International Standard Industrial Classification of All Economic Activities, Statistical Papers, Series M, No. 4, Add. 1, New York, 1956.

[29] For a discussion of this subject in relation to the industrial classification used in the United States Census of Manufactures see Ref. 12, chapter 2, Appendix A (in annex I).

[30] Ref. 5, p. 441 (annex I).

CHAPTER 4

THE FORM OF THE INDEX NUMBER SYSTEM

49. Accounts in constant prices: In chapter 2 it was suggested that the key entires in a system of national accounts might be deflated and presented within a balancing system of accounts in real terms. The form of the proposed accounts in real terms is given below. These accounts conform to the equations of paragraph 18 of chapter 2, and represent an abridgement of the system of accounts in current money terms given in the United Nations report. Even if the balancing principle of the full set of accounts given here should not be accepted, there is wide acceptance of the balancing properties of Account 1, while the majority of the entries in the external transactions and other accounts are also significant in considering the preparation of estimates in constant prices.

Account 1 - Domestic product

1.1 Gross domestic product at factor cost (2.4)	1.4 Private consumption expenditure (3.1)
1.2 Indirect taxes (3.7)	1.5 General government consumption expenditure (3.2)
1.3 Less subsidies (3.8)	1.6 Gross domestic fixed capital formation (4.1)
	1.7 Increase in stocks (4.2)
	1.8 Exports of goods and services (5.1) Expenditure on gross domestic product and imports
	1.9 Less imports of goods and services (54)
Gross domestic product at market prices	Expenditure on gross domestic product at market prices

Account 2 - National income

2.1 Employee input (3.4)	2.4 Gross domestic product at factor cost (1.1)
2.2 Employee increment (3.5)	2.5 Net factor income payments from the rest of the world (5.2)
2.3 Gross property income (3.6)	2.6 Trading (5.3)
Gross national income	Gross national product at factor cost

Account 3 - Consumers account

3.1 Private consumption expenditure (1.4)	3.4 Employee input (2.1)
	3.5 Employee increment (2.2)
3.2 General government consumption expenditure (1.5)	3.6 Gross property income (2.3)
	3.7 Indirect taxes (1.2)
3.3 Gross saving (4.4)	3.8 Less subsidies (1.3)
Gross national expenditure at market prices	Gross national income and net indirect taxes

Account 4 - Capital formation

4.1 Gross domestic fixed capital formation (1.6)	4.4 Gross saving (3.3)
4.2 Increase in stocks (1.7)	
4.3 Surplus of the nation on current account (5.5)	
Gross capital formation	Gross saving

Account 5 - External transactions

5.1 Exports of goods and services (1.8)	5.4 Imports of goods and services (1.9)
5.2 Net factor income payments to the nation (2.5)	5.5 Surplus of the nation on current account (4.3)
5.3 Trading (2.6)	
Receipts from abroad	Disposal of receipts from abroad

50. The system of price indexes: The system of price indexes set out here conforms, subject in practice to a number of reclassifications and abridgements, to the accounting framework adopted for the system of quantity indexes. As already mentioned, the basic classifications of transactions for purposes of price index definition are (a) transactions in intermediate goods and services between domestic industries, plus transactions in intermediate goods and services imported by domestic industries, and (b) transactions in final goods and services between domestic industries and final buyers, plus transactions in final goods and services imported directly by final buyers. The basis of this broad classification of the

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indexes is represented in the accounting form set out below, by way of
illustration. Transactions with the rest of the world and capital consumption
allowancees, net indirect taxes and stock changes are omitted from this example
for simplicity.

Classification of industries	1 Purchases of goods and services (intermediate products)	2 Value added	3 Sales of goods and services: Total	4 To other industries*	5 To final buyers
	$	$	$	$	$
A	30	40	70	45	25
B	20	45	65	25	40
C	10	30	40	15	25
D	40	25	65	15	50
Totals	100	140	240	100	140

*Excluding capital goods.

51. In a closed economy the purchases of industries (col. 1) and the sales
of industries to other industries (col. 4) represent two ways of classifying the
same group of inter-industry transactions. Price indexes relating to the purchases
of intermediate products set out in column 1 and to the sales of intermediate
products set out in column 4 would therefore measure price changes in transactions
between domestic industries concerned with intermediate goods and services. In an
open economy it is also necessary to take account of the price changes in purchases
of intermediate products by domestic industries from the rest of the world, by
extending the coverage of the index to include the relevant entries for the import
sector.

52. It has already been suggested that in constructing price indexes the
transactions taken into account should be limited to transactions in the market
economy. The coverage of the price indexes for the intermediate transactions may
be further reduced by the omission of certain classes of transactions for which
price information is not especially needed; that is, indexes relating to intermediate
transactions in services (as opposed to transactions in goods) and transactions

at wholesale by the trade sector. It has been noted that these sections are commonly omitted in national wholesale price indexes. (On the other hand it has been found convenient on occasion to extend the coverage of the price indexes for intermediate transactions to include price changes in intra-industry transactions, generally referred to as the "gross" presentation. This presentation, by taking account of all inter-enterprise transactions of this order, would render the coverage of the indexes invariant to changes in the detail of the industrial classification employed).

53. Price indexes relating to the final expenditure categories of column 5 would measure price changes in the purchases by residents from domestic industries for purposes of consumption and capital formation; in an open economy, it would also be necessary to take account of price changes in exports by industry and direct imports by final users for consumption and capital formation. There is in principle a dual entry for each of these transactions between industries and final buyers, to record the transaction as it affects both buyers and sellers. This double record provides a basis for the classification of price indexes relating to these transactions both by categories of sellers and by categories of final buyers.

54. Questions affecting the detailed classification of price indexes for these intermediate and final expenditure flows are taken up in following sections. A more extensive consideration of the construction of wholesale and retail price indexes and a description of certain country practices are given in a recent United Nations report[31]/ on this subject.

55. There is one further type of price index sometimes constructed by countries which should be mentioned at this juncture. This index is obtained by dividing a real value added series for the economy or a particular sector into a corresponding value added series expressed in current money terms. The resulting implicit index measures changes over the period of the index in the prices of the factors of production employed in the given sector. Price indexes of this order, classified by industries, would indicate the extent to which changes in factor prices have contributed to changes in the prices of industry sales. It would often be valuable

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[31]/ Index Numbers of Wholesale Prices, memorandum submitted by the Secretary-General to the Ninth Session of the Statistical Commission, Document E/CN.3/204, 6 December 1955.

to contrast the factor price movements measured by this index with price changes in industry purchases of intermediate products (inputs), which are measured by certain of the indexes previously considered.

56.   The supporting tables in constant prices: A number of supporting tables which provide for the presentation of detailed sub-classifications of the principal accounting flows of a system of quantity statistics are given below.   The items in these tables may be presented in the form of index numbers, or values at fixed prices or, perhaps preferably, in both forms.   Apart from Table I, these tables refer in turn to the classifications recommended for the industrial origin of domestic product, capital formation, private consumption expenditure, general government consumption expenditure and the external transactions.   In Table I, the broad component flows of expenditure on gross domestic product are shown and this aggregate is then related to the aggregate of expenditure on gross national product.   These tables correspond with certain of the supporting tables given in the United Nations report.

57.   In addition to the sub-classification of the product and expenditure aggregates provided in these tables, it has been proposed in earlier sections that non-marketed production, consumption and capital formation measured in any of the product or expenditure flows of Tables 2, 3 and 4 should be separately stated, at least where these non-marketed entries are economically significant. It has also been proposed that Table 4 relating to private consumption expenditure might where feasible be supplemented by a table showing the analysis of this expenditure aggregate by important socio-economic groups.   The socio-economic groups considered significant would vary between countries; in some under-developed countries the principal division might possibly be between rural and urban consumers, and in some industrialized countries the main division might be between the consumption of farmers, wage earners and "others".   Because of the divergent breakdowns needed and pending an expression of views by countries on this subject, firm proposals regarding the form of this table are not put forward.

58.   Countries which have a particular interest in the economics of the rural sector (or the farm sector) might also consider the preparation of quantity indexes relating to the entries of Table XII in the United Nations report, namely receipts and disbursements of the rural sector.   It would presumably be necessary to exclude items 5, 6, 11 and 12 relating to transfers and borrowings.   Given price,

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quantity and value data for the transactions of the rural sector, it might be possible to compute the gain (or loss) from changes in the terms of trade for the sector in a manner analogous to that used in computing the effect of changes in the terms of trade upon the whole economy.

59. In Tables 2 and 4 below only the broad sub-headings of the tables given in the United Nations report have been reproduced. Where it is proposed to present the quantity indexes in more detail than is given here, reference should be made to the United Nations report for information concerning further sub-classifications. Reference should also be made to the United Nations report in the case of Table 3 to obtain the detailed industrial categories proposed for Part B and the detailed sectors proposed for Part C. In Tables 3 and 5 alternative classifications of the aggregates of gross domestic capital formation and general government consumption expenditure respectively are proposed. It is recognized, however, that while each of these classifications would be of value, the forms of the basic statistics and the methods of estimation used may often inhibit the presentation of quantity indexes under some of the alternative forms put forward.

Table 1. Expenditure on gross national product (I)

1. Private consumption expenditure
2. General government consumption expenditure
3. Gross fixed capital formation of private enterprises
4. Gross fixed capital formation of public corporations
5. Gross fixed capital formation of government enterprises
6. Gross fixed capital formation of general government
7. Increase in stocks

   Expenditure on consumption and gross capital formation
8. Export of goods and services

   Expenditure on gross domestic product and imports
9. Less imports of goods and services

   Expenditure on gross domestic product
10. Net factor income payments from the rest of the world
11. Trading gain

    Expenditure on gross national product

Table 2. Industrial origin of gross domestic product at factor cost (II)

    1. Agriculture, forestry, hunting and fishing
    2. Mining and quarrying
    3. Manufacturing
    4. Construction
    5. Electricity, gas, water and sanitary services
    6. Transportation, storage and communication
    7. Wholesale and retail trade
    8. Banking, insurance and real estate
    9. Ownership of dwellings
  10. Public administration and defence
  11. Services

Gross domestic product at factor cost

Table 3. Composition of gross domestic capital formation (VI)

A. By type of capital good
    1. Fixed capital formation
        a. Dwellings
        b. Non-residential buildings
        c. Other construction and works
        d. Transport equipment
        e. Machinery and other equipment
    2. Increase in stocks

Gross domestic capital formation

B. By industrial use
    1. Fixed capital formation in:
        (11 industrial categories)
    2. Increase in stocks in:
        (6 industrial categories)

Gross domestic capital formation

C. By type of purchaser
    1. Fixed capital formation:
        (4 sectors)
    2. Increase in stocks:
        (4 sectors)

Gross domestic capital formation

Table 4. Composition of private consumption expenditure (VIII)

     1. Food
     2. Beverages
     3. Tobacco
     4. Clothing and other personal effects
     5. Rent and water charges
     6. Fuel and light
     7. Furniture, furnishings and household equipment
     8. Household operation
     9. Personal care and health expenses
   10. Transportation and communication
   11. Recreation and entertainment
   12. Miscellaneous services
   13. Expenditure of residents abroad

     Total

   14. Less expenditure of non-residents in the country
   15. Less value of gifts sent abroad

     Consumption expenditure of households and private
     non-profit institutions

Table 5. Composition of general government consumption expenditure (X)

A.   By type of expenditure
     1. Compensation of employees
     2. Purchases from enterprises and abroad
     3. Less purchases by households and enterprises

     General government consumption expenditure

B.   By purpose
     1. General administration
     2. Defence
     3. Justice and police
     4. Education and research
     5. Health services
     6. Special welfare services
     7. Transport and communication facilities
     8. Other services

     General government consumption expenditure

C.   By type of authority
1. Central government
2. State governments
3. Local authorities
4. Social security funds

General government consumption expenditure

Table 6. External transactions (XI)

1.   Exports of goods and services
    a. Merchandise (f.o.b.)
    b. Transportation
    c. Foreign travel
    d. Government
    e. Other

2.   Net factor income received from the rest of the world

Current receipts from the rest of the world

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3.   Imports of goods and services
    a. Merchandise (f.o.b.)
    b. Transportation
    c. Foreign travel
    d. Government
    e. Other

Current payments to the rest of the world

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60. The detailed classifications of a system of price indexes: The detailed price indexes of the present system are also defined within an accounting framework. As far as possible, the classification of these indexes should correspond with the classification of the supporting tables given in para. 59 above, and with the additional classifications of private consumption expenditure by socio-economic groups tentatively considered earlier. It seems eminently desirable that the three series, (i) current values (ii) quantity (or fixed price) statistics and (iii) price index numbers, should be displayed as far as practicable in the same manner, perhaps, indeed, in juxtaposition in the same tables, so that for each item the particulars specified will be available. Changes in (i) overtime can thereby be readily "explained" in terms of (ii) and (iii). In

this matter of presentation, no difficulty will be experienced in regard to
(i) and (ii): the rubrics in the tables will be identical. An earlier
recommendation may be recalled that, for each item in which the imputed part
(subsistence, etc.) is sizeable, separate figures should be given for the
imputed and marketed constituents in the case of both the current value and the
fixed price series.

61. As regards price index numbers, it will be evident, by reference to the table
headings given above, that the price series are determinable, at least
conceptually, in a unique manner for items in all sections except table 2 -
Industrial origin of gross domestic product - in the sense that, with this
exception, [32]/ there will be one price index for each item. In fact, usually
the price indexes will be the quotients of the value by the fixed price series.
It may be deemed desirable to print the "price" index numbers pertaining to the
imputed sub-items in italics or with some other distinguishing mark to draw
attention to their special character. In considering table 2 and the input, output
and value added estimates for individual industries, several price index numbers
can be made. Three types for each selected economic sector can be distinguished
(1) sector purchase prices (2) sector sales prices and (3) added value prices;
and, in turn, more than one price index is conceptually valid in the case of
(1) and (2). Two concepts only will be considered here: -

    (a) price index numbers pertaining to purchases and sales compiled
on an establishment basis within the economic sector;

    (b) price index numbers pertaining to purchases and sales compiled
on a sector basis, whereby intra-transactions in the sector are
not taken into account.

These may be termed respectively the "gross" and the "net" concepts. According
to (a), the weighting diagram consists of the aggregates of the quantities and
values of items of purchases and sales, such as are commonly returned in the
industrial production censuses. There is no conceptual problem about computing
price (or unit value) indexes from such material. As regards (b), one envisages

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32/ And the "gain from terms of trade" entry in Table 1.

a production boundary drawn around the sector and one is concerned only with the
price indexes relevant to the flows across the boundary, in and out; intra-
transactions are ignored.[33/] It is not deemed necessary to appraise here the
relative merits of the gross and net concepts of sectoral purchase and sale
indexes in the general context of price index numbers required for economic
analysis. While recognizing that the gross index is easier to compute and that
it takes into account a wider range of products by stage of manufacture than does
the net concept, there can be little doubt that, for the present purpose (in which
the production boundary and the sectional flows have so predominant roles and in
which the index numbers have to be juxtaposed with current value and quantum
series), the net concept is the more appropriate one. For instance, for the
appraisal of its economic trend agriculture as a composite branch of economic
activity is far more concerned with the prices of commodities like fertilizers,
animal feed, machinery etc. purchased outside the sector than in internal
transactions which affect the individual farmer but in which one man's loss will be
another man's gain; and analogous considerations apply to sales. Even if this
preference for the net concept be not accepted, it is reassuring to observe that,
in the application of the indexes for the deflation of current value inputs and
outputs to obtain volume added value, the results will be the same using the gross
or net approaches.

62. The last consideration lends force to the suggestion that, in addition to
the price indexes relating to purchase and sales, a "price" index of added value
for each sector, computed as the quotient (x 100) of current added value by
quantum of added value, should be displayed. Thereby the value term will be
"factorized" into price and quantity. The index of the "price" of added value

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33/ Both for the gross and net concepts the sector will usually be conceived
     as a group of establishments, though exceptionally it may be possible to
     isolate departments in very miscellaneous establishments. It must be
     recognized that the products of any sector will be variegated in a degree,
     in the sense that all the products may not pertain to the sector. For
     instance the food industry may sell some tin containers and purchase
     tinplate. Usually such "alien" products will constitute only a small
     fraction of the sales of the sector. Despite this unavoidable element
     of heterogeneity of product, it is not recommended that attempts should
     be made to allocate alien products to their proper sectors. Therefore
     the sectoral price index numbers should take account of such products.
     If desired, separate index numbers can be computed for main groups of
     commodities in each sector.

in each sector could be interpreted as indicating pro rata the money reward of the factors involved. In turn this factor price would be explained by the more realistic prices of purchases and sales: e.g. if factor price has increased it will be possible to say that this came about mainly by a fall in the price of goods and services purchased, etc.

63. It is therefore recommended that for each economic sector in table 2 of the schedule in paragraph 59 there be displayed in juxtaposition or in separate tables:-

       (1):(a)   current values, (b) index of current value,

      (ii):(b)   value at fixed prices, (b) quantity index for the sector
                 as a whole,

     (iii):(a)   price index of purchases, (b) price index of sales,

          (c)   price index of added value.

64. Formulae: The presentation of price and quantity indexes within the framework of the national accounts implies certain constraints not only in the coverage and classification of the indexes, but also in the formulae adopted in their construction. In principle, the component quantity indexes of the system should in all cases employ the price relationships of the same period as weights, to yield composite indexes which permit a meaningful interpretation. To quote from a United States[34] study on this point, "unless the various physical quantities or their prices all change in the same proportion, the use of prices of different years as the basis of valuation will result in different percentage increments of the composite series, and no unique measure of the real output is possible". This requirement that consistent formulae should be used for all component indexes is reinforced by noting that each transaction is recorded in the accounts, in principle, as a double entry, and consistent weighting procedures are needed to maintain the conceptual equality of the various aggregates in constant as in current prices.

65. In addition, there should be interdependence between the system of price indexes and the system of quantity indexes. Interdependence involves the use of base-weighted (laspeyres) quantity indexes in conjunction with current-weighted

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34/   Ref. 9   (See Annex I).

(Paasche) price indexes, or current-weighted (Paasche) quantity indexes in conjunction with base-weighted (Laspeyres) price indexes. By using interdependent indexes, the implicit quantity and price indexes derived from current value estimates may be given weights in each case which are in accordance with the formula governing the directly computed indexes. For example, the use of a price index weighted in accordance with the Laspeyres formula (base-weighted) to deflate a current value index would be required to yield a quantity index with current weights (Paasche's formula). The decision concerning the use of a particular formula for the quantity indexes should be general, for the reasons already set out. The need to aggregate price indexes in presenting these indexes as components of a price index system implies the adoption of a single formula in this case also.

66. The consistency requirements given above are unlikely to be achieved in practice, at least in the short term, principally because of the need for purposes of economy to work with conventional sector price and quantity indexes constructed under diverse formulae and on varying weight bases. When price relationships have not changed markedly in the sector involved between the base period selected for the system of indexes and the weight base year of the conventional index, the bias resulting from the use of the conventional index converted arithmetically to the standard base is unlikely to be significant. In such cases the use of the conventional index would be acceptable. In other cases, the decomposition and reweighting of the conventional indexes would usually be advisable.

67. In most country studies, the quantity and price indexes presented within an accounting framework conform to either the well known Laspeyres or Paasche index number forms. The nature of these two formulae and their application in constructing indexes of industrial production have been examined at length in a United Nations publication on this subject.[35/] It is pointed out in this study that the Laspeyres and Paasche formulae allow a clear interpretation of the indexes, are easily computed, and make use of data likely to be available promptly and regularly. These same criteria suggest the use of the Laspeyres and Paasche formulae in national accounting. While there is an unavoidable bias in these as in other forms

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[35/] United Nations: Index Numbers of Industrial Production, Studies in Methods No. 1, New York, September 1950.

of quantity index, there is some evidence to suggest that the bias tends to be in an upward direction in a Laspeyres quantity index, and in a downward direction in a Paasche quantity index. The experience in these matters gathered in a United States study concerned with the deflation of gross national product is given below: "However, tests have indicated that the choice of recent year prices tends to reduce somewhat the indicated long-term growth in gross national product. The reason for this is that the products whose output expands most tend to be the ones that decline in relative prices. Hence they receive a smaller weight in the total if recent year prices are used to value output. While the differences obtained are not large, they are of sufficient magnitude to be kept in mind when making analyses of long-term trends in production and productivity."[36]

68. The choice between Laspeyres and Paasche indexes is primarily a matter concerned with the character of the available basic statistics. Consistent methods of deflation using these formulae require the use of base-weighted quantity indexes in conjunction with current-weighted price indexes, or current-weighted quantity indexes in conjunction with base weighted price indexes. A wide range of current year data must therefore be collected in a form suitable for index number construction whichever formula is selected for the quantity indexes. A number of countries have found it convenient to prepare their system of quantity indexes in conformity with the Laspeyres formula. These countries have usually constructed a certain number of quantity indexes by using selected quantity indicator series and base year value weights often computed from the extensive statistics available in a census year. The conversion of the available price indexes to indexes with current weights has then been undertaken to permit the deflation of current value series to yield the remaining (base weighted) quantity indexes of the system, by methods which are described in following chapters.

69. Base years: In considering the question of the periodical review of the base year of an index of industrial production, the Statistical Commission of the

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36/ Ref. 9 (see Annex I).

United Nations recommended[37]/ that countries should review the weights of the index every five years, and if necessary, adopt a new weight base, in the light of recommendations on the general suitability of different years for this purpose.[38]/ The Statistical Commission has also recommended a thorough review of the components of each country's wholesale price index from time to time, and has suggested that the same weight base should not normally be used without re-examination for a period of more than ten years.[39]/ In the case of index numbers of quantum relating to external trade, the Commission requested at its eighth session[40]/ that a survey should be made of the methods employed by countries in checking the reliability of the external trade indexes, to determine, inter alia, whether or not a change of base is desirable.

70. The need for periodical revisions of the weight base of price and quantity indexes presented within an accounting framework has been emphasized. Apart from questions of incomplete data, the degree of bias in an index is determined by the extent of the changes in the commodity composition and price relationships of the flow in question over the period of the index. It follows that changes in the weight base of the indexes should be more frequent in periods of marked economic change than in periods of comparative stability. But even in favourable conditions a change every few years in the weight base is usually advisable, to maintain the accuracy of indexes which are often employed to measure changes in volume or prices of relatively small extent. The recommendation of the Statistical Commission that the weight base of the index of industrial production should be reviewed every five years therefore appears to have equal merit when applied to the components of a system of price and quantity indexes. The short period indexes could then be extended by linking to maintain the continuity of the accounting data and to provide longer time series.

37/ United Nations: Report of the Statistical Commission (fifth session) to the Economic and Social Council, New York, May 1950.

38/ This procedure is also recommended in the United Nations publication Index Numbers of Industrial Production, op. cit.

39/ United Nations: Report of the Statistical Commission (seventh session) to the Economic and Social Council, New York, February 1953.

40/ United Nations: Report of the Statistical Commission (eighth session) to the Economic and Social Council, New York, April 1954.

71. In any such review of the weight base it would be useful to compute quantity indexes according to both Laspeyres and Paasche formulae. Significant deviation between the two indexes would signal the need for revision of the weight base. Despite revision, the original number base might be retained by linking when lengthy time series and certainty in the published data are considered necessary. There is an alternative proposal in this connexion which is worth review, namely that for each price or quantity index two index numbers should be computed, one with the base year as 100 and one with the previous year as 100. It is envisaged that in constructing the index to base previous year 100, the recomputation of the index on previous year weights would be undertaken, rather than a simple arithmetic conversion of the primary index. Such a series could be linked by continual multiplication to any year as 100 and by comparison with the base weighted series would indicate when the latter required revision. It might not be useful to publish this linked series.

72. The principles of consistency and interdependence which should be observed in constructing a system of price and quantity indexes imply that any decision to change the base period of the indexes should apply generally. In practice, it may often be difficult to implement this rule. There are usually certain conventional price and quantity indexes with differing formulae and base periods already in existence when the construction of a system of price and quantity indexes is undertaken. Further, the base periods and formulae of some of these indexes may be prescribed by statute, for example, consumer price indexes in some countries, or by agreement among contractual parties of employers and wage earners or other groups. Where for these or other reasons it is not feasible to introduce standard formulae and base periods, it may often be necessary to sub-divide and reweight the conventional indexes before they can be fitted into the accounting framework.41/ Alternatively, where it has been ascertained that a sufficient degree of consistency in the price relationships exists between the base period of the original index and the standard weight base period selected for the system

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41/ As discussed in ref. 9, p. 26, this reweighting is not often carried
     below a certain level of product detail   (See Annex I).

of accounts, a simple arithmetic conversion of the conventional indexes from the existing to the standard base period is justified. Nevertheless, it would contribute to the accuracy of the system of indexes and reduce effort if the weight bases of the conventional indexes could be revised over time. In this connexion every effort should be made in planning new indexes or major revision of existing indexes to ensure that they are computed on the standard weight base period. It would no doubt be necessary to continue the use of other base periods for the conventional indexes in special cases, for example in constructing indexes such as the external trade indexes when the price or quantity weights of these indexes have been subject to especially rapid change during the period under review. But such indexes would then represent the exceptional rather than the general practice.

73. <u>Periodicity</u>: The accounting period implicitly considered in the United Nations report is the calendar year. Some countries also produce abridged systems of accounts in current money terms for shorter periods, usually quarters. Since most countries compute price indexes for monthly periods and conventional quantum indexes such as the index of industrial production for periods of a month or quarter, it would be feasible, given the availability of quarterly accounts in current prices, to undertake construction of compatible quarterly price and quantity data within the framework of the accounts. Such information would be of especial value for economic studies concerned with short term policy problems. Extension of the scope of the monthly price-quantity indexes and their rearrangement to conform to the system of flows defined in the national accounts would probably require comparable changes in the coverage and form of basic price and quantity data. In addition, more intensive efforts might be needed to improve the collection of current value data; for example, the collection of establishment purchases, sales and stocks data on a quarterly basis would assist the preparation of these estimates. Detailed consideration of these questions has not been undertaken in this paper.

CHAPTER 5

METHODS AND STATISTICS

74. The scope of the various quantity indexes which measure the production of the economy and its component industries and the volume of the final expenditure flows has already been defined. In the case of the production indexes, the measure relates to the contribution of each industry to domestic product; this contribution is measured gross of capital consumption allowances and is valued at factor cost. The quantity indexes of final expenditure measure the volume of transactions in goods and services between domestic producers and final buyers (plus direct imports of final products by residents); valuation is at market prices and the capital formation expenditures are presented on a gross basis. In computing these quantity indexes, various alternative methods have been developed by countries to make best use of the available basic data. In essence, these methods embody one or other of three principal revaluation procedures, namely:

(a) extrapolation of base year values by quantity indexes;

(b) deflation of current value series by indexes of selling prices;

(c) deflation of current value series by cost indexes.

These procedures are described below in general terms to illustrate their underlying principles and the compromises usually involved in their use, as a preliminary to the discussion of particular methods and basic statistics.

75. Extrapolation by quantity indexes under this procedure, changes in the volume of a given flow, whether the inputs or outputs of an industry, or an item of final expenditure, are represented by physical series of goods and services. Values of the weight base period are employed to combine the quantity data of the base and succeeding years in the formation of a quantity index. For example,

> "Thus we multiply the number of tons of steel ingots produced for sale
> or shipment by steel mills in a given year (designated by q_1) by the price
> of steel ingots per ton in the weight-base period (   ); do the same for
> steel sheets and for other products of steel mills; then add these
> computed values to obtain the physical output of steel mills. In algebraic
> language, this is   . We secure these values for each year, and
> to compute the index of output, express them as relatives on a
> comparison-base period;   42/

42/ Ref. 12, p. 358 (See Annex I).

76. In the case of most economic flows the available quantity statistics provide only a partial coverage; the diversity of products making up any given flow, even when relatively broad product classes are adopted, is usually sufficient to inhibit the collection of comprehensive quantity data, although the attainment of a wide coverage is desirable. The given quantity statistics or some selection of these figures are therefore employed as "indicator" series to represent changes in the flow in question, and an adjustment is made to complete the coverage of the indicators.

77. Alternative coverage adjustments have been employed and described in country studies.[43] The weights of the unrepresented series may be attached generally to the sum of the indicator series, or to particular indicators where close technical or market relationships are discerned, on the assumption that the representation provided by the given indicator series is satisfactory. Changes in the coverage ratio[44] are in this case attributed to changes in the relative prices of the indicator and the unrepresented products.

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[43] The Statistical Office of the United Nations has prepared reports on the methods used in adjusting both indexes of industrial production and indexes of quantum in international trade for incomplete coverage. The former report, Index Numbers of Industrial Production, op. cit., discusses in chapter VII methods of imputing the weights of an uncovered sector in constructing an index of production. The second report, entitled Indexes of Quantum in International Trade, Statistical Papers, Series M, No. 3, New York, 1949, examines the "kinds of adjustment that are usually made to take account of items of trade which are not directly used in the calculations". Four principal adjustments are considered and evaluated in this latter report, namely adjustments based on the following assumptions:

(a) The same price changes as all the other items in the trade aggregate.

(b) The same price changes as certain other groups of related commodities.

(c) The same quantum changes as some or all of the other items of the trade aggregate.

(d) Such variations that no adjustment is attempted and the quantum index is applicable only to that part of total imports or exports directly used in the computations.

[44] The ratio in any year between the current value of the indicator quantities and the total current value of the flow which they represent.

Secondly, the index yielded by the indicator products in a given year may be adjusted to the extent necessary to restore the coverage ratio of the given year to the base year ratio.

"The procedure is illustrated in the following hypothetical example, in which we assume that there has been no change in the true total output:

		1929	1933
1.	Index of output based on selected products	100	70
2.	Coverage ratio	0.80	0.56
3.	Index of output adjusted for change in relation between the value of the selected products and the total value of products of the industry	100	100"[45]

This adjustment rests on the assumption of a parallel movement in the prices of the represented and unrepresented products. In an unofficial United States study it was adopted "with but a few exceptions ... only when the coverage ratio in both years compared (was) at least 0.40," [46] to limit the possibility of error. The choice of the adjustments described here rather than the adjustment described in the preceding paragraph implies the assumption that the given sample of product prices provides more accurate representation than the sample of quantity data. The selection of any particular coverage adjustment, or simply a decision to forego the available adjustments and to seek more extensive information, is of course materially assisted by detailed study of the economic and technical factors underlying the particular flow under review.

78. An alternative to the coverage adjustments described here would be to segregate the aggregate of residual "value only" items in the flow and to deflate the aggregate by a specially prepared price index. The deflated sum could then be added to the sum product for items with quantity specified. This procedure would often be preferable to the practice of deflating the residual "value only" items by the price index derived from the quantified items, implicit in the coverage adjustment described in the preceding paragraph.

45/ Ref. 12, p. 362 (See Annex I).
46/ Ref. 12, p. 364 (See Annex I).

79. Deflation by indexes of selling prices: The construction of price indexes for the deflation of accounting flows requires the assembling and weighting of price data in a form governed by the accounts, to yield indexes which measure price changes in specific accounting flows. In the case of the final expenditure flows, for example, the prices collected should represent prices paid by final buyers, with appropriate sub-classifications by sector and product to conform to the various classifications of the expenditures on final product defined in the UN report.

80. In the usual case, these price indexes are based on a small selection of prices, which are assumed to represent all price movements in the given flow. The prices collected relate to precisely defined products, which may be defined not only in physical terms but with some regard to sales conditions and the supplementary services provided. In collecting representative prices, and in making price imputations, due allowance is made for differences in regional and seasonal price levels. The coverage of the available prices must be extended to represent the prices of all products concerned, as a prerequisite to the weighting of the price relatives by the product values of the weight base period, and the compilation of the index. It is often feasible in selecting a representative group of transactors (buyers and sellers) from whom price information is collected, to adopt sampling methods; but the extension of these methods to the selection of representative products for pricing purposes tends to be inhibited by the absence of a comprehensive product schedule. It is therefore necessary to exercise judgement in extending the available price data to represent the price movements of other qualities of the same product and related products. In some instances it is possible to make a further imputation and to extend the coverage of a price index for a particular set of transactions to apply to related flows. This sort of imputation is discussed in relation to the deflation of industry inputs and outputs in Index Numbers of Industrial Production, para. 79.

81. In country studies, the accounting entries have sometimes been deflated by existing convention indexes such as the wholesale and retail price indexes, or components of these indexes. However, the coverage and weighting systems of these indexes do not often conform to the specifications required for accounting

purposes. Some countries have therefore returned to the basic price detail
of these indexes, and have adapted this information to accounting forms. As
a first step, the available prices have been set down against the products or
product groups whose prices they represent. Where necessary, the prices have
been adjusted to the required distributive level by allowing for such factors
as changing distributive mark-ups and transport charges. Supplementary price
data have then been collected from other indexes, from mail order catalogues and
similar records, and sometimes directly by questionnaires, to complete the
coverage of the indexes; but it has been found practicable to rely to some extent
on price imputation procedures to complete the coverage of the indexes. "In
general, it is believed that increasing refinement of the price deflation
procedure runs into rapidly diminishing returns beyond a certain point. This
conclusion is based on tests that were run by deflating only the broader segments
of national product by corresponding composite price series, based on the major
indexes, and omitting the minor, supplementary price series."[47]

82.   The next step is to reweight the individual price series in conformity
with the governing formula. A number of countries have adopted the Laspeyres
formula for their quantity indexes and the Paasche (current weighted) formula
for their system of interdependent price indexes. Their procedure has then been
to secure relatively detailed component value series for a given flow, and to
deflate these series by corresponding price indexes constructed from the
available price series. At this level, the price series are usually formed into
indexes using the weights of some recent period for which the necessary detail is
available, rather than the current year weights indicated by the formula. This
deflation process yields individual constant price series which may be added
together to yield a comprehensive constant price estimate for the flow in
question. The choice of the base period for the detailed price indexes is
governed by the formula (Laspeyres or Paasche) adopted for the system of
quantity indexes, since "the choice of a base period for the price indexes is
arithmetically the same thing as using the relative prices of that period as
weights, or multipliers, for the component output estimates in the other given
years".[48]

47/ Ref. 9, pp. 21-22 (See Annex I).
48/ Ref. 9, p. 26 (See Annex I).

83. In the study for Canada,[49]/ where Laspeyres quantity indexes were computed by a procedure similar to that described above, it was stated that "an implicit (currently weighted) price index may be obtained at any stage of the summation by dividing current dollar totals by the constant dollar totals". That is, when individual product series are separately deflated, they yield constant price series valued at the prices of the base year selected for the price deflator; the aggregation of these component series would then yield a quantity index having the values of this same base year as its weights. Where this quantity index is a Laspeyres (base weighted) index, the implicit price index derived by dividing this index into the current value series is an index with current year weights. This statement does not take into account the use of inappropriate weights in the construction of the detailed price indexes employed in the initial stage of the deflation process. The use of such weights is usually imposed by lack of adequate current information, and may only be justified by an assumption that the weights used approximate those required by the general formula. Canada has found that this assumption is not valid for flows which are subject to marked short term changes in price relationships and product composition, in particular the export and import flows.[50]/

84. A practice sometimes adopted as an alternative to the collection of a price sample is to compute "unit values" or average prices for a particular category of products, by dividing the quantity estimates into the current value estimates. Unit values computed in this way have the advantage of providing an extensive or comprehensive price coverage for the transactions involved. But this procedure implicitly assumes that homogeneity of product has been maintained over the period of the calculations within the product classes for which statistics are available. This question is discussed generally in a later section. The assumption is only likely to be valid where the quantity and value statistics used are given in considerable product detail.

49/ Ref. 23, p. 124 (See Annex I).
50/ Ref. 23, p. 125 (See Annex I).

85. Deflation by cost indexes: This procedure represents a solution to special problems of deflation which occur when the nature of the available basic statistics hinders the compilation of quantity indexes and the direct construction of price indexes. The procedure calls for the construction of price indexes based on costs of production instead of exchange prices. For example, the sales of an industry to other industries and to final buyers, and the purchases of final buyers from a given industry (e.g. construction), might in each case be deflated by price indexes based on the cost structure of the industries concerned rather than on their selling prices. This treatment derives its logical support from the accounting equality of material costs and factor payments on the one hand and sales plus the stock imputation on the other.

86. In principle, the input costs collected should represent the costs in each year of all materials used up in production and all factor services applied to these materials. The weights employed in combining these cost series to form an index should represent the proportionate shares of the various materials and factor services consumed in the weight base year. It may be noted that the bias in such an index would be attributable to changes in relative prices and quantities of the material and factor inputs rather than in the relative prices and quantities of the goods produced; insistence upon a particular weight base year in such a case would have little meaning.

87. In practice the available cost data are usually restricted to a selection of the materials and labour costs of the industry. An index based on this information involves the implicit assumption that there has been no change in the productivity of labour and that (in some sense) this cost index was a suitable deflator for the sum of the profit and net indirect tax margins. It was found in a United States study of the construction industry[51] that "the errors due to the neglect of profit margins and of productivity (were) additive", because of the inverse correlation of profit margins and productivity during the business cycle in this industry. It was therefore considered advisable in this instance to adjust for changing profit margins, although the further adjustment for changes in productivity was not feasible. Adoption of the technique

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51/ Ref. 14, p. 156 (See Annex I).

described in this section, and in particular the inclusion or exclusion of the adjustments for changing productivity and profit margins, implies also the adoption of a specific approach to the measurement of quality changes in products. This question is considered in later sections.

88. <u>Quantity indicators</u>: The basic quantity series used in the direct construction of the quantity indexes of a system of accounts should relate to the inputs and outputs of an industry and to the final expenditure flows as defined in earlier chapters. The output series for an industry should therefore measure "production of completed items at the end of a stage of production, e.g., production of cotton cloth or automobiles",[52] whether sold or added to the industry's stocks; and in addition should include changes in the amount of work in progress in the industry. The input series for an industry should relate to the materials and services used up in production during the period, and should therefore represent the intermediate materials and services purchased by the industry, after adjustment for changes in the quantities of these materials held by the industry in stocks. Quantity statistics for the final expenditure flows should measure those goods and services which are the subject of transactions between producers and final buyers, and should therefore constitute a record of the goods and services which cross the production boundary of an economy.

89. It is often necessary in practice to use quantity series which are not fully in accord with these definitions. In some sectors, the industrial classification of the quantity statistics may not agree with the classification adopted in the national accounts, particularly when the statistics are obtained from trade association and related sources or collected by government agencies as a by-product of their administrative functions; for example, data from these sources often refer to all production of a particular commodity, both within the census industry and as a subsidiary product of other industries. In other cases the output statistics may refer to quantities of goods delivered rather than to the required measure of goods sold plus net additions to industry stocks. Quantity statistics for the final product flows must often be compiled at the stage at which the goods are transferred from the producer to the wholesaler or

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[52] <u>Index Numbers of Industrial Production</u>, op. cit., p. 25.

retailer, rather than at the final product stage. Import figures should then be added to these production estimates and exports and stock increases deducted to give the required expenditure estimate; it has been found however that in practice it is not always feasible to make the adjustment for stock changes. A further significant shortcoming sometimes found in quantity series of output stems from the difficulty of measuring changes between periods in the amount of work in progress.

90. Discrepancies of the above order may sometimes be offset by the choice of appropriate methods for compilation of the quantity indexes. For example, where quantity indicators of output relate to all production of a particular commodity, whether as a primary or a subsidiary product, it is often possible to compute the real product of the industries concerned without serious loss of accuracy by an approximate reallocation of the value added weights between the industries to correspond with the classification of the indicators.[53] In industries such as construction, shipbuilding and aircraft, where period to period changes in the amount of work in progress are usually significant, "the general solution is to break up the industry into stages and to devise quantum series for each stage".[54] When the available quantity data exclude stockpiling, as is sometimes the case, a check should be made with the industry concerned to ensure that it does not maintain extensive and fluctuating stocks before using the data in the construction of an index.

91. The unit of quantity in which output is to be expressed for index purposes may also involve difficult decisions in a few special cases. For most transactions "the appropriate measure can usually be determined by considering what the producer is under contract to provide, or what the producer in fact obtains ...".[55] But for government services provided without charge, defence,

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[53] See Ref. 5, pp. 441-2 (See Annex I).

[54] Index Numbers of Industrial Production, op. cit., p. 32.
This method is described in detail in pages 32-33 of the above report, and is also considered in the final chapter of this paper.

[55] Ref. 11, p. 38 (See Annex I).

education and civil administration have been cited, the absence of contract
provisions may make it difficult to establish the appropriate unit of quantity.
Country practices in this field are described in the following chapter. The
principle widely adopted is to determine what the unit of contract might be if
these services were the subject of a normal commercial transaction and to employ
this unit in constructing the index.[56]/ For many of these services the available
statistics are limited, and this factor in itself may impose an admittedly
arbitrary decision on the choice of a quantity unit.

92. The wide range of commodities produced by an economy can only be organized
and recorded for statistical purposes within relatively broad product classes;
categories such as "black coal", "ploughs" and "tractors" are sometimes employed
for the presentation of these data. The use of material classified in this way
to produce quantity indexes must then rest on an assumption of homogeneity in
the component products of a class, or rather of constant proportions among the
component (sub-class) products. Unit value figures derived from a comparison
of the relevant quantity and value data should be used wherever possible to
check this assumption. The assumption may be invalidated in some industries by
a lack of concurrence between the production periods for sub-products and the
statistical period; for example, "batch" production methods may lead broad
sections of an industry to concentrate on the manufacture of large horse power
tractors for the greater part of one year, and to switch to smaller models for
the greater part of the succeeding year. Cyclical movements in output, sharp
changes in foreign demand or supply, wars and other crises may also cause short
term changes in the size-quality composition of a given product class. The
assumption of homogeneity in class components should not therefore be made
without close examination of the nature and statistics of the industry concerned.

93. The use of partial quantity series to extrapolate a base year value estimate
has already been discussed. As part of this procedure, it is usual to assume that
proportionate movements have occurred over the period of the index in the
indicator and unrepresented commodities of a given flow. This assumption should
also be supported by careful review of the available indicators, which may

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56/ Ref. 21, p. 20 (See Annex I).

sometimes be subject to significant bias. The omission of statistics for the
minor classes of an industry's production such as spare parts, repair-work, or
by-products; the omission of the production of firms below a certain size;
and concentration in data collection upon sub-industries composed of a few large
enterprises, subject to monopoly or government control, or producing uniform
and basic products, may conceivably lead to error because of differences in
cyclical movements between the covered and the omitted series. For example, it
has been found in some industries (e.g. agricultural machinery) that the
percentage of output represented by spare parts increases sharply in depression
years: and it is the experience of many industries that the number of small firms
tends to mushroom during boom periods.

> "In choosing indicators which will broadly 'move with' the output of
> each industry, our major objective is to minimize the likely error in
> each case, but we must also try to avoid consistently choosing indicators
> which will be too optimistic (or pessimistic) under circumstances which
> are likely to arise. If a number of our basic series are liable to common
> errors of this type we must try to correct for them even if the
> adjustments are rather arbitrary". 57/

94. For some industries the number and variety of input and output commodities
preclude satisfactory classification - some engineering products industries -
even with ample statistical resources and after all possible adjustments. In
these circumstances, as in the other cases considered where the available
quantity data fall short of the required standards, the adoption of price
deflation methods rather than methods based on quantity indexes may represent
the most practicable solution. Alternatively, a mixed system may be used,
whereby the quantity part is dealt with directly and the value of the non-quantity
part deflated by a suitable price index which will usually not be that appropriate
to the quantity part. With a knowledge of the kind of goods included in the
non-quantity part it is often possible to devise an index from prices derived
from a diversified wholesale price system, even if the weights of the index must,
of necessity, be conjectural.

95. Price indicators: Apart from any recourse to unit value methods which
circumstances may render necessary, the basic price data used in compiling
the price indexes of the system described here are necessarily restricted to

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57/ Ref. 25, p. 20 (See List of References in Annex I).

a small sample of the transactions making up any given flow. Use of sampling
has the advantage that it permits a very precise definition of products for
pricing purposes. Account may be taken not only of the detailed physical
characteristics of a product but also of the sales conditions and supplementary
services provided, and differences in regional and seasonal conditions of sale,
which serve to differentiate otherwise identical products. When current value
estimates are deflated by price indexes based on such information to yield
quantity indexes, the product components of the quantity indexes are in effect
distinguished by each of the characteristics mentioned, and accorded different
weights, to the extent of any differences in their relative prices. Thus otherwise
identical products sold in different regions or in different seasons are
regarded as distinct commodities. The effective realization of this principle
depends however upon the adequacy of the sampling methods adopted.

96. The sampling procedures by which price data are usually collected involve
considerable elements of judgement rather than close attention to mathematical
precepts. It is necessary to select products for pricing purposes whose prices
may be taken to represent "price movements of different qualities, or 'price
lines', of the same commodity, and of other commodities in the same 'family'".[58]
This procedure is scarcely susceptible to precise sampling methods because of
the detailed preliminary listing of commodities that sampling would entail. In
addition, a sample of the sellers or buyers of a particular commodity must be
selected to report prices which are assumed to represent the prices charged or
paid by all transactors, with due allowance at this stage for the regional
distribution of transactors. Where an enumeration of the transactors exists,
it is both feasible and advisable to apply sampling procedures in the selection
of reporters. Since conceptually what is required in relation to each variety of
a product is an estimate of "national average price", the sampling system
should be such as to include a higher proportion of large manufacturers,
wholesalers etc. than of small. In considering this question in connexion with
cost of living statistics, the report prepared for the Sixth International
Conference of Labour Statisticians in 1947[59] commented as follows:

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58/ Ref. 9, p. 18   (See Annex I).
59/ Ref. 8, p. 19   (See Annex I).

"In principle, in making up an average price for each commodity in each
city, all the outlets at which goods are purchased by the particular
group of population concerned should be taken into account and each type
of outlet weighted in accordance with its importance.... In order to
determine the importance of each type of outlet, special studies are
required to survey the extent to which the different outlets are in fact
patronized by the population in question".

But judgement is then required once more in establishing the timing of the price
reporting, to ensure that allowance is made for both the price trend and the
seasonal factor in price movements.

97. As with quantity statistics, the price statistics should be collected at
the industry boundaries in the case of intermediate products, and at the
boundary between producers and final users in the case of commodities sold to
final buyers. The national accounting framework provides in most cases precise
classifications of transactions and commodities traded which would facilitate
the selection of products for pricing purposes and the selection of reporters.
In many countries, however, the existing price data are collected within the
framework of the conventional wholesale, cost of living and other price indexes.
Here, while the sample of sellers chosen to report the prices of given products
may be adequate for accounting purposes, it is usually found that supplementary
information is needed to provide a more comprehensive price coverage of products
traded. Procedures by which the available data may be sub-divided, extended and
reweighted to yield price indexes drawn up within the framework of the accounts
have been described briefly in the preceding section.

98. In using these price indexes to deflate accounting flows, it is assumed
that the price movements indicated by the available price data represent the
average price changes in the given flow. The common cost basis of all or most
of the goods produced within some product families, the tendency occasionally
noted to adopt uniform pricing policies within an establishment and the normal
effect of competition strengthens this assumption, which tends in many cases to
be more accurate than the assumption of representative product movements discussed
in the preceding section. For example, the relative levels of output of a range
of farm implements may vary sharply over time, in response to changes in demand
which are restricted to specific implements; on the other hand, the input factors
of labour, steel etc. are common to most implements, and changes in their prices
tend to transmit a common impetus to price changes in many of the products of
the industry.

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99.   In revaluing a given flow, the choice between price deflation and
extrapolation by quantity indexes in computing constant price series depends
largely upon the "representativeness" provided by the available quantity and
price data. Other elements in this decision include possible error in the
current value series, and the rate at which price changes have occurred; a
wide margin of error in the current value estimates or rapid price change would
tend to affect seriously the accuracy of price deflation methods. Given the
opportunity to establish a programme of statistical collection, it would
nevertheless often be advisable to suggest the development of a system of price
indexes for the deflation of current value flows rather than reliance upon
quantity data. It is often possible to apply a more adequate sampling technique
to the collection of prices than to the collection of quantity data; prices may
be collected for both basic and minor products, and for products which have been
precisely described; and price deflation techniques permit certain adjustments
for new or re-shaped products which are not possible with broadly classified
quantity statistics. But these decisions may only be reached after close study
of the nature, products and sources of the statistics of each industry in turn.
Countries in a position to do so might consider the production of estimates
using both methods as a guide to the limits of errors of estimation.

100. Changes in product specifications and new products: Some reference to this
problem has been made in the previous section. In all economies, and particularly
in industrialized and developing economies, numerous changes in product
specifications occur from year to year and new products are occasionally
introduced. The incorporation of price and quantity data relating to these new
and re-shaped products in quantity and price indexes may require a number of
necessarily approximate adjustments to the indexes. In constructing quantity
indexes on the basis of quantity indicators subject to periodical changes in
specifications, a method is needed to express the extent of the qualitative
change in the indicators in values of the base year. In constructing price
indexes, a procedure is required for the introduction of substitute products
which permits of a reasonable compliance with the principle that identical
products should be priced in the successive periods of the index. New products
can only be brought into a quantity index by imputing to the quantity series

an assumed base year value; similarly, some assumption regarding the base year prices of these products must be made when they are incorporated in a price index. A decision is also required concerning the allowance to be made in both quantity and price indexes for the price reductions which often occur through the developmental phases of manufacture of a new product.

101. In preparing national accounts estimates in constant prices and related price index systems an attempt is usually made to allow for at least the major changes in product specifications. In preparing quantity indexes, allowance might be made for changes in specifications by varying the unit of measurement: numbers, weight, volume, area, caloric content, power output, etc. have been chosen in particular cases, on the assumption that the base year values within a product group were in proportion to these quantities. A recent OEEC study describes a detailed procedure for the analysis of the price-specification relationships existing within the relevant product group, which would sometimes provide an adequate solution of this difficult problem.[60] Where the method of estimation requires the use of output data to indicate changes in value added, changes in output specifications might be offset approximately by changes in input, leaving real product (value added) per unit of output approximately constant; under these conditions an adjustment would not be required. It must be accepted however that many changes in specifications will be hidden within the given classifications of quantity data - classifications such as single furrow ploughs, kitchen tables, etc. do not reveal quality changes within these classes. The problem of quality change then merges with the problems of classification discussed previously, to which the most appropriate solutions may often be found by adopting a price deflation method.

102. In constructing price indexes, on the other hand, an endeavour is sometimes made to offset any change in specifications by adjustment based on the cost relationships of the products at the time of change-over.[61] Alternatively, the unit of quantity for a product may be changed to a unit which is common to both

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[60] Ref. 24; see also Ref. 26 (See Annex I).
[61] Ref. 9, p. 31 (See Annex I).

the old and the re-shaped product, and the price of the product before and after change-over computed on this basis. For example, where the quality of milk changes, prices might be compared on the basis of caloric content rather than by reference to a volume measure.[62]/ When a new product is involved the best course may often be to estimate the base year price by reference to the price trend of similar products. Concerning new products, American practice has been stated in the following terms.[63]/ "In the price indexes, new products are usually incorporated only after they have reached relatively large-scale commercial production, and they are linked into the index for the group to which they belong at the prevailing index number level. ...For example, television sets were introduced into the U.S. consumers' price index in January 1950 at the level of the radio-phonograph group price index. The procedure of linking into the price series for a comparable product is probably as good an expedient as can be devised. But the timing of the link is crucial. The practice of linking in only after sizeable output of the item has been attained results in giving the new product a considerably lower weight (hypothetical base year price) than it would have had the price-link been performed in an early stage of production of the new commodity."

103. The real difficulty arises when the change is merely one of specification, the altered product being designed for the same market and to fulfil the same general function as the product it replaces. One procedure is to link in the altered product to the price index only after more than one price-period quotation is available; to this procedure the objection may be raised that any "real" price change occurring at the date of introduction may thereby be left out of account. The alternative procedure of linking in the altered product immediately also gives rise to certain difficulties. Consider the case where there has been only a slight physical change in a new variety which has been sufficient, however, to increase the article's attractiveness and to induce a rise in its price. In such a case it may seem reasonable to assume that the rise in value is wholly attributable to a rise in price and to adjust the price index

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62/ Ref. 26, pp. 47-49 (See Annex I).
63/ Ref. 9, pp. 28-29 (See Annex I).

accordingly, especially if the former variety is no longer on the market and purchasers are left without choice. But the use of such an index in deflating a value series would tend to understate the resulting volume series, e.g. real advances in the standard of living consequent on the improvement in quality or utility of commodities in general.

104. It is in the face of these and related difficulties that it may be suggested that the common practice of using unit values for the estimation of volume of import, export and industrial production is less reprehensible than is often assumed to be the case, always postulating, of course, that the commodity schedule is sufficiently detailed and that close regard is paid to individual items, so as to eliminate or amend those whose unit value fluctuations are unduly large. Using the term "price" in relation to an exactly specified variety of a commodity and "unit value" as the quotient of the value by the quantity at the commodity level, a unit value could be regarded as a price if the commodity classification were sufficiently detailed; and a unit value trend would reflect the true price trend if the proportions of each variety in the commodity remained substantially unchanged. If changes occur in specifications of varieties without change in the description of the commodity, the unit values may still be taken as representing, if with qualification, changes in price. It is a point in favour of unit values that the coverage is complete whereas prices of varieties, as already pointed out, refer to only a small sample of transactions. The fact of complete coverage may have the desirable effect of cancelling out price biases due to changes in constituent varieties. One country which, some years ago, systematically collected wholesale prices of varieties of every important commodity in every major flow found so many changes occurring in specifications of import varieties that the resulting index number, computed after recourse to all reasonable expedients, fluctuated much more from month to month than did the existing unit value index number. The project of computing a genuine wholesale price index for imports had therefore to be abandoned. At present this country incorporates selected unit values for imports in its wholesale price system.

105. Of course, the foregoing considerations do not dispose of the issue of prices versus unit values or give any clear lead as to what to do about changes in varieties in constructing price index numbers. The intention has only been

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to pose the problem in the hope that a generally acceptable solution may be forthcoming. It is satisfactory to note, in this connexion, that by resolution the Ninth International Conference of Labour Statisticians in April-May 1957 requested the Governing Body of the ILO to instruct the Office:

(a) "to make a study of the theoretical and practical aspects of the measurement of consumer price changes through index numbers, paying special attention to price collection problems, such as the definition of a price for all types of expenditure, seasonal price changes, the selection of retail outlets and of items to be priced and the appropriate procedures to observe when the universe of items changes (the quality problem), and to applying modern statistical methods in the field of price measurement and assessment of the influence of other factors in order to ascertain the degree of accuracy of the consumer price index."

The outcome of this study will have considerable interest in connexion with the problem of deflating one of the most important flows in the national accounts and from it guiding principles may emerge for dealing with the problem of quality changes in other flows.

106. The manner in which an adjustment is made for changes in product specifications is of particular importance in deflating transactions in manufactured consumer goods and many classes of capital goods, where quality changes tend to be frequent and substantial. It has already been indicated that the broad categories used in classifying quantity statistics may often preclude adjustment when the direct construction of quantity indexes is undertaken. When price deflation methods are employed, it is usually feasible to make at least a partial allowance for quality changes in constructing the price indexes; this allowance is then transmitted to the constant price series by the process of deflation. In some countries, the price indexes for items of capital equipment are adjusted to allow for new models by regarding only the change in the cost of production of the new model at the time of changeover as the real product difference. In effect, any change in real product not reflected in costs is excluded from real capital formation. This procedure therefore excludes from real capital formation any gains in durability, productivity and other qualities of capital goods which result from technological progress, to the extent that they are achieved with a less than proportionate increase in the resources embodied in capital formation. On the other hand, deflation of the capital formation series by price indexes based on the labour and materials costs of producing these

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goods would tend to treat all value increases in the capital goods, in excess of
the cost increases, as real capital formation.   Similarly, deflation of a
particular capital formation series subject to marked change by a price index
for related but more stable goods (the price imputation procedure) would also
tend to show value increases in excess of cost increases as real capital
formation.   This question is examined further in Chapter 5 under the heading of
Gross domestic capital formation.

107. Despite adjustments to allow for some of the more significant quality
changes taking place within an economy, it has not often been practicable to
make adequate allowance for the numerous changes of a lesser order which occur
from year to year.   These omissions would introduce some bias to the indexes.
It has been proposed therefore that some judgement concerning the direction of
bias might be attempted, and added as a verbal supplement to assist the
interpretation of the index, especially in the case of indexes extending over a
long period of years.   (See also E/CN.3/246 which deals with the collection of
comparable wholesale price series.)

108. Estimation of real domestic product: The principal methods used to
compute the product of the component industries of an economy in constant prices
are described below under the following headings:

       (i)   Quantity or deflated input and output data.

      (ii)   Quantity or deflated input data (commodities, employment,
            energy).

     (iii)   Quantity or deflated output data.

In applying these methods it is useful to retain the industrial classification
adopted for the product estimates in current money terms.   This principle does
not preclude marginal adjustments to the data for some industries to bring the
estimates closer to a product basis of classification and to reduce "overlapping"
between industries.   It may also be necessary to introduce additional industrial
detail to improve the representativeness of the available quantity indicators
or price indexes, and on occasion to combine certain industries to take advantage
of widely representative data.

109. Quantity or deflated input and output data: This method is described in
Index Numbers of Industrial Production, paragraphs 52-55.   The method requires the
calculation in base period prices of both the inputs and outputs of an industry,

and the deduction of inputs from outputs in each year to yield real product estimates. The resulting estimates are valued gross and at market prices; the deduction therefrom of real net indirect taxes[64]/ yields a gross product estimate at factor cost. The revaluation of inputs and outputs at constant prices may be undertaken by extrapolating the base year estimates by quantity indexes computed for both flows; alternatively, these flows in current money terms may be deflated by appropriate price indexes for industry purchases and sales, with in principle at least, separate deflation of the stocks entries by specially constructed indexes.

110. Inputs and outputs of a sector may be presented gross or net of intra-sectoral transactions for purposes of the present calculations. Where the data are shown on a gross basis, intra-sectoral transactions would in principle cancel out, and would leave unaffected the estimate of real value added. In dealing with the manufacturing sector, at least, it would usually be more convenient to adopt a gross presentation, thereby avoiding the statistical difficulties sometimes encountered in eliminating intra-industrial transactions from the input and output flows. Furthermore, as suggested in other sections in considering the preparation of quarterly or monthly estimates, it would usually be inconvenient to undertake the elaborate calculations involved in eliminating intra-sectoral transactions more frequently than once a year. On the other hand, it would then be necessary to prepare the price index numbers needed to deflate these flows on a correspondingly gross basis and some arguments against this procedure have been suggested in earlier chapters. The problem of gross or net aggregation from the viewpoint of price and quantity index number construction appears to require further study in the light of actual experience.

111. This method would normally provide an accurate estimate of industrial product in constant prices. It would eliminate a significant cause of error in these studies by providing for the separate revaluation of inputs and outputs, thereby allowing for changes in technical input-output relationships and in business organization within an industry. Use of the method is particularly valuable in industries such as agriculture, whose real input-output ratio is affected

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64/ Methods used to deflate this and other adjusting entries are described below.

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sharply not only by technical factors but also by weather and other natural causes.   Similarly, the method may increase the accuracy of estimates for many manufacturing industries, especially in economies in process of rapid industrialization;   these industries are often characterized by an increasing amount of processing per unit of output and by industrial reorganization (vertical integration), which make invalid the assumption of a constant technical input-output ratio implicit in other methods.

112. The method may nevertheless produce errors in the estimates for individual industries, because of the inherent bias in real terms estimates, which may distort the estimates of input and output in different degree, and therefore affect the real product estimate.   In Index Numbers of Industrial Production, paragraph 52, an extreme case is mentioned in which "considerable substitution between materials takes place in response to large relative price changes", leading to marked bias in the real input estimate and the derivation of a negative product estimate for the given year.   But detailed study of this method based on statistical data for Ireland[65]/ has led to the statement that "on the whole the experiment has shown that the concept of net output volume is likely to be effective in normal times". Examination of the price and quantity data of both the inputs and outputs of a given industry would presumably reveal conditions under which use of the present method is not appropriate.   It might also be advisable to employ other methods when there is some doubt concerning the reliability of the input or output indicators.   Deficiencies in the basic statistics of input or output could seriously distort the real product estimate computed as the margin between real input and real output, especially when the amount of processing carried out by the industry is proportionately small.[66]/   In such cases the extrapolation of the base year product estimate by means of one or other of the input and output series, on the assumption of a constant ratio of real input to real output over the period of the study, might often represent a more accurate approach.

113. Quantity or deflated input data: Under this method the product of a sector in the base year is extrapolated by a volume index of inputs (materials and services) computed by deflating a value of input series or by quantity index methods.   As variants of this method, indexes of energy or employment input

65/ Ref. 7, p. 259 (See annex I).

66/ Ref. 27 (See annex I).

are sometimes substituted. The use in this way of input indexes (excluding for the time being consideration of energy and employment series) involves the principal assumption of a constant amount of work done per unit of input over the period of the calculations. The method is therefore best applied to industries having a stable input and product "mix"; this in turn usually implies the use of a relatively fine classification of industries in applying the method.

114. In combining quantity series of the materials and services used up in production to form an input index, the indicator series are weighted by their respective values in the weight base year; the weights of the unrepresented series are added to the weights of the indicator series to give full weight to the input of the sector. Alternatively, value estimates of the sector inputs may be deflated by appropriate price indexes, which should also be designed to yield quantity indexes with the standard weight base. The use of sector input indexes to extrapolate a base year value added estimate restores the final estimate for the sector to the product or value added concept required.

115. Reliance upon input indicators should be restricted to the few narrowly defined industries where the method is likely to give accurate results. In applying the method to broad sectors of industry there is a risk that differences in the growth rates of the sub-sectors would distort the estimate; this danger could however be avoided by substituting value added for input value weights at the sub-sector level. It has already been suggested that the use of input series to extrapolate a product estimate must be supported by an assumption of proportionate movements in real input and real output. This assumption may not be valid when applied to industries (i) whose inputs may be employed in the manufacture of a number of alternative commodities, (ii) which are acquiring new techniques, introducing new product specifications or undergoing structural changes, or (iii) which are tending over time to make a substantially greater or less efficient use of a given input. It is these characteristics of an industry which are likely to change the amount of processing applied to a given unit of input, and therefore to reduce the accuracy of this method. For example, the development of certain engineering industries tends to be accompanied by an increasing amount of processing per unit of steel input as more complex processes are introduced; the input of wood pulp in the paper industry may be used in the production of newsprint, writing papers, wrappings, carpet felt, etc. in variable proportions,

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with corresponding changes in real product. The method is most acceptable therefore where some firm technical relationships between input and output may be discerned. In examining this matter in some detail, the study Index Numbers of Industrial Production, para. 65, cites the linen industry (flax consumed) and the production of newspapers (consumption of newsprint) as industries where the method might be applied advantageously. The study also refers to the difficulties found in using the method in industries which have lengthy production periods and the ability to vary the amount of work in progress, since any variations of this order could clearly affect the work done per unit of input.

116. In the absence of adequate price and quantity data, labour or energy input series are sometimes employed to extrapolate a base year value added figure. The use of a labour index must usually be supported by the assumption that productivity per employee has been constant throughout the period of the study. However, when per capita productivity studies are available, for at least a sample of the establishments within an industry, this material could be used to correct the employment index. The employment data could be refined still further by adjustment to a "man hours" basis. The real product estimates given by these adjustments would tend to be very accurate. In the absence of productivity data, changes in the age and sex distribution of employees, and in the equipment, techniques and skills of the industry, and the occurrence of labour disturbances, raw material shortages and other matters affecting productivity would impair the accuracy of the method. The use of energy input series may be acceptable in special cases where there is good reason to anticipate a close relationship between the input index and real product, but in general this practice would be likely to lead to increasing error.

117. Quantity or deflated output data: Under this method a volume index of industry output is constructed and used to extrapolate a base year estimate of the product of the industry, usually gross domestic product at factor cost. The volume index of output may be constructed:

(a) by deflating an output series in current money terms by a price index of the industry's sales, after adjusting the index, in principle at least, to allow for price changes in the stock imputation;

(b) by deflating an output series in current money terms by a price index of the industry's materials and labour costs; or,

(c) by computing a quantity index of output on the basis of selected output indicator series.

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118. The output series represent work done in the industry, so that the appropriate weights for use in combining the individual output series are value added estimates. However, where multiple indicators (or a deflated value series) are used to represent work done in an industry, the weights employed at this level to combine the individual indicator series are usually the values of the output commodities rather than the value added in their production. In special cases employment or other weights have also been used. Notwithstanding this replacement, as a matter of necessity, of "value added" data by other weights in combining intra-sector series, "value added" weights should still be used wherever possible in combining the data for individual sectors. Such extrapolations should be made within narrowly defined industrial categories, to minimize the error which results from the application of inappropriate (value of output) weights to combine indicators with possibly widely different growth rates.

119. The use of this method again requires the assumption of a constant real input - real output ratio within the sector.[67]

> "Any change, therefore, in the ratio of net to gross output would result in the measure being, to that extent, inaccurate. For example, if a manufacturing firm decides to install its own electricity generating plant, the resulting increase in its net output would not be reflected in the measure of gross output of manufactured goods. Changes in the ratio of net to gross output can also be caused by changes in the amount or quality of workmanship incorporated in the product: by economy or extravagance in the use of materials; by changes in the technical processes of production; by changes in the degree of integration of industry, which may affect the comparability between the classification of industries and the available statistics of gross output; or by changes in costs of advertising, or payments for other services, per unit of output. Precise information about such changes is not usually obtainable". [68]

In expanding economies, the development of some secondary industries may proceed from the initial assembly of imported parts to the complete domestic manufacture of a product, and in these cases the changes in real output bear little relationship to the changes in real product. The deficiencies in coverage and quality of the available output indicators imply other limitations in this method which have already been discussed in more general terms.

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[67] An alternative but related method sometimes used is to deflate the input series by an implicit or direct price index relating to the output series; under this latter method there is an implicit assumption of proportionate price changes in the output and input flows, in place of the assumption of proportionate volume changes.

[68] Ref. 11, pp. 39-40 (See annex I).

120. Estimation of expenditure on gross domestic product at constant prices:
The flows considered under this heading relate simply to transactions between
producers and categories of final buyers. Their revaluation is therefore
without some of the complexities found in preparing the estimates of value added
in constant prices discussed in the preceding section. The three revaluation
procedures described earlier may be applied in conjunction to convert the detailed
expenditure flows into constant prices. In most countries the principal method
adopted is that of deflation by price indexes of selling prices. But some
countries have also relied widely upon the use of basic quantity statistics and
the direct construction of quantity indexes of final expenditure. For some flows,
price indexes of production costs have been found to give the most reliable
results.

121. Where existing price indexes are of the conventional commodity price index
type, which are not closely related in coverage to the final expenditure flows
defined in the national accounts, the indexes have in some instances been
decomposed into the price series for individual products and reconstructed to
represent price movements in specific accounting flows in the manner described
earlier in this chapter. In other cases components of the retail and wholesale
price indexes have been applied in the revaluation of current price series
without any adjustment, as a temporary expedient, on the assumption that they
represent with sufficient accuracy price changes in the final expenditure flows
defined for accounting purposes. In extreme cases the sum of the final
expenditures or broad components of this aggregate have been deflated by a single
index like the conventional retail or wholesale price index. Deficiencies in
the coverage and weighting of these indexes tend to limit the usefulness of the
resulting constant price estimates. For example, retail price indexes are
often restricted in coverage to the basic expenditure items of particular
categories of consumers in given regions or cities; while wholesale price indexes
may relate simply to a limited selection of the materials and commodities traded in
a few major markets. The assumption of comparable movements in all final
expenditure prices and in the prices covered by these conventional indexes may
be difficult to sustain, particularly in economies with segmented markets, and
the use of the revalued data in precise analysis then becomes uncertain.

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122. Price indexes of input costs are used principally to deflate product flows when the specifications of the products are highly variable, and the development of consistent quantity and price series correspondingly difficult. This is the case for example with some sectors of the machine tools and the construction industries, whose products often lack constant or relatively constant specifications from period to period. Quantity index methods are mainly relied upon where detailed quantity statistics have provided the basis of the estimates for a given flow in current money terms. In current price estimates this method involves the estimation of the quantity components of a flow - household fuels, automobiles, etc. - and their valuation at current retail prices; conversion of these series to base year prices is therefore a relatively simple operation.

123. The classification of the final expenditure flows and the methods used to revalue these flows at constant prices are dictated largely by the character of the basic statistics of quantity and price, and by the forms and methods employed in preparing national accounts estimates in current money terms and special sector estimates. A decision to carry out the calculations in detail may give rise to further special problems, which may be concealed in a more aggregative approach. For example, the detailed deflation of business stock series should take account of stock turnover periods in the sectors distinguished and the principal stock accounting methods; the detailed deflation of government purchases of goods and services may require adaptation to particular central and local government accounting practices; and the deflation as a separate item of tourists' expenditure abroad must allow for movements in foreign price levels and in the relevant exchange rates. An extensive study of methods for revaluation of the final expenditure flows has therefore been postponed until the chapter on Country Practices, where these various questions can be considered in the light of actual country experience.

124. Estimation of the adjusting entries: This section considers some of the methods employed by countries to compute the adjusting entries of:

    (a) The trading gain.

    (b) Net factor income payments from the rest of the world.

    (c) Net indirect taxes.

Estimates of these entries are required to express the relationships between the aggregates of gross domestic product at factor cost, gross domestic product at market prices, gross national product at factor cost (equals national income including depreciation), and gross national product at market prices.

125. The trading gain: As already described in chapter 2, this entry in the accounts measures the gain or loss resulting from changes since the base year in the volume of imports received in exchange for each unit of a country's exports. This gain or loss, which is relative to trading conditions in the base year, is measured in values of the base year to correspond with the general system of values adopted in the accounts. The significance of this gain or loss in the system of accounts has already been examined in considering the conversion of a domestic product aggregate to a national product aggregate. Imports and exports are defined in accordance with the UN report; the proposed measure is therefore comprehensive in coverage, and takes account of price and volume changes in all goods and non-factor services bought from or sold to the rest of the world, including "merchandise and charges made for the provision of transport, insurance and other services".

126. The nature of the adjustment to measure the effect of changes in the terms of trade may be illustrated by an example, which constitutes an arithmetical illustration of the theory expounded in chapter 2, the tentative character of which is re-emphasized:

		Year I		Year II		Year II (in prices of Year I)	
		No.	$	No.	$	No.	$
Domestic product	Goods A	10	10	20	40	20	20
Exports	Goods A	4	4	10	20	10	10
Imports	Goods B	8	4	30	20	30	15

Net factor income payment from abroad and net indirect taxes are assumed to be nil. In the example given, domestic product and national product or income in Year I equal $10. In Year II, on the basis of the price relationships of the base year (Year I), there is a net gain due to improvement in the terms of trade of 10B valued in base year prices at $5. That is, on the basis of the relative

export-import prices of Year I, the export of 10A would have secured in return the import of 20B; in fact, this number of A exchanged for 30B in Year II, a gain in terms of goods available for the use of residents of 10B, valued at $5 in base year prices. In Year II domestic product in prices of Year I equals $20 and national product equals $25.

127. In actual computation, the procedure in the example cited would be to deflate the export or import aggregate of Year II firstly by an import price index then by an export price index;[69] the difference between these deflated values would represent the real gain or loss from changes in the terms of trade. There is a further complication in practice, however, which follows the usual inequality (in current prices) of exports and imports. In these circumstances, it must be decided whether to compute the trading gain or loss on the basis of the figure for which an actual exchange occurred, (the lower of the export and import figures), in respect of the higher of these two aggregates, or as sometimes suggested, consistently in respect of the export aggregate.[70] The adoption of the lower of the export and import figures would give the more conservative estimate, and would correspond with the principle given in chapter 2 in discussing the balancing properties of a system of accounts in constant prices.

128. In countries with multiple exchange rates there is a further statistical problem in this area due to the possibility (a) of changes within the period of the study in the rates at which particular export or import commodities are converted to domestic currency, or (b) of general changes within the study period in the rates at which either exports or imports are converted to domestic currency. In other words, the unilateral adjustment of certain of the buying or selling rates of a multiple rate system will distort the calculations of this entry when carried out in terms of the domestic currency unless an appropriate correction is introduced. further, the marked disparity between the average buying and selling rates of exchange which sometimes exists distorts the annual estimates of exports and

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[69] In deflating the export or import aggregate the export and import price indexes used should be those general indexes relating to all exports and all imports as defined in the system of accounts. The form (Paasche or Laspeyres) of the indexes should also correspond with the indexes used in deflating exports and imports, so that in this as in other sections of the study the price relationships adopted would be those of a common base year.

[70] See Ref. 10, pp. 127-9 for a discussion of this question. (See List of Reference in annex I)

imports in terms of the domestic currency, and because of this distortion would also affect the calculation of the trading gain or loss. It is therefore a common practice in preparing an index of the terms of trade of a country with multiple exchange rates to avoid this difficulty by computing the terms of trade index in terms of a foreign currency, for example dollars.[71/] A further step is required in these circumstances to estimate the gain or loss to the economy from changes in the terms of trade as measured by this index, and to express this gain or loss in base year values of the domestic currency. This gain or loss in base year values of the domestic currency unit may be computed by estimating the difference between the current year export or import aggregate in base year values of the domestic economy and this same figure when adjusted by the terms of trade index. The choice between the export and import aggregates as the basis of this calculation is governed by the principle discussed in the preceding paragraph.[72/]

129. In interpreting the significance of the estimated gain or loss, it should be kept in mind that in general the international trade in question does not take place unless it is of mutual benefit; the gain or loss then is strictly relative to the terms of trade prevailing in the base period. Further, the gain or loss from changes in the commodity terms of trade is a measure which should be read for some purposes in conjunction with the record of changes in the real costs (productivity) of producing the export commodities concerned. It is possible that changes in the volume of imports received in exchange for the products of a domestic unit of production will be in a different direction or of a different order from changes in the commodity terms of trade. As one example, an increase in domestic product due to an increase in productivity of an export good might be offset by the loss from changes in the terms of trade, leaving national product constant. The basis of such a productivity study would be provided by the industrial breakdown of domestic product in constant prices.

71/ Ref. 6 (See Annex I).

72/ The principle set out in that paragraph suggests that the choice between the export and import aggregates should be governed by a comparison of these aggregates in current values; in this context the values to be compared should be current dollar or other foreign currency values.

A less detailed approach has been developed in Denmark, where "indirect taxes
less subsidies are deflated separately by applying the percentage of the gross
factor income in the base year accounted for by these amounts to the gross factor
income of the current year at the prices of the base year". Estimates of
industrial product computed by means of explicit tax and subsidy entries compare
in principle with estimates at factor cost given by other methods. In practice,
the explicit treatment of taxes and subsidies may often permit a more precise
and valid extrapolation of the base year tax and subsidy values than is afforded,
in effect, by methods such as the extrapolation of a broad value added estimate,
already converted to factor cost, by one or more quantity indicators. Since
few industry estimates of real product are as yet prepared by the deflation of
both inputs and outputs, the present need to compute industry indexes of net
indirect taxes would be limited.

134. In preparing estimates of total indirect taxes and subsidies in constant
terms, the totals should be decomposed and the detailed tax and subsidy series
revalued within the framework of the industrial product and the final
expenditure estimates. It would be feasible for example to allocate specific
indirect taxes and subsidies to industries which pay or receive them, and to
revalue these series by extrapolating the base year figures by the relevant
quantity output series. Indirect taxes which cannot be allocated to particular
industries or products, such as certain excise and sales taxes, may often be
apportioned among the detailed final product flows and extrapolated by the related
quantity indexes; and taxes such as general sales taxes with a still wider
incidence may be extrapolated by correspondingly broad expenditure indexes. It
is evident however that estimates computed in this way would be subject to a
certain margin of error.

135. Apart from the value of real net indirect tax estimates as an adjusting
entry in the system of quantity indexes, tax and subsidy series in constant
values have direct usefulness to taxation and fiscal authorities, at least when
shown in the detail of their computation. The principal accounting use of this
entry would be to permit the comparison of gross domestic product aggregates
computed independently by the industrial product and the expenditure methods, as

a check on their accuracy; it may be noted here that movements in the net indirect tax series would tend to diverge from movements in the domestic product aggregates to the extent that substantial changes have occurred over the period of the study in the incidence of taxes or subsidies or in the relative real expenditures on taxed or subsidized products.

CHAPTER 6

COUNTRY PRACTICES

(a) Estimation of the Real Product of Selected Industries

136. In this section information on the methods employed by countries to convert
estimates of the value added in industry to constant prices is given under major
industry headings; in some parts of this section a brief evaluation of methods
is also undertaken. The sources of the material presented here include official
and unofficial country reports and studies confined to the product of particular
sectors.

137. Agriculture: Many countries base their estimates of agricultural product
in current values upon separate quantity and price material relating to output
and some input items.[74] The calculation of value added in agriculture in real
terms from current price data is in these circumstances a relatively
straightforward operation, requiring principally the revaluation of the available
quantity data in the prices of a given year.

138. The United States estimates of value added in agriculture (in current values)
may be taken to illustrate this statement.[75] In this country basic data of
output quantities and prices are obtained from agricultural censuses (quinquennial),
from a crop and livestock reporting system, and from crop and livestock buying,
shipping, distributing, etc., agencies. Current estimates of crop yield, acreage
harvested, farm prices and other data are usually obtained by sample surveys of
farmers and adjusted by reference to the benchmark data. Separate quantity
figures relating to own-consumption, sales, additions to stocks, and own-use as
fodder and seed are sought from farmers by means of sample surveys and from
distribution and inspection agencies. The basic statistics relating to certain
of the input items of this sector also contain separate quantity and price data.
This quantity and price data represents the basic information needed to compute

[74] See United Nations, Methods of National Income Estimation, op. cit.
[75] Ref. 14. (See annex I)

not only the estimates for the sector in current money terms, but also quantity
indexes for the principal output and input flows.

139. The construction of accurate quantity indexes is assisted by the collection
of quantity and price data within detailed rather than broad product classes.
Where the available statistics relate to broad product categories,[76/] changes
in the composition of a particular product group over the period of the index
could affect the accuracy of the index calculations. Factors which distinguish
the components of a product group for pricing purposes include quality differences,
seasonal and regional differences in the availability of the product, and the
addition to the product of various ancillary services prior to its marketing.

140. The suggested presentation of the basic quantity and price statistics in
relatively detailed categories would permit some allowance to be made for changes
in product composition by providing separate series for the major product
sub-classes distinguished on the basis of the quality differences, etc., mentioned
above. When the available data are given only in broad product classes, it is
sometimes feasible to check the homogeneity of a product class by comparing
movements over time in the "unit value" (average price) of the product class with
movements in the actual prices of some of its component products.

141. In some countries deficiencies in the available statistics of agricultural
output have been met for some sub-sectors of agriculture by computing estimates
of output from household sample surveys of primary products consumed or from
assumed per capita consumption figures, after adjustment for quantities directed
to other uses or added to stocks.[77/] In this instance also the basic data usually
include separate quantity and price statistics and the preparation of constant
price estimates for these sub-sectors again calls for the revaluation of the
quantity data at base year prices.

142. In the production of crops and livestock the operation of both technical and
climatic factors tends to cause significant short-term changes in the ratio of

76/ In Australia, for example, estimates of the output of wool in current money
terms are based on sales figures provided by wool brokers to establish an
average price for greasy wool of all types, which is applied to the relevant
quantity estimates given by a census of agriculture to yield the gross value of
production. In India it is the practice to convert relatively broad product
categories to money values by carefully compiled averages of harvest period
prices. (See Ref. 16, annex I)

77/ See Methods of National Income Estimation, op. cit., p.50.

output to input. Many countries therefore make an especial effort to deflate both
inputs and outputs in computing the real product of this sector. The principal
inputs usually include fertilizers, irrigation, purchased fodder and seed, fuels,
and repairs, for which separate quantity and price information are often
available; as with the output-flows, it is often convenient to constuct quantity
indexes in converting the inputs of this sector to constant prices. For example,
seed input is sometimes estimated in quantity terms by reference to the area under
crop and technical information on sowing methods and seed requirements; and
quantities of fertilizer, fuel and fodder used are obtained from the distributors
handling these commodities. Related sections of the wholesale price index or
specially constructed price indexes are sometimes used to deflate the remaining
inputs expressed in money values. In this context it may be indicated that
Denmark has deflated the value added in agriculture by dividing both inputs of
raw materials and the outputs of this sector into a practicable number of uniform
commodity groups, and by then multiplying the quantities of the current year in
each group of inputs and outputs by the prices of the base year. A similar
practice has been adopted by this country to deflate the output of the fishing
industry; inputs on the other hand have been deflated by a price index based on
the prices of the principal raw material groups.

143. Manufacturing. The methods which may be used to convert value added in
manufacturing industries to constant prices correspond with those used in
preparing an index of industrial production. The preparation of industrial
production indexes has been examined in detail in the United Nations study Index
Numbers of Industrial Production,[78] to which reference should be made for a
comprehensive description of the methods used in constructing indexes for the
manufacturing sector.

144. In most of the country studies examined physical measures of output are used
widely as quantity indicators in this sector to extrapolate the value-added figures
of the base year. However, in the case of industries with heterogeneous products
such as mechanical engineering, it has often been found more appropriate to

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[78] Op. cit.

estimate the gross output in base year prices (to be used in extrapolating the base year production figure) by price deflation methods. On the other hand industries with diverse outputs and relatively uniform input commodities such as the paper industry and the electrical wires and cables industry are often dealt with by employing quantity inputs for purposes of extrapolation.

145. In the United Kingdom, which has provided a full description[79] of the methods used in deflating the product of this sector, real product is usually computed by taking either output or input series to represent movements in real product; changes in production are measured by (a) physical measures of output, (b) deflated gross production values, using price indexes relating either to outputs or input of materials and factors, (c) physical measures of input, and (d) labour input. Methods (a), (b), and (c) each represent the most suitable adaptation to particular groups of industries. Method (d) was considered to provide only "a very rough indicator of variations in output". Method (b) was used for industries such as some machinery industries and the clothing industry which have a wide and miscellaneous range of outputs. Method (a) is especially useful in measuring the output of industries with relatively homogeneous outputs, such as certain metal refining industries, and in industries with more diverse outputs when there is some confidence in the representativeness of the available output indicators. Physical measures of input were mainly used for industries having one principal input material and diverse outputs, for example the leather goods industry and production of anchors, chains, bolts, nuts, etc. In industries where repair work constitutes a significant part of all production, for example shipbuilding and motor cars, this item presented an additional problem. Commonly, neither value nor quantity data are available. The product of shipbuilding repairs was estimated on the basis of labour statistics supported by the assumption that the productivity of labour engaged in repair work equalled that of the known productivity of shipbuilding employees. Petrol consumption was taken as an indicator of motor vehicle repairs, in the view that there is a relationship between repair work done and the extent of vehicle usage.

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[79] Refs. 18 and 19 (See annex I).

146. Because of the importance of the method of extrapolating detailed sector estimates of value added by single quantity indicators, an example of the method, taken from an unofficial United Kingdom study, is given below.[80]   In this example, selected quantity series are used to estimate changes in the value added of an industry shown in 1948 prices. As pointed out in the text of the study quoted,

> "value added is assumed to vary in proportion to the movements of the indicator shown ...."

> "The use of the indicators involves various assumptions, in many cases (for instance) homogeneity of product and a constant relation between input and output ...."

> "Care should be taken to avoid the idea that the value added is attributable solely to the product named in the indicator".

Example

Standard Industrial Classification		Indicators		Estimated Value Added at 1948 Prices £.M.				
No.	Heading			1946	1947	1948	1949	1950
79.	Other electrical goods	Electric cookers	Produced number	4.92	7.12	8.00	6.73	8.30
		Electric fires, bed-warmers, blankets and pads	"	2.81	1.87	0.50	0.48	0.43
		Vacuum cleaners	Delivered number	7.45	9.92	7.10	8.76	11.49
		Electric irons	"	3.53	2.53	1.80	1.68	2.03
		Electric Meters	Pr. number	4.09	5.98	6.30	4.44	5.04
		Electric wash boilers and waterheaters	"	3.18	2.93	1.80	1.50	1.87
		Electric kettles	Del. number	1.04	1.28	0.80	0.65	0.76
		Electric fans	Pr. number	1.37	1.34	1.20	1.19	1.05
		Total:		28.39	32.97	27.50	25.43	30.97

[80] Ref. 13 (See annex I).

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147. In Poland[81] in 1947, the year to which the available descriptions relate, estimates relating to the Industries category were examined under four sector headings, state-owned industry, communal and co-operative industries, private industries, and handicrafts. Within state-owned industries data of gross production at constant prices were provided largely by the producing enterprises "according to self-cost"; material costs, provided by the enterprises in current prices, were analysed according to origin and deflated by the relevant selling price "multiplier" applicable to state-owned industries; net production was then obtained by deducting costs from gross production after adjusting for work in progress. For communal, co-operative and private industries, annual industrial statistics of gross production and material costs were available for all firms having more than four employees; these statistics were mainly in current prices but included gross production data in constant prices for communal industries. Gross production estimates in constant prices for co-operative and private industry were obtained by applying price multipliers to the current figures. Various adjustments were devised to compensate for inadequacies in the information concerning work in progress and product detail of the inputs. Net production of the communal sector was computed "by adopting a similar ratio of gross and net production as for the computation at current prices". In the case of co-operative and private industry, real material costs were deducted from gross production to obtain real net production. For this purpose the material costs of these industries in current values were deflated by wholesale price multipliers relating to sales of intermediate goods by private and state enterprises. The assessment of the real product of handicrafts was based upon employment data derived largely from a trade licensing system to give the dimensions of the sector, together with corrected gross production figures from the same source and material cost data obtained from questionnaires. Production and cost data were deflated by price multipliers the details of whose estimation were not given.

148. In some country studies, an appraisal of the various methods used in revaluing the value added series for this sector has been made. It has been pointed out that in a dynamic economy significant short-term changes may occur in

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81/ See Ref. 20 (See annex I).

the input-output ratio of some manufacturing industries; in such cases failure
to deflate both the input and output flows of industry could impair the accuracy
of the volume estimates. It has been pointed out that change in the level of an
industry's advertising expenditure would be sufficient to affect the input-output
ratio. Even the more fundamental technical relationships of an industry may be
subject to marked changes in a short period of years. Recent production statistics
relating to the soap industry of Australia for example indicate a change in the
ratio of the input of the quantities of the principal materials used (tallow,
soda ash, coco-nut oil) to quantities of soap, soap extracts etc., from
86 per cent to 74 per cent in a four-year period. In expanding economies the
amount of processing per unit of gross output has tended to increase, so that
indexes constructed by reference to quantity output indicators alone would in these
circumstances have a downward bias.

149. The use of input or output data alone may also lead to error where technical
relationships are stable but alternative products may be made from a given input
or alternative inputs used to make a given product. For example in the paper
industry pulp input may be used to make a variety of papers including newsprint,
printing, writing, wrapping and blotting papers; in such cases, when output
proportions are subject to change and value added in the manufacture of the various
products is not uniform, the use of input data as an indicator of movements in the
real product of the industry has been found to give a relatively wide margin of
error.

150. The use of selected quantity indicators to measure changes in the input or
output flows of the manufacturing sector may also involve an element of
approximation. This practice requires the assumption that movements of the
indicators are representative of movements in the total flow. The limitations of
this assumption have been examined in general terms in earlier sections. In
manufacturing industries the available quantity data often relate to commodities
whose nature permits ready collection and classification - automobiles, basic
chemicals, steel products. Extrapolations based on these data would be subject
to probable bias unless supplemented by appropriate indicators for the remaining
goods and services of a given flow, including advertising and other input
services, and miscellaneous output commodities, work in progress and repairs.

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151. In some studies an adjustment to offset the low coverage of the available quantity indicators has been made by correcting the index of output given by the quantity indicators for changes in the percentage coverage of the total value of output in current money terms provided by the indicators. This practice has been examined briefly in earlier sections of this part, and is discussed in detail in an unofficial United States study.[82/] The practice amounts, in effect, to the substitution of price deflation methods (using a price index built up from the unit values of the given quantity indicators), for the process of extrapolation by means of quantity indicators.

152. At the present time, countries tend to rely largely upon methods employing quantity output or input indicators. However, the more widespread adoption of a sector basis for the construction of wholesale price indexes is expected in the future to lead to the substitution of price index deflation methods for such quantity indicators for some of the component industries of this sector, particularly those industries with a wide and varying range of products. If countries are reasonably confident of the reliability of the values of current input and/or current output in the period of reference (month, quarter or year) - and these are the kind of aggregates that firms can fairly readily supply - then surely the use of price deflation methods is to be recommended. Thereby, at any rate, complete coverage is ensured; and, with due care in the construction of the deflating price index, the problem of allowing for changes in quality and specification in the aggregates concerned between base and current year will be largely surmounted.

153. In the absence of basic price and quantity statistics, series of labour input or energy input are employed occasionally to extrapolate the base year production of certain manufacturing industries. Labour series may be adjusted to an hours worked basis and corrected broadly for changes in age and sex composition of the labour force and changes in skills. Even with these adjustments the use of labour series to measure real production may lead to error. Reasons for this conclusion based on the conditions affecting labour productivity in an industry have been set out in earlier sections.

154. Construction. This industry covers a wide range of activities including the construction, repair and demolition of buildings, streets, harbours and transport systems, marine construction such as dredging and many similar operations. In principle, the coverage of the industry should relate only to construction undertaken

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82/ See Rev. 12, pp. 362-369 (See annex I).   /...

by enterprises as a primary activity, while construction carried out by an establishment as an ancillary activity (for example, own construction by steel mills) should be included under the relevant primary industry heading. However, in some sub-sections of this industry the available basic construction statistics relate to all construction of a particular kind whether undertaken as a primary or ancillary activity. It may then be necessary to construct production indexes for these sub-sectors which cover both the primary construction activities of the sub-sector and the related ancillary construction.

155. Whatever the nature of the classification adopted, the industry covers many diverse activities with relatively few standardized outputs, so that the preparation of adequate price or quantity indexes for some of its sub-sectors may call for unconventional methods. In fact, deflating of the value added estimates for some sectors of the construction industry is notoriously difficult. A typical practice in estimating the real product of this industry is to deflate gross output by a price index of labour and materials input, adjusted where possible to allow for changes in profit margins and productivity; and then to derive the real product by extrapolating the base year value added estimate by this deflated output series, on the principal assumption of a constant real input - real output ratio. In Ireland the construction index was compiled for some years in similar fashion using an index of materials and labour input to extrapolate a base year value added estimate. Recently a change was made in this procedure and the index used for purposes of extrapolation was restricted to a single index of materials input, since investigation showed that the assumption implicit in the earlier method of unchanged labour productivity was invalid.

156. Adequate data are rarely available to permit effective adjustments to be made for changes in profit margins and productivity, which in some circumstances may be sizeable. The difficulty met in making these corrections suggests that an especial effort should be made to sub-divide the statistics relating to this industry, and to discover appropriate price indexes or quantity output data for any sub-sectors in which their use is feasible. The use of quantity output data may often be adopted for example in deflating the output of the building sector (especially residential building), given good statistics on types of building, the volume of work done in various stages of construction,[83] and related information. The assumption of proportionate movements in input and output may

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[83] For a discussion of this subject see Index Numbers of Industrial Production, Op. cit., para. 84, p. 33.

also be a source of error in estimating the real product of construction, as
there is a tendency for marked variations to occur between sub-sectors and
overtime in the input-output ratio of this industry. These problems may be
avoided by separate deflation of input and output series for certain of the
sub-sectors of this industry where quantity or price data relating to major and
relatively uniform inputs exist. Some of the principal inputs of the building
industry for example are cement, steel, timber, bricks, stone, fuel, and similar
products for which accurate quantity and price data may usually be found.

157. In estimating the product of permanent house building in the United Kingdom,
on a monthly basis, three alternative methods were used to allow for the varied
forms of the basic statistics.[84] Only a brief description of the principal
method will be given here. This method made use of statistics which recorded
at each month's end the numbers of houses falling within each of five stages of
construction; from these figures the number of entrants to each class in a given
month could be determined. Given adequate time series, it was then possible
to classify the houses within each stage by number of months since entry and to
estimate the average length of time spent within each stage. The amount of work
involved in each stage of construction was also known from a sample study of
house building operations. Then with this information and on the principal
assumption that one permanent house was roughly equivalent to any other, the
volume of house building carried out in any month was determined. In Denmark,
the real product of the building industry was computed by multiplying the work
carried out, expressed in square metres, in the various kinds of buildings, viz.
residential, farm, business, and public buildings, by the price standards
prevailing in the base year. Repairs and maintenance activities in this industry
in the base year were extrapolated by an estimate of numbers employed in this
work. The output of "other construction" was deflated by means of a specially
designed index of construction costs; raw material inputs were estimated on the
basis of the percentage of raw material inputs to output in the base year.

158. In the absence of more comprehensive data, employment figures are sometimes
used to extrapolate the base year production estimate of particular sub-sectors
of construction. The product of the sometimes considerable sector of repairs and
maintenance of buildings and other constructions must often be converted to
constant prices by this means. Employment data should be refined by classification
according to skills and productivity where this is practicable.

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[84] Ref. 18 (See annex I).

159. Estimates of the product of some sub-sectors of the industry in current prices are sometimes based upon the value of materials used and other costs of construction.[85] The basis of this method is provided by price and quantity data for the major inputs; this information is then adjusted to allow for other input costs, and estimates of wages and other factor payments are added. In these circumstances the base year product of the sector may be extrapolated by a quantity index relating to inputs, with adjustments to take account of any changes over time in wage and profit margins incorporated in the current price estimate. The possibility of serious error in the use of this method, especially in industries where the real input-output ratio is unlikely to be stable, has already been mentioned.

160. Transport and communication. Most countries estimate the real product of the major parts of this sector by employing quantity indexes of output to extrapolate base year value added figures. This approach is assisted by the ability to classify the units of output of the sector under a relatively small number of headings such as ton-miles, passenger-miles, letters sent and telegrams sent. However, the use of quantity indicator methods is not without difficulties. The adoption of a few wide product classifications to cover the output of the sector rests on two assumptions which may not always be realized; these are the assumptions of constant quality and of proportionate movements in sub-class output. Convenience, speed and other qualities of particular transport services may change without affecting the passenger mile statistics. Of more importance, there may be changes in the proportions of say refrigerated freight to general merchandise freight, and excursion travel to regular travel, which might not be revealed by passenger mile statistics classified under a few broad headings. Furthermore, several countries have been unable to collect accurate quantity statistics for certain transport sectors, particularly the transport of goods by road, and have then been obliged to substitute price deflation methods for the direct construction of quantity indexes.

161. The preparation of quantity indexes for this sector by quantity indicator methods would be assisted by the presentation of the basic quantity transport statistics under as many sub-headings as possible - for example, in a United Kingdom study railway passenger mile statistics were given under the heading of

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[85] See Methods of National Income Estimation, op. cit., p. 33.

workmen's season, full fare, monthly return, excursion, and "others". Similarly
in a United States study of the communications industry quantity statistics
relating to the telephone and telegraph industries were sub-divided into such
categories as local calls, toll and long-distance calls, and domestic telegraph,
ocean cable and radio telegraph, respectively, with further sub-classifications
of the telegraph data by "full rate", "day letter", "night letter", etc. It is
not often possible in these studies to make any allowances for changes in the
quality of specific transport services. The continuing improvement in the speed
and comfort of air passenger transport, for example, can not usually be
represented in index number form. In the real product studies examined, data were
not often available to permit separate deflation of the inputs of the various
transport and communication industries. It has been pointed out that in some
cases improvements in the quality of output would be at the expense of a higher
input per unit of output; in these circumstances the failure to allow either for
changes in the quality of output or for changes in the ratio of real input to
output tends to some extent to be offsetting. But in circumstances of
technological change improvements in the quality of output and economies in input
might be effected together. It is generally desirable therefore that an attempt
be made to deflate both input and output of these industries, and to adjust
where possible for changes in quality.

162. The collection of ton-mileage statistics for road transport by sample
inquiry has presented statisticians with acute difficulties; in addition, the
sampling error in this type of inquiry has tended to be very large. Some countries
have found it more accurate to construct a quantity index by collecting statistics
for the value of turnover of road transport establishments and deflating the
aggregate by an appropriate price index. The price index used for this purpose
has in some instances been constructed as a cost index by reference to the costs
of oil, petrol, repairs, wages etc., rather than by reference to freight rates.
But the direct construction of a freight rates index should be feasible and would
add to the accuracy of the quantity data. The price data relating to inputs of
goods and non-factor services could then be used to construct an input price
index. Given comprehensive statistics in current money terms for the road
transport sector, both inputs and outputs could then be deflated, and real value
added computed as the difference between the deflated figures.

163. Some segments of the transport industry are attached as ancillary services to other industries - transport of ores by the mining industry, deliveries by retail stores. It is often found however that the indicators used to measure the output of these (non-transport) industries relate simply to their primary outputs, and in these cases it may be difficult to make any allowance for disproportionate changes in the scale of the ancillary transport services. In addition, the indicators for the transport sector, and especially of road transport, sometimes relate both to the transport of the "merchant hauliers" and of transport firms proper. Some countries have therefore found it convenient in estimating the real product of transport to separate the ancillary road transport services from the primary production of an industry and to transfer these transport activities to the transport sector. Such a comprehensive estimate of transport would often be valuable for special inquiries concerned with this sector, e.g., competition between rail and road transport. In general, however, it would be useful to maintain the national accounts principle of a classification based on establishments and, therefore, economic sectors. It is interesting to note here that the method of deflating input and output of the sector by appropriate price indexes is most suitable from this point of view; the current value data of inputs and outputs for the transport sector usually and most conveniently relate to establishments, and their deflation yields real terms data classified on the same basis.

164. In the United Kingdom,[86]/ detailed passenger-mile and ton-mile data sub-divided by categories of passenger and freight transport were available to extrapolate the value added in the base year in rail transport. For goods transport by road an indicator of licensed transport vehicles weighted by average unladen weight was used to provide an upper limit to changes in the product of this sector, while the lower limit was given by an estimate of the petrol consumed by goods vehicles. For sea transport the indicator used was "tonnage of British ships afloat --- with a division between tankers and others". Similarly, revenue passenger-miles, mail ton-miles and freight ton-miles were the principal indicators used to extrapolate the product of air transport.

165. In Denmark, the gross freight receipts from shipping in foreign trade in the base year were extrapolated by an index of mercantile tonnage after adjustment for the degree of its utilization. The gross freight receipts from the inland shipping of goods in the base year were extrapolated by an index of the inland turn-over of goods. Data were also available concerning passenger transport by

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86/ Ref. 5, p. 445 (See Annex I).

ship, and these figures were used to extrapolate base year figures of the gross receipts from this source. Of the raw materials consumed in the shipping industry, fuel costs were deflated by a fuel price index; the quantities of the remaining inputs were estimated by assuming a continuation of the base year proportions between inputs and outputs.

166. <u>Wholesale and Retail Trade</u>. Two principal methods used in deflating the product of the trade sector are (a) the separate revaluation at constant prices of the gross trade margin (turn-over at selling prices less its value at purchase prices) and inputs (costs of materials and services) of the sector and (b) the extrapolation of the product (value added) of the sector in the base year by an index of goods traded. Under method (a) the gross trade margin may be deflated by a general price index relating to the selling prices of goods traded, on the principal assumption that the trade margin represents a fixed percentage addition to the purchase price of the goods; alternatively, the gross margin of the base year may be extrapolated by a quantity index of goods traded. Since trade margins differ significantly between sub-sectors of this industry, the accuracy of these methods would be increased by sub-classification of the industry, (for example by categories of export goods, consumer goods, capital goods) and the preparation of separate estimates for each category.

167. Implicit in the methods described is the assumption of constant quality in the services performed in distribution. The experience of many countries in the post-war period has indicated that in periods of disequilibrium, particularly when "sellers'" markets operate, substantial deterioration in distributive services is likely to occur. In more normal periods short-term changes in the quality of these services are not likely to be significant. Despite the evident need on occasion to correct for changes in quality, the statistical problems encountered are usually sufficient to preclude adjustment. To the extent that the trading services relate to goods sold to domestic enterprises, the absence of adjustment for changes in quality in gross output of the trade sector tends to be offset by a corresponding lack of adjustment in the gross inputs of other industries, leaving the total domestic product unaffected by quality changes in wholesale distribution.

168. The practices adopted in studies relating to the real product of Poland and the United Kingdom may be used to illustrate the methods discussed above.

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In Poland in 1947 the real value added in private trade was estimated after separately estimating and deflating the gross trade margin and the material costs.[87] The "gross margin" (turn-over at selling prices less its value at purchase prices) of private trade in current values was assessed by using a commodity flow approach. Estimates were made of the value of goods entering the private trade sector and the percentages of this flow of goods going to wholesalers, directly to retailers, and from wholesalers to producers or to retailers. With this commodity flow data and information on the average margins for these trade channels, the values of sales to ultimate consumers were computed. The trade "gross margin" could then be derived by deducting the aggregate purchase value from the selling value. "Material costs" of the trade sector, obtained by means of questionnaires, were next deducted from the gross margin to give the net trade margin. The gross margin at constant prices was then derived by deflating the figure at current values by a "weighted price multiplier of commodity production". Material costs were also deflated, and this item in constant prices was deducted from the "real" gross margin to give the net margin of trade in the private sector at constant prices.

169. In a recent United Kingdom study[88] the distribution industry was sub-divided for deflation purposes into three principal sectors relating to consumer goods sold in the home market, exports, and the rest (largely industrial materials and machinery). The estimate for the consumer goods sector was prepared by first classifying base year sales on a commodity basis, then determining the net value added by distribution in each commodity classification in the base year; base year value added figures in each category were next extrapolated by comparable sales data in base year values, to give series of real value added in the distribution of consumer goods. Distribution services in the export sector were extrapolated in this study by a series based on the volume of recorded exports; this device was adopted in the "crude form" of a constant price series based on exports and re-exports, although a split "by commodities and/or markets in accordance with the varying proportions of additional net output" produced by sectors of the export trade was planned for later studies. For the remaining classification of materials and machinery the base year value added estimate was extrapolated by a number of volume series relating to items "which require a substantial amount of distribution, notably coal, petrol, cloth, flour, builder's

87/ Ref. 20 (See Annex I).
88/ Ref. 5, p. 446 (See Annex I).   /...

materials ---." Weights were given to these series in proportion to the value
added in their distribution in the base year, and the series were then treated
as representative of the whole sector. It was noted in this study that in
establishing the value added weights to be attached to the various classes of goods
traded the value added in wholesaling and retailing was combined. This practice
does not allow for changes in the proportions of wholesaling to retailing output
due to stock-piling or the running down of stocks, but it does on the other hand
offset any changes in the division of functions between wholesalers and retailers.

170. Ownership of dwellings: In the United Nations report A System of National
Accounts and Supporting Tables the contribution of this sector to domestic product
is defined to include the value of all housing services (rented and owner-occupied)
after deduction of costs such as rates, repairs, taxes and insurance. The basic
data available for computing the product of this sector and the methods used vary
between countries. In some countries the benchmark data for the estimation of this
item in current prices is given by a housing census showing numbers and types of
dwellings and information regarding gross rentals of these properties, from which
average rentals for each class of dwelling can be calculated. For post-census
years, the gross rents of new dwellings are computed as a percentage of the cost
of construction of these dwellings; movements in rentals beyond the census year
are given by the periodical collection of rent data on a sample basis.[89]/ This
material is sufficient to permit the measurement of the gross rentals,of dwellings
in the prices of the selected base year. Information on the input costs of this
sector is usually obtained from a number of sources, and deflation of the input flow
is likely to require separate price change data relating to the component flows
of rates, taxes, repairs and maintenance, insurance, etc. In most studies, since
these costs usually represent only a small proportion of gross rentals, they are
simply assumed to move in real terms in proportion to real gross rentals to avoid
the question of their separate deflation.

171. In other studies the numbers of dwelling units, or the amount of rates and
taxes paid and data showing the average relationship between these taxes and gross
rental values, provide the basis of the estimation of gross rents of dwellings.
In these studies costs are often determined as a fixed percentage of gross rents.
Where numbers of dwelling units are used as a starting point, the number of units

89/ See Methods of National Income Estimation, op. cit., p. 16.

in a given year may be multiplied by the average rental value of the base year to give the value of gross rents in constant prices the average rental value has been determined in some studies by applying the prevailing rate of interest for property loans to the current cost of building a new house after adjustment to allow for depreciated dwelling units. Where tax revenues and their relationship to gross rentals have been used as basic data in estimating gross rents in current prices, it would usually be more accurate to deflate the rental figure by the appropriate rental component of a price index than to attempt inter-temporal adjustments of the tax-rental relationship. The practice of estimating costs as a percentage of gross rents in current price studies could usually be extended to the estimation of real costs.

172. General government services: In this section methods of deflation relating to all government production other than that of government enterprises are examined. In addition to public administration and defence, government activities in such industries as health, education, police and justice, and the numerous small-scale activities at the municipal level are dealt with jointly at this point; for purposes of industrial classification these industries are usually classified under their separate headings. The diversity of these activities would in any circumstances present difficulties in deflation. But in the case of government services of this order the absence in most cases of the conventional market contract to govern their distribution, or the levying of only a nominal charge accentuates this problem.

173. From the output side, problems arise in determining the appropriate units of quantity for these services and their corresponding base year valuations; further, in the absence of market prices, only quantity index methods of revaluing output may be employed. On the other hand, the product of general government "is conventionally evaluated at factor cost", and consists mainly of compensation of employees, with rent and interest on government buildings forming a small additional component. This indicates a relatively simple method of revaluing the product of general government by an approach from the side of input; an index of the quantity of labour input may be employed or the product deflated by an

appropriate wage index. But in using these indexes it is not often possible to make the required allowance for changes in the efficiency of the work force.

174. In establishing the unit of quantity in these industries the approach adopted has usually been to establish a unit of quantity which relates to the unit of utility provided by the service. This follows from the use of value weights in these studies intended to express the relative significance of various units of output in terms of utility. For some industries - Army, Police, Fire-fighting force - this criterion has led to the adoption of an employment unit as the unit of quantity, adjusted where possible for changes in the efficiency of men and equipment, on the ground that "essentially, the service provided is that of keeping a fire-fighting force of given size and efficiency 'on tap' ...".[10] In other services the unit of quantity chosen to measure output has been defined without reference to the labour input of the industry. The numbers of claims paid, pensions paid, cases tried and similar indicators have been selected to represent movements in the output of Pension Departments, Courts of Justice and other offices. In using these indicators relatively detailed classifications should be sought to reduce bias due to changes within classes in the proportions of particular types of services. The indicators should also be tested for reasonableness by reference to employment and other series. It is sometimes practicable to support quantity indicators of the order described with indicators intended to make some allowance for changes in quality. Thus in a United Kingdom study[91] the number of pupils has been accepted as the primary indicator for education with the number of teachers introduced as a secondary indicator and given half the weight, to measure changes in the quality of the schools.

175. The need for quantity output indicators rather than employment indicators follows from the use of constant price estimates in measuring the productivity of employees; reliance upon employment indexes for purposes of extrapolation would of course frustrate this purpose. Despite this objective, the output of many general government industries does not lend itself to measurement in precise quantitative terms. In these industries extrapolation of base year figures is

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90/ Ref. 21, p. 20 (see annex I).

91/ Ref. 5, p. 450 (see annex I).

often made by using employment or man-hour data. Where the basic data exist,
these figures might be further refined by the introduction of sub-classifications
showing distribution of the data by age, sex, rank or grade or other
classifications having a bearing on efficiency. A correction might also be made
to allow for changes in the stock of equipment used in providing a given service.
As an alternative to this procedure wages and salaries paid are sometimes deflated
by an appropriate wage index. This method would allow in principle for changes
over time in the proportions of the staff with particular skills; but it could
lead to error where recruitments at higher than customary levels and promotions
have been made as an alternative to increases in the salary scale. It is now
widely believed that it is not practicable to obtain quantity output indicators
for more than a few sectors of the government service. However, there is a
contrary view that the practice of "work measurement" in government offices is
capable of considerable expansion. Should this be the case, as seems reasonable,
the increasing use of accurate quantity indicators for this section might be
anticipated. As previously mentioned, it is proposed in this paper that government
services of use to business should be treated as final products.

176. Banking, insurance and real estate: This sector embraces a wide range of
activities in the financial field, including commercial and central banking,
other credit agencies, investment and holding companies, and security brokers and
exchanges; insurance carriers of all kinds (life, fire, marine, accident, health,
etc.) are also included; in real estate, the activities are restricted to agency
services such as the activities of house and estate agents, and rent-collecting
agents.

177. The accounting treatment of both the financial intermediaries and
insurance sectors calls for the introduction of certain accounting imputations.
For banks and other financial intermediaries the United Nations report A System
of National Accounts and Supporting Tables recommends that the difference
between the investment income received and the deposit interest paid by these
institutions should be taken as the value of the free services rendered by them
to businesss and households. Business costs and the final expenditure of
households are increased by the amount of this imputation, and a corresponding

increase must be made in bank incomes (imputed bank charges). In the case of the
insurance industry, investment income received by insurance firms is imputed to
policy-holders (businesses and households) as income; in a corresponding entry
the same amounts are imputed to businesses and persons as insurance charges.
Value added in insurance is defined as equal to wages and salaries and interest
paid by the industry, plus the operating surplus of the industry.[92]

178. Because of the range of services performed by these industries, and the
manner in which payments for services are sometimes compounded with other payments
or effected by an offsetting operation - imputed bank charges, the construction
of price indexes or quantity indexes relating to this sector requires varied and
detailed basic statistics. The services rendered by banks and other financial
intermediaries to businesses and persons include the handling of cheques and
accounts of depositors, the management of depositors' funds and several
subsidiary functions. In a United Kingdom study[93] the indicators selected to
measure movements in the real product of commercial banks in the handling of
depositors' cheques and accounts and in the management of depositors' funds were
respectively (a) the number of cheques paid, deduced from stamp duties on
cheques received, and (b) "a 'management percentage' of the deflated value[94] of
their various types of assets - the percentage being highest for advances and
very low for such things as Trasury bills". The distinction between the
management of accounts and the management of depositors' funds is essential in
selecting appropriate quantity indicator series for use in computing the real
product of the banking sector. For example, where the use of cheques is
increasing at a faster rate than the increase in bank deposits, the use of a
single indicator series relating to the number of cheques paid would tend to
overstate the increase in the real product of banks. Some countries including

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[92] For discussion of the accounting treatment of the insurance sector see
United Nations: Measurement of National Income and the Construction of
Social Accounts, Studies and Reports on Statistical Methods, No. 7,
Geneva 1947, p. 41-42.

[93] Ref. 5 (annex I).

[94] Deflated by a price index relating to price changes in the total personal
expenditure of the nation.

the study cited here have introduced additional indicator series for the special services performed by banks such as investment services, and have made a correspondingly more detailed allocation of the base year value added estimate for weighting purposes.

179. Banking practices in charging for services differ from country to country. In some countries banks levy a charge for each cheque drawn so that the total of bank charges, deflated where necessary for changes in bank charge rates, would provide a measure of the work done by banks in handling depositors' accounts; where a flat rate is charged for the management of each account, the number of depositors' accounts would provide an appropriate measure. The services of banks in managing depositors' funds (payments for which is in effect made by offset against the investment income of banks) do not lend themselves to precise statistical measure, so that the construction of a quantity index in this case must be based on data relating to the amount of funds invested and the nature of the investments. The relative weights allocated to the management of depositors' accounts and the management of their funds in preparing a quantity index must rest on a somewhat arbitrary allocation of the base year value added by financial intermediaries in providing these services.

180. The services provided by the insurance sector fall into a number of separate categories including insurance against risk of fire, accident, illness, early death, etc., and the regulation and investment of personal and business savings. Several of these categories may also be sub-classified by commodity - fire insurance of furniture, automobiles, houses, for example. (The use where feasible of output indicators rather than indicators relating to factor input in deflating value added in the service industries has already been suggested in the section on the product of general government.) The amount of risk insurance extended by the industry may often be measured by taking the numbers of insured commodities in each sub-category of insurance as the basis for construction of an index - numbers of houses insured against fire, or some approximation to this mesure. These data would not provide a measure of changes in the quality of insurance, such as would follow from changes in the degree of risk assumed or in the liberality of payments against claims. In the usual case only broad

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commodity groupings would be available, so that changes in the commodity composition of these groupings would affect the accuracy of the estimates. The allocation of the base year value added weights between these various output categories could also be expected to provide some difficulties. In considering the deflation of the sub-sectors of life insurance, more difficult problems are encountered. Again the allocation of the value added weight for this form of insurance must usually be undertaken on some arbitrary basis, in this case between the services of the management of funds, the organization of saving, and the provision of insurance against risk. The indicator for the "management of funds" function would be provided by data relating to asset holdings, deflated by a general price index, and sub-classified by type of investment in the manner discussed in the section above on banks. The amount of premium and annuity contributions in each period, deflated by a general price index, would provide an index of the savings function organized by the insurance sector. The insurance function required as an indicator the number of policies in force, corrected in principle by an index measuring the change since the base year in the coverage provided per policy against risk of premature death; for this purpose actuarial data would have to be drawn on.

181. The services of real estate agents are largely rewarded by commissions on rents collected and on the values of properties sold. Other services include appraisal fees and fees for the management of properties. The methods used in computing the value added by the sector in current prices again influence the choice of methods for revaluation of the value added estimate. Where basic data permit, the value added by the sector should be sub-divided into value added in the collection of rents, in the sale of properties, in appraisals, and in the performance of other services in whatever detail is practicable. In illustration of the methods employed in deflating the major parts of this sector, net commissions on rents collected are sometimes deflated by a rent index, and net commissions on property transfers by an index of real estate values, to measure the volume of services performed. In this and other service industries deflation of the value added in a particular service by a price or quantity index relating to output of the service (gross of input costs), implies an

assumption of proportionate movements in the prices of the outputs and inputs of the sector. This assumption should be checked by separate deflation of the inputs of at least the major sectors where data permit; inputs represent a very small proportion of outputs in most of these industries, however, and in these circumstances the assumption mentioned is generally acceptable.

(b) Estimation of Expenditure on Domestic Product

182. The broad components of expenditure on gross domestic product have been described in earlier chapters. These components correspond with the expenditure flows for current value studies defined in A System of National Accounts and Supporting Tables, and provide an initial breakdown suitable for the preparation of estimates in constant prices. The nature and extent of the additional expenditure breakdowns in constant prices are determined largely by the forms of the basic data, but to the extent possible these should conform to the Standard Tables shown in an earlier section. In the revaluation of these expenditure flows, the three basic techniques of extrapolation by quantity indexes and deflation by price indexes relating either to market prices or production costs are again employed. Usually, the choice of method is governed by the available price and quantity data and the methods used in preparing the current value estimates; the discussion in succeeding pages has therefore been related closely to these questions.

183. Private consumption expenditure: The composition of this flow and various methods by which it is estimated in current values are examined in the United Nations paper Methods of National Income Estimation.[95] This paper distinguishes four principal methods by which consumption expenditure is usually computed: the commodity flow method, the collection of separate quantity and price data, the direct estimation of retail sales, and consumer budget studies. All four methods may of course by employed in conjunction to estimate components of this flow.

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[95] Op. cit., pp. 22-28.

184. <u>The commodity flow method</u> provides value estimates of consumer spending in considerable detail. In constant price studies, these detailed expenditure series are sometimes separately deflated by corresponding components of the conventional retail, wholesale and other price indexes. Apart from the range of information provided by a fine breakdown of real consumption expenditure, separate deflation of these series may contribute substantially to the accuracy of the study. By deflating expenditure series on individual products or services, then recombining these series by weights indicated by the standard formula, deficiencies of coverage or formulae in the conventional price indexes may largely be overcome.

185. In practice, the need for economy may suggest that the sub-division of the retail and other conventional price indexes should not be carried beyond certain product group levels. The United States[96] and Canada have concluded in their studies that moderate inconsistencies of this order are unlikely to lead to significant error in short period studies. "It is believed, and relevant tests made by the National Income Section of the Bureau of Statistics support the contention, that, with the exception of exports and imports, the discrepancies which arise from the use of base-weighted rather than currently weighted price indexes in the initial stage of the deflation process are not large enought to affect seriously the general conclusions to be drawn from the resulting series."[97]

186. Thus in Canada, revaluation of the private consumption flow at constant prices was undertaken by the separate deflation of approximately fifty component series.[98] Most of these series were deflated by price indexes representing various combinations of the sub-groups and individual items of the cost-of-living index; but in a few instances the base year value were extrapolated by quantity indexes. Where quantity indexes were employed, the products concerned were usually of a relatively uniform description - e.g., tobacco.

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[96] Ref. 9 (see annex I).
[97] Ref. 22 (see annex I).
[98] Ref. 23 (see annex I).

Deficiencies in the available price data were in a few cases made good by the use
of prices obtained from such sources as mail order catalogues and by direct
correspondence with businessmen.

187. In the United States, private consumption was divided into detailed
component series, which were in the main deflated by corresponding components
of the cost of living and prices paid by farmers indexes;[99/] data from these
two indexes were combined to represent prices paid in both rural and urban
markets. For some private consumption categories however, other means of
revaluation were devised, including quantity indexes, price indexes of costs
adjusted for changing profit margins, and specially constructed indexes based
on published price data such as mail order prices.

188. There is an economic limit to the amount of price detail that may be
collected for the construction of price indexes, so that price sampling forms an
essential part of the deflation process. In this work countries have attempted
to collect prices which relate to precisely defined products, and which give
due representation to regional and seasonal variations in prices. For example,
in some countries the prices of primary products tend to decline at harvest time
when purchases are heaviest; harvest prices in these circumstances have been
weighted to give due effect to the heavy volume of transactions taking place
at that time. In the selection of products for pricing purposes an endeavour is
also made to find products whose price movements can be extended to represent
price changes in related products or product groups believed to be subject to
similar demand factors and costs of production. "Various tests are conducted
periodically to determine that the imputations continue to be reasonable, so
that the sample remains representative of the universe".[100/]

189. The estimation of certain components of the private consumption flow in
current values by multiplying quantities bought by consumers by retail prices

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99/ Ref. 9, (see annex I).
100/ Ref. 9, p. 19 (see annex I).

affords a straightforward method of revaluing these components at constant prices;
the quantity series need simply to be expressed in the prices of the base year
selected for the study. However, the diversity of the products and qualities
in this flow has tended to inhibit adoption of this method on a broad scale.
Quantities consumed are usually estimated from production, import and export
and stock change data; prices are obtained principally from data collected for
construction of the consumers' price index. The statistics relating to
"quantities consumed" which form the basis of this method must of course be
organized into a workable number of product classes, and supported by an
assumption of constancy in the composition of each class. In fact, the
composition of some product classes may change sharply in the short period,
although it is not usually possible to take account of such changes
in estimating real expenditure. This consideration indicates a possible
weakness in the wide use of this method.

190. The calculation of components of private consumption expenditure in current
prices by the retail sales method is based largely on retail trade material from
merchandising censuses. The extrapolation of these benchmark data may often
be undertaken with data from sample surveys. The resulting expenditure series
may be converted into constant prices by deflating by the cost of living and other
conventional price indexes. This method of deflation using conventional price
index material is particularly effective where the expenditure flows are given
in some detail so that they may be separately deflated by corresponding
components of the price indexes. Where the information available relates only
to broad expenditure flows, deflation by cost of living, wholesale and other
price indexes in the conventional form could introduce some error into the study
because of inconsistencies in index formulae and coverage. In working with
broad flows, deflation can best be carried out using price and quantity
indexes constructed to conform to the national accounting framework and a common
formula. As a methodological point, special care must be taken to ensure the
inclusion of new outlets in current estimates. Some countries have found that
estimates of current turnover based on a matched sample of shops included at
the last distribution census are too low after a very few years by reference to
estimates made by other means.

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191. The fourth method of estimating private consumption expenditure examined in Methods of National Income Estimation is the family budget survey method based on sample studies. This method yields a breakdown of private consumption expenditures in current money terms by commodity and service groups, and may also be used to provide a cross classification of these expenditures by socio-economic groups such as wage earners and farmers. However, a further principal use of these surveys has been to establish the weights of a group of price indexes drawn up in conformity with the detailed classifications of the private consumption expenditure flow. Both the expenditure components and the price index components obtained in this way could be defined in terms of the classifications of private consumption expenditure recommended in this paper. The deflation of the detailed expenditure series by the corresponding price indexes would then yield estimates of private consumption expenditure in constant prices in the form set out in the relevant supporting tables. The basic statistics for these estimates are provided by a sample survey of household expenditures and a sample survey of consumer prices, so that the accuracy of the real terms data would in this case be determined by the character of the sampling methods used. To have real relevance to the present topic, the sample inquiries should be deemed continuous. Such surveys tend to be subject to large random sampling errors. They have also proved to be very costly, so that their use has been restricted largely to marginal inquiries.

192. Government consumption expenditure: The components of this flow include principally compensation of employees and net purchases of goods and services by general government. The expenditure of government enterprises is omitted. More comprehensive definitions of this item, which discuss such matters as military expenditures, transfers, and the allocation of final expenditure between government and households, are given in the United Nations reports A System of National Accounts and Supporting Tables, and Methods of National Income Estimation. Deflation of this category of expenditure often presents serious difficultires because of sharp changes over time in the pattern of government expenditures, differences in the accounting systems of various governing bodies, or the lack of a detailed breakdown of expenditure by product classes.

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193. Some simplification of these problems may often be achieved however by extracting certain large and relatively uniform classes of government expenditure for separate deflation. Compensation paid to government employees is usually deflated either by a wage index or extrapolated by an employment index. Expenditures on military equipment and construction are often dealt with by specially constructed price indexes, which may where necessary be computed from input rather than output prices of the construction and munitions etc., industries. Similarly, imports for government use may be deflated by components of an import price index and other sizeable expenditure categories revalued by means of appropriate components of the wholesale or other price indexes. This approach would provide the information required to complete part A of the table in chapter 4 showing composition of general government consumption expenditure, classified by type of expenditure. Part C might be completed by sub-classifying the basic data relating to wage payments and certain classes of purchases by type of authority. Part B, which classifies government expenditure by purpose, could only be completed upon the basis of a more detailed expenditure breakdown and a corresponding classification of wage and commodity price indexes.

194. An example of this technique is provided by the method used in Canada,[101] where government consumption expenditure is deflated mainly by means of:

(a) a special wage rate index covering selected civil service occupations, and annual employment data concerning the civil service, used to deflate compensation of employees,

(b) a moving average of interest rates and construction costs used to deflate "productive government interest payments",

(c) export price indexes relating to commodity exports financed by foreign aid, used to deflate official contributions such as those to Mutual Aid,

(d) selected price indexes relating to capital formation, used to deflate government investment expenditures,

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[101] Ref. 23 (see annex I).

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(e) a cost of living index, used to deflate routine expenses such as office supplies and repairs to equipment, and a combined price index of materials used and wage rates paid in producing machinery and equipment, employed for the deflation of part of the expenditure on war materials.

195. The deflation of government expenditure on compensation of employees by a wage rate index or an employment index may present a problem of accounting balance when direct quantity indicators of education, health, etc. services have been used on the other side of the accounts to estimate value added by government. Conceptually domestic product of the economy is equal to expenditure on domestic product, so that in deflating government wage expenditures allowances for productivity changes equivalent to the allowances made in computing the real value added by government should be made wherever possible. This procedure would tend to reduce the statistical error in the accounts, and to improve the measure of economic welfare provided. It may be noted in this context that in deflating government expenditure on the National Health Service, on education and on certain other services, the United Kingdom[102/] has used the same indicators as were used in measuring real output. Purchases of defence equipment by public authorities are also "measured in real terms consistently with corresponding indicators of the volume of output used in the index of industrial production".

196. Gross domestic fixed capital formation: The main classes of capital outlay include expenditure on transport equipment, machinery and other equipment, dwellings, non-residential buildings, and other construction and works. Two principal methods of estimating this capital flow in current money terms have been adopted: the production approach and the expenditure approach.[103/] The production or commodity flow approach, which is in wide use by countries, tends to yield a very detailed commodity classification of capital expenditures; the expenditure approach, which is based on a survey of the purchasers of capital goods, yields a detailed classification of capital formation outlays by industries but is not often designed to provide much commodity detail.

102/ Ref. 11, p. 270 (see annex I).

103/ These methods are described in Methods of National Income Estimation, op. cit., pp. 30-35.

197.   In countries which rely on the production approach or on a combination
of the two approaches mentioned, it is usually possible to supplement basic
statistics of capital formation in value terms by corresponding quantity
statistics for at least a number of the important sub-categories of this flow.
In the United Kingdom, for example, separate price and quantity data were
available for the flows of expenditure on road vehicles and ships.[104]   These
statistics permit the direct computation of quantity indexes for the relevant
expenditure classes, but their use in this way must be supported by an
assumption of product honogeneity within the given product classes.   In the
United Kingdom and in most other country studies the principal method used in
converting to constant prices is that of deflation by price indexes.   For the
United States,[105] where detailed capital formation series are available in
current values, many of the series of construction expenditure were deflated
by indexes of correspondingly narrow coverage, based on input prices of materials
and labour; in preparing these indexes adjustments were made for changes in
profit margins, but no adjustment could be made for productivity changes.
Expenditure on producers' equipment was divided into numerous classes, which
were deflated mainly by corresponding components of the wholesale prices and
other indexes, including indexes based on prices obtained from publications such
as mail order catalogues.   In Canada,[106] gross domestic fixed capital
formation was classified into four broad groups and certain sub-groups for
revaluation at constant prices.   Various price indexes were used in deflation.
Residential and certain non-residential construction outlays were deflated by
means of composite input price indexes based on appropriate building materials
prices and construction wages rates.   Similarly, an "input" price index was used
to deflate investment in domestically produced non-farm machinery, while
investment in farm machinery was deflated by an index of farm machinery prices.

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[104]   Ref. 11, pp. 299-300 (see annex I).

[105]   Ref. 14, p. 156 (see annex I).

[106]   Ref.23 (see annex I).

198. In deflating capital expenditure flows the treatment of year to year changes in specifications and performance of the goods involved may present difficulties. In some country studies the principle adopted has been to present a measure in real terms of the resources used up in the production of capital goods, (embodied resources), omitting any allowance for changes over time in the capacity, durability or other quality of these goods per unit of resource input. In other studies an attempt has been made to impute a base year value to at least the major changes in the specifications of a capital good, irrespective of changes in its real costs, and to regard this value as positive or negative capital formation.

199. The first approach requires the adoption of price deflation methods to be effective. The "embodied resources" approach is then applied by determining the difference in cost between the new and the old model or type of capital good "at the time of change-over, attributing this to real product difference, and measuring the rest of the price difference as a price change". "Thus, in so far as quality changes are reflected in real cost changes, they are not included in price changes, and therefore show up as changes in real product in the deflated series". 107/ Since many improvements in the quality of a capital good occur with little or no increase in its cost of production, this method tends to exclude from the real capital formation series a sizable part of the gain accruing to an economy from improvements in the quality of these goods.

200. The alternative approach requires the imputation of base year values to products or models which were not in existence in the base year, by taking account not only of cost factors but also of factors which might be expected to affect the price of the capital good by their influence on demand. These imputations necessarily involve an element of judgement and present serious practical difficulties. Since they have already been considered in an earlier chapter, they will not be re-examined in detail at this point. In brief, however, when quantity statistics and base year values are employed in the direct construction of quantity indexes, the quantity data may be corrected to allow

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107/ Ref. 9, p. 31. (See Annex I)

for the principal changes in size, power, performance, etc. In practice, the detail required to permit these corrections is not often available. When price deflation methods are employed, the current value series of expenditure on a particular capital good may be deflated by a price index for related products, or, where this is not feasible because of widespread changes in quality, by a price index based on the materials and labour costs of producing the particular category of capital goods under review; under this method the changes in value attributable by and large to demand factors are included in real capital formation, in addition to changes in the real costs of production, as a measure of the real gain (or loss) accruing from changes in the quality of the capital good. The common practice of deflating expenditures on custom built machinery by price indexes based on the costs of production may be cited as an example of this approach to the problem of quality changes in capital goods. As already remarked earlier in connexion with quality or specification changes, no procedure at present in use for establishing a constant price series for capital goods seems entirely satisfactory. It would be very useful for general guidance if countries in a position to do so could produce estimates based on the several existing practices. It would be reassuring if the results were in reasonably close concordance.

201. It has been shown in chapter 2 that conceptually the domestic product of an economy equals expenditure on domestic product in constant as in current prices. It follows that identical principles of valuation should be adopted in measuring the flow of capital goods as the output of domestic industry on the one hand, and as expenditure on capital formation on the other. In treating this problem of quality change every effort should therefore be made to apply methods in revaluing the final expenditure and the industrial product estimates which in principle at least are consistent.

202. Increase in stocks: The coverage of this item and methods adopted by countries in estimating the value of stock changes for purposes of accounting in current prices has been examined in the United Nations report Methods of National Income Estimation. 108/ It is mentioned in this report that the item refers to

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108/ Op. cit. pp. 35-38.

"the value of the physical change in raw materials, work in progress (other than work in progress of the building and heavy construction industries which is included in fixed capital formation) and finished goods held by enterprises and in government stockpiles".

203. The procedure in estimating stock changes in constant prices is identical in its early steps with that used in estimating the entry "value of the physical change in stocks" for accounts in current prices. The latter entry is computed by deflating the book value of stocks in give stock values in base year prices; by deriving from the deflated data the year to year changes in stocks in base year prices; and by multiplying these estimates of year to year changes by appropriate price indexes to give the values of the physical changes in stocks in current prices. In constant price accounting it is necessary only to revalue the book value of stocks at base year prices and to derive from these data estimates of year to year stock changes in real (base year) terms.

204. The statistical work involved in computing this item is nevertheless considerable. A full survey of some of the usual methods of estimation and sources of basic statistics is given in the report Methods of National Income Estimation referred to above. For a limited number of industries, primarily agriculture, the basis of this estimate is provided by quantity statistics. Constant price stock series are in this case computed by multiplying the quantity data by the base year prices. In most cases, however, because of the diversity of commodities involved, price deflation methods are needed to reduce stock series to constant prices. In this work the stocks are usually classified by industries and deflated by sectional price indexes. A Canadian report [109] has described the price indexes used as indexes appropriate to the commodity content of the inventories, and the turnover periods and the inventory accounting methods employed in the various industries. In the United States, [110] the book values of non-farm stocks, classified by industries, were deflated mainly by appropriate price indexes constructed from price information contained in the wholesale price indexes, and "weighted, as far as possible, by the relative importance of the principal types of inventory goods represented by the indexes".

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[109] Ref. 23, p. 127 (See Annex I).

[110] Ref. 14, p. 156 (See Annex I).

The indexes were "appropriately lagged" to allow for the principal methods of inventory accounting and stock turnover periods before being applied to the year-end book values of stocks. The year to year change in the deflated series was then taken to represent the "increase in business stocks" series in constant prices. For farm stock changes, quantity data relating to year-end holdings of crops and livestock were valued at base year prices.

205. Exports and imports of goods and services: The United Nations report defines exports and imports as transactions in merchandise and the provision of transport, insurance and other services. International transfers, for example, remittances, donations and tax payments are not entered in the external transactions current account in the United Nations system. The component items of the export and import flows as defined are therefore divisible into separate price and quantity components in each instance. The omission of transfers and the separate deflation of exports and imports avoids some of the difficulties found in deflating a balancing item of net foreign investment inclusive of unilateral money flows; in addition, this procedure permits explicit treatment of factor income payments to and from abroad and the gain or loss from changes in the terms of trade in arriving at a balancing item for the external transactions current account, should this extension of the constant price estimates be undertaken

206. This work is complicated however by the fact that the conventional quantum indexes of imports and exports computed by most countries differ, for valid statistical reasons, in coverage and timing from the definitions of these flows adopted in this paper (in conformity with balance of payment definitions). The conventional quantum import indexes are also commonly valued on a c.i.f. basis, while the indexes defined herein are valued f.o.b. the exporting country; the transport and insurance costs, to the extent that these services are supplied by foreigners, are presented as separate entries.

207. It has been possible in a number of country studies to adjust the conventional import and export indexes to provide indexes which conform to the national accounting concepts. In the United Kingdom,[111]/ the trade export volume indexes were adjusted to Balance of Payments concepts in two steps. For export items included in both the trade and the Balance of Payments accounts, the

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111/ Ref. 11, pp. 346-8. (See Annex I)   /...

procedure was to adjust the timing of the trade figures to accord with the Balance of Payments requirements. For export items not included in the trade accounts, the value estimates were deflated by approximate price indexes. Deflation of the import estimates was complicated by presentation of the trade figures at c.i.f. values. It was necessary therefore to re-weight the trade volume indices by reference to detailed figures for certain years showing the ratio of f.o.b. to c.i.f. prices of imports, and to extend the coverage of these indexes. Similar adjustments were made to the trade estimates of imports in current prices. Comparison of the revised import volume index and the revised current price estimates yielded a price index which was then used to deflate the total value of imports of merchandise given in the balance of payments, presumably after the necessary correction of the price index for timing.

208. Canada [112]/ found it necessary to undertake a special project to construct price indexes with current year weights for use in deflating merchandise exports and imports. Basic data were provided by the trade statistices, but it was found necessary to make certain adjustments in both the grouping and the coverage of these figures. As with the United States, the price indexes were based on unit volumes and values of imports and exports. It was stated concerning the indexes for the latter country that "the commodity groups were broken down finely enough in most cases for the indexes to approximate price movements and not reflect shifts in commodity composition."[113]/ The especial efforts made by some countries to construct price indexes with the appropriate weight base have been made necessary by the sharp changes in patterns of foreign trade and in price relationships which occur in the external transaction sector.

209. A number of countries have deflated expenditures by tourists and servicemen abroad by indexes based on retail price changes in various countries after adjustment for changes in exchange rates. Expenditures by foreigners

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[112]/ Ref. 23, p. 127   (See Annex I).
[113]/ Ref. 9, p. 17   (See Annex I).

within the country have been deflated by indexes based upon the prices of goods and services purchased by tourists. The deflation of the service components of the import and export entries has tended to present considerable statistical difficulties, which can only be overcome effectively by the collection of additional information relating to shipping freights, insurance rates and charges for other services.

ANNEX I

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