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European system of national and regional accounts in the Community

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EUROPEAN SYSTEM OF ACCOUNTS
ESA 1995

CHAPTER 10

PRICE AND VOLUME MEASURES

10.01. In a system of economic accounts, all the flows and stocks are expressed in monetary units. The monetary unit is the only common denominator which can be used to value the extremely diverse transactions recorded in the accounts and to derive meaningful balancing items.

The problem when using the monetary unit as a measuring unit is that this unit is neither a stable nor an international standard. A major concern in economic analysis is to measure economic growth in volume terms between different periods. It is then necessary to distinguish, in the value changes for certain economic aggregates, the changes arising solely from price changes from the remainder which is called the change in 'volume'.

Economic analysis is also concerned with comparisons in space, i.e. between different national economies. These focus on international comparisons in volume terms of the level of production and income, but the level of prices is also of interest. It is therefore necessary to factor the differences in value of economic aggregates between pairs or groups of countries into components, which reflect the differences in volume and the differences in price.

10.02. When time comparisons of flows and stocks are concerned, equal importance should be attached to the accurate measurement of changes in prices and in volumes. In the short term, observation of price changes is of no less interest than the measurement of the volume of supply and demand. On a longer term basis, the study of economic growth has to take account of movements in the relative prices of the different types of goods and services.

The primary objective is not simply to provide comprehensive measures of changes in prices and volumes for the main aggregates of the system but to assemble a set of interdependent measures which make it possible to carry out systematic and detailed analyses of inflation and economic growth and fluctuations.

10.03. The general rule for comparisons in space is that accurate measures must be made for both the volume and the price components of the economic aggregates. As the spread between the Laspeyres and Paasche formulae is often significant in spatial comparisons, the Fisher index formula is the only acceptable one for this purpose.

10.04. The economic accounts have the advantage of providing a suitable framework for constructing a system of volume and price indices as well as ensuring the consistency of the statistical data.

The advantages of an accounting approach can be summarized as follows:

(a) on a conceptual level, the use of an accounting framework covering the entire economic system requires the prices and physical units for the different products and flows in the system to be specified consistently. In a framework of this type it is imperative that, for example, the price and volume concepts for a given group of products should be defined identically in both resources and uses;

(b)   on a statistical level, the use of the economic accounts framework imposes accounting constraints which must be respected at both current and constant prices and will normally require some adjustments to be made to ensure consistency of the price and volume data;

(c)   furthermore, the creation of an integrated system of price and volume indices in the context of a system of economic accounts provides the national accountant with extra checks. Assuming the existence of a balanced system of supply and use tables at current prices, the construction of such balanced tables at constant prices means that a system of implicit price indices can be automatically derived. Examination of the plausibility of these derived indices can lead to revision and correction of the data at constant prices and even, in some cases, of the values at current prices;

(d)   finally, the accounting approach permits the measurement of price and volume changes for certain balancing items in the accounts, the latter being derived by definition from the other elements in the accounts.

10.05.   Despite the advantages of an integrated system based on the balance, both overall and by industry, of transactions in goods and services, it has to be acknowledged that the price and volume indices thus obtained do not meet all needs or answer all possible questions on the subject of change in prices or volume. Accounting constraints and the choice of price and volume index formulae, although essential for the construction of a coherent system, can sometimes be a hindrance. There is also a need for information for shorter periods such as months or quarters. In these cases, other forms of price and volume indices may prove useful.

SCOPE OF PRICE AND VOLUME INDICES IN THE ACCOUNTS SYSTEM

10.06.   Among the flows which appear in economic accounts at current prices, there are some (mainly concerning products) where the distinction between changes in price and volume is similar to that made at microeconomic level. For many other flows in the system, the distinction is far less obvious.

In the former case, the flows cover a group of elementary transactions in goods and services, the value of each being equivalent to the product of a number of physical units and their respective unit price. In this case it is sufficient to know the breakdown of the flow in question into elementary transactions in order to determine its average variation in price and volume.

In the latter case, which concerns a number of transactions relating to distribution and financial intermediation as well as to balancing items such as value-added, it is difficult or even impossible to separate directly current values into price and volume components and special solutions have to be adopted.

There is also a need to measure the real purchasing power of a number of aggregates, such as compensation of employees, disposable income of households or national income. This can be done, for example, by deflating them by means of an index of the prices of the goods and services which can be bought with them.

10.07.   It must be emphasized that the objective and the procedure followed when measuring the real purchasing power are fundamentally different from those followed when deflating goods and services and balancing items. For these an integrated system of price and volume indices can be established, which is useful, among other things, for measuring economic growth. The valuation in real terms of flows of the last type uses price indices of flows other than those considered, which may differ according to the objectives of the analysis: it can only be a convention and cannot be done in a unique way within an integrated system of price and volume indices.

THE INTEGRATED SYSTEM OF PRICE AND VOLUME INDICES

10.08.   The systematic division of changes in current values into the components 'changes in price' and 'changes in volume' is restricted to flows representing transactions, recorded in the goods and services accounts (0) and in the production accounts (I); it is carried out both for the data relating to individual industries and for those relating to the total economy. Flows representing balancing items, for example value added, cannot be directly factored into price and volume components; this can only be done indirectly using the relevant flows of transactions.

The use of the accounting framework imposes a double constraint on the calculation of the data:

(a)   the balance of the goods and services account must for any sequence of two years be obtained at both constant and current prices;

(b)   each flow at the level of the total economy must be equal to the sum of the corresponding flows for the various industries.

A third constraint, not inherent in the use of an accounting framework but resulting from a deliberate choice, is that every change in the value of transactions must be attributed either to a change in price or to a change in volume, or to a combination of the two.

If these three requirements are fulfilled, valuation of the goods and services accounts and production accounts at constant prices means that an integrated set of price and volume indices can be obtained.

10.09.   The items to be considered when constructing such an integrated set are as follows:

Transactions in products		
Output	P.1	
Market output		P.11
Output for own final use		P.12
Other non-market output		P.13
Intermediate consumption	P.2	
Final consumption expenditure	P.3	
Individual final consumption expenditure		P.31
Collective final consumption expenditure		P.32
Actual final consumption	P.4	
Actual final individual consumption		P.41
Actual final collective consumption		P.42
Gross capital formation	P.5	
Gross fixed capital formation		P.51

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Changes in inventories		P.52
Acquisition less disposals of valuables		P.53
Exports of goods and services	P.6	
Exports of goods		P.61
Exports of services		P.62
Imports of goods and services	P.7	
Imports of goods		P.71
Imports of services		P.72
Taxes and subsidies on products		
Taxes on products, excluding VAT		D.212 and D.214
Subsidies on products		D.31
VAT on products		D.211
Consumption of fixed capital	K.1	
Balancing items		
Value-added	B.1	
Gross domestic product	B.1*g	

PRICE AND VOLUME INDICES FOR OTHER AGGREGATES

10.10.   In addition to the price and volume measures considered above, the following aggregates can also be decomposed into their own price and volume components. The objectives for these measures vary.

Inventories	AN.12
Stock of produced fixed assets	AN.11
Compensation of employees	D.1

Inventories at the beginning and at the end respectively of each period may have to be calculated at constant prices in order to estimate the volume change in inventories during the period.

The stock of produced fixed assets has to be calculated at constant prices to estimate capital output ratios, as well as to obtain a basis for estimating consumption of fixed capital at constant prices.

Compensation of employees has to be calculated at constant prices for purposes of measuring productivity and in some instances also when outputs have been estimated by using constant price data on inputs.

10.11.   Compensation of employees is an element of income. For the purpose of measuring purchasing power it can be valued in real terms by deflating with an index reflecting the prices of products purchased by employees. Other income elements too, such as

disposable income of households and national income, can be measured in real terms in the same general way.

GENERAL PRINCIPLES OF MEASURING PRICE AND VOLUME INDICES

DEFINITION OF PRICES AND VOLUMES OF MARKET PRODUCTS

10.12.   The creation of an integrated system of price and volume indices is based on the assumption that, at the level of a single homogeneous good or service, value (v) is equal to the price per unit of quantity (p), multiplied by the number of quantity units (q), that is

$$v \equiv p \times q$$

10.13.	*Definition:*	Price is defined as the value of one unit of a product, for which the quantities are perfectly homogeneous not only in a physical sense but also in respect of a number of other characteristics described in paragraph 10.16. To be additive in an economic sense, quantities must be identical and have the same unit price. For each aggregate of transactions in goods and services shown in the accounts, price and quantity measures have to be constructed so that $$\text{value index} = \text{price index} \times \text{volume index}$$ This means that each and every change in the value of a given flow must be attributed either to a price change or to a change in volume or to a combination of the two.

10.14.   For transactions in goods it is in many cases easy to define the physical unit involved in the transaction and hence the price per unit. In a number of cases, for example for unique capital goods, it is more difficult and special solutions have to be adopted.

For transactions in services it is frequently more difficult to specify the characteristics which determine the physical units and differences of opinion on the criteria to be used may arise. This may concern important industries such as financial intermediation services, wholesale and retail trade, services to enterprises, education, research and development, health or recreation. In view of the growing importance of the service industries, it is essential to find common solutions to the problem of the choice of physical units, even if they are only conventional ones.

DIFFERENCES IN QUALITY AND DIFFERENCES IN PRICE

10.15.   The physical and other characteristics to be taken into consideration when identifying products constitute differences in quality and play an important role, while at the same time raising difficult statistical problems.

The fact is that for many goods and services intended for a specific purpose there exist several varieties of differing qualities, each with its own price.

10.16.   Differences in quality are reflected by the following factors:

(a)   physical characteristics;

(b)   deliveries in different locations;

(c)   deliveries at different times of the day or at different periods of the year;

(d)   differences in conditions of sale or the circumstances or environment in which goods or services are supplied.

With given physical characteristics, the differences in the other factors imply that the physical units are not identical in an economic sense, and that the value differs among the units. These differences in unit values are considered to be differences in volume and not as differences in price.

In reality, the payment made when a good is purchased covers not only the price of a good but also the price of the services associated with the supply of goods. This means that in principle identical goods sold at different prices and in different circumstances should be considered to be different products. This conclusion is explicitly acknowledged in the supply and use tables, where the value of trade and transport margins (which represent the main services associated with the provision of goods) is recorded separately.

10.17.   Within a given market and in a single period, the coexistence of several unit values can, except in the cases described in paragraph 10.19, be considered as evidence of the existence of quality differences. Accordingly, the various models of cars and even different versions of the same model must be treated as different products: similarly, a distinction must be made between first-class and second-class railway journeys.

For the purposes of calculating price and volume measures, it is necessary to use as detailed a product classification as possible so that each product identified has maximum homogeneity, regardless of the level of detail used in the presentation of results.

10.18.   The dimension of quality has to be taken into account also when changes over time are to be recorded. The change in quality due, for example, to the modification of the physical characteristics of a product must be considered to be a change in volume and not in price. Also the effects of aggregation have to be considered. Variations in the composition of a flow which imply, for example, a shift in favour of higher average quality have to be recorded as a volume increase and not as a price increase. It follows that for outputs, the effect of shifts between markets with differing prices, for example domestic versus external, or industrial uses versus markets for consumer products, will be treated as changes in volume and not as changes in price. It also follows that a price change for a given flow can occur only as result of changes in prices at the level of individual transactions.

10.19.

Definition:	The existence of observed unit value differences is not to be considered as an indicator of differences in quality when the following circumstances apply, namely lack of information, price discrimination reflecting limitations in freedom of choice and the existence of parallel markets. In these cases, the unit value differences are considered as differences in price.

10.20.   Lack of information means that purchasers may not always be properly informed about existing price differences and may therefore inadvertently buy at higher prices. This, or the opposite, may occur also in situations where individual buyers and sellers negotiate or bargain over the price. On the other hand, the difference between the average price of a good purchased in a market or a bazaar, where such bargaining often occurs, and the price of the same good sold in a different type of retail outlet, such as a department

store, should normally be treated as reflecting differences in quality due to different sales conditions.

10.21.   Price discrimination implies that sellers may be in a position to charge different prices to different categories of purchasers for identical goods and services sold under exactly the same circumstances. In these cases, there is no or limited freedom of choice on the part of a purchaser belonging to a special category. The principle adopted is that variations in price are to be regarded as price discrimination when different prices are charged for identical units sold under exactly the same circumstances in a clearly separable market. Price variations due to such discrimination do not constitute differences in volume.

The possibility of the retrading of goods in a given market implies that price discrimination for these types of products in most cases can be assumed to be insignificant. The price differences that may exist for goods can normally be interpreted as due to lack of information or to the existence of parallel markets.

In service industries, for example in transportation, producers may charge lower prices to groups of individuals with typically lower incomes, such as pensioners or students. If these are free to travel at whatever time they choose, this must be treated as a price discrimination. However, if they are charged lower fares on condition that they travel only at certain times, typically off-peak times, they are being offered lower-quality transportation.

10.22.   Parallel markets may exist for several reasons. Buyers may be unable to buy as much as they would like at a lower price because there is insufficient supply available at that price, and a secondary, parallel market, where higher prices are quoted, may exist. There is also the possibility that a parallel market exists, where sellers can charge lower prices because they can avoid certain taxes. In these cases too, a price variation constitutes a difference in price and not in volume.

10.23.   A change in the structure of a flow affecting its total value may occur when in the circumstances of lack of information, price discrimination and the existence of parallel markets identical products are sold at different prices.

Suppose that a certain quantity of a particular good or service is sold at a lower price to a particular category of purchaser without any difference whatever in the nature of the good or service offered, location, timing or conditions of sale, or other factors. A subsequent decrease in the proportion sold at the lower price raises the average price paid by purchasers of the good or service. This must be recorded as a price and not a volume increase.

PRINCIPLES FOR NON-MARKET SERVICES

10.24.   The establishment of a comprehensive system of price and volume indices covering all supply and uses of goods and services encounters a particular difficulty when measuring the output of non-market services. These services differ from market services in that they are not sold at a market price and their value at current prices is calculated by convention as the sum of the costs incurred. These costs are intermediate consumption, compensation of employees, other taxes less subsidies on production and consumption of fixed capital.

10.25.   In the absence of a unit market price, the change in the 'unit cost' of a non-market service can be considered as an approximation of the change in the price. If non-market services are consumed on an individual basis, it is in principle possible to estimate quantities which are homogeneous and which reflect the utilization of these services and apply the unit costs of a base year to obtain data in constant prices. By such type of output-measurement it will be possible to analyse changes in productivity

for individual non-market services. For collective services it is generally not possible to establish unit costs and quantities reflecting their utilization. If attempts are made to account for changes in productivity for collective services by indirect methods, users should be made aware of this.

10.26.   In the context of the economic accounts, it is of prime importance to adopt the principle that the production and consumption of non-market services, like the production and consumption of goods and market services, must be defined in terms of the actual flows of these goods and services and not in terms of final results obtained from their use. As these results depend on several other factors as well, it is not possible to measure, for example, the volume of teaching services by the rise in the level of education, or the volume of health services by the improvement in the health of the population.

PRINCIPLES FOR VALUE-ADDED AND GDP

10.27.   Value-added, the balancing item in the production account, is the only balancing item to form part of the integrated system of price and volume indices. The very special characteristics of this item must, however, be emphasized, as must the significance of its related volume and price indices.

Unlike the various flows of goods and services, value-added does not represent any single category of transaction. It cannot, therefore, be directly broken down into a price component and a volume component.

10.28.

Definition:	Value-added at constant prices is defined as the difference between output at constant prices and intermediate consumption at constant prices. $VA = \Sigma P(0)Q(1) - \Sigma p(0)q(1)$ where P and Q are prices and quantities for output and p and q are prices and quantities for intermediate consumption. The theoretically correct method to calculate value-added at constant prices is by double deflation, i.e. deflating separately the two flows of the production account (output and intermediate consumption) and calculating the balance of these two revalued flows.

10.29.   In some cases, where the statistical data remain incomplete or not sufficiently reliable, it may be necessary to use a single indicator. If there are good data on value-added at current prices, one alternative to double deflation is to deflate current value-added directly by a price index for output. This implies the assumption that prices for intermediate consumption change at the same rate as for output. Another possible procedure is to extrapolate value-added in the base year by a volume index for output. This volume index can be calculated either directly from quantity data or by deflating the current value of output by an appropriate price index. This method in fact assumes that the volume changes are the same for output and for intermediate consumption.

For certain market and non-market service industries, such as finance, business services, education or defence, it may not be possible to obtain satisfactory estimates of price or volume changes for output. In these cases the movements of value-added at constant prices can be

estimated by means of changes in compensation of employees at constant wage rates and consumption of fixed capital at constant prices. Compilers of data may be forced to adopt such expedients, even when there is no good reason to assume that labour productivity remains unchanged in the short or long term.

10.30.   By their very nature, therefore, the indices of volume and price for value-added are different from the corresponding indices for the flows of goods and services.

The same applies to price and volume indices of aggregate balancing items such as gross domestic product. The latter is equivalent to the sum of all the values added minus Fisim, i.e. to an addition of balancing items, plus taxes less subsidies on products and from another point of view can be seen to represent the balancing item between total final uses and imports.
PROBLEMS IN THE APPLICATION OF THE PRINCIPLES

10.31.   To apply the principles of price and volume to the different flows in the system it is necessary to specify the solutions to be adopted for a number of problems which arise in this connection.
GENERAL APPLICATION

10.32.   The need to determine which of the various factors described in the previous section explain differences in price arises whenever one studies time series of value data and has to separate price changes and volume changes. It follows that, even at a fine level of detail, series of quantity data may give only crude measures of volume changes, as they do not properly reflect changes that may have occurred in the mix of different qualities. This means that, for example, a constant number of physical units, recorded for a certain flow, understates the volume change if the composition has changed in favour of units with higher quality. This shift implies a change in average quality and must be registered as an increase in the volume index. In general, the best method of estimating volume changes for flows of goods and services is deflating value data with price indices. Since all changes in average quality are correctly reflected in the value series, dividing by a representative price index, which is adjusted for quality changes, gives a correct volume index.

10.33.   Deflation with price indices may not always be best in practice and other methods have to be adopted. Value series may, for example, have been established by multiplying price and quantity data and constant price data can then be obtained by using prices from the base year. Alternatively, some value series may be of an inferior quality or difficulties may exist in obtaining reliable price indices. Estimates can then be made on the basis of quantity indicators. In these cases care must be taken that the quantities refer to products that are as homogeneous as possible. If none of the methods described above are applicable, constant price data on outputs may have to be based on estimates of inputs at constant prices.

10.34.   For non-market services the possibility of deflating values by using price indices does not exist and other solutions have to be applied. These are described in paragraphs 10.41 to 10.46.
APPLICATION TO SPECIFIC FLOWS
Flows of goods and market services

10.35.   Of all the flows in the economy, the changes in the value of the flows of goods and market services are the most readily broken down into price and volume changes. In this context a clear distinction should be made between:

(a)   flows representing transactions actually carried out on the market at a certain price;

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(b)   flows representing output for own final use (e.g. own-account production of agricultural products and services from owner-occupied dwellings);

(c)   flows whose value is defined as a balance between transactions in goods and services (e.g. trade margins);

(d)   flows whose value is defined as a difference between distributive and/or financial transactions (e.g. financial intermediation services indirectly measured and insurance services).

10.36.   The flows in category (a) are by far the most numerous and commonplace. Changes in the values of these flows can, by their very nature, be split into volume and price changes. The general method of deflating the current value of these flows by price indices is applicable in all cases where goods and services can be expressed in units, the majority of which are homogeneous from one year to the next.

10.37.   The flows in category (b), which are notional transactions, are typified by the absence of an actual price for the transaction. This is the case for such goods as agricultural products for own final use and goods for fixed capital formation on own-account. For services, the most important type refers to owner-occupied dwellings. Values for these imputed flows are to be obtained by applying prices of similar products when marketed and the deflator should therefore be the same. Since it is usually necessary to value output of own-account construction by costs of production rather than prices, the deflator has to be adjusted in this respect.

10.38.   The most important flows in category (c) are those whose value at current prices is obtained as a difference between the values of two flows of goods. This arises in the case of trade margins, whose value at current prices is defined as the difference between the actual or imputed price realized on a good purchased for resale by the wholesale and retail trades and the price that would have to be paid by the distributor to replace the good at the time it was sold or otherwise disposed of. By one method, estimates of trade margins at constant prices can therefore also be made by difference, by subtracting the constant-price value of goods bought for resale from the constant-price value of goods resold by these trades. An alternative method of measurement would be to extrapolate the trade margins of the base year either by the volume of sales or by the volume of purchases made by the wholesale and retail trades. To be correct, this alternative has to take into account the fact that trade margins vary among different products and uses. This is explicitly acknowledged in the supply and use tables.

10.39.   Category (c) also includes output of travel agency services measured as the value of service charges of agencies (fees and commission charges). These services can also be measured as the difference between two flows: the full payment made by the purchaser and the expenditure made for transport and accommodation by the producer. The volume measure can be obtained as the difference between these flows calculated at constant prices. Alternatively, the fee or commission can be defined as the price per unit of the type of transportation or accommodation arranged and the volume indicator for the service charge would therefore move in the same way as these flows.

10.40.   The flows in category (d) consist of financial intermediation services: service charges from insurance and pension funds are also included. Financial intermediation services are provided by banks and other financial corporations and consist of lending money to businesses or households, providing a safe and convenient means of saving, safeguarding money and other valuables, buying and selling foreign currencies, clearing cheques, providing general economic intelligence, dealing in stocks and bonds, and offering investment advice. In some cases these services are easily defined

and specifically paid for, for example in the case of renting space in bank vaults, or when fees are charged in connection with issues of stocks, bonds or loans. The current value of transactions can then be defined, as well as prices and quantities necessary for price and volume measurement. However, a breakdown into price and volume components for financial intermediation services indirectly measured and for insurance services can usually only be made on arbitrary grounds and would have to be based on conventions.

Flows of non-market services

10.41.   The non-market services produced by general government and non-profit institutions serving households (NPISH) cover a vast range of services both necessary and useful to society. They fall into two main categories:

(a)   services provided to individuals, i.e. whose consumers or beneficiaries are individually identifiable. Consumption of these services requires individual initiative on the part of those concerned;

(b)   pure collective services, i.e. services which are consumed jointly by the entire population.

10.42.   The services provided to individuals can be given to single individuals (e.g. medical care) or to groups of individuals (e.g. teaching). By their nature, these services can be supplied on a market or a non-market basis; in many cases, the individual can obtain services of this type either by applying to a market unit (paying the price) or by turning to a non-market unit of general government or NPISH (getting the services free, or almost free).

For market units the method of deflating current values by price indices should be used, since the variations in the mix of products with differing prices are then correctly shown as influencing volumes rather than prices. For non-market services provided to individuals, output estimates can be based on quantity indicators. For education these may relate to numbers of hours spent by pupils in classes or in individual tutoring, and for non-market health services the indicators should reflect treatment in hospitals or visits to doctors or nurses. In both cases there is a quality dimension reflected in the amount of resources provided per pupil or patient. Care must be taken to use data with a detailed breakdown so that each indicator for which calculations are made is as homogeneous as possible in respect of costs. It is only then that changes in the mix of products are shown correctly as volume changes.

In the case of services provided to individuals, changes in the volume of their output and consumption should, in principle, be measured on the basis of the use which is made of these services; this will avoid using different criteria for the same services depending on whether they are market or non-market. Of course, any change in quality must be treated as a change in volume; but this applies as much to market services as to non-market services provided to individuals.

10.43.   The pure collective services are produced by general government for the benefit of the entire population. In fact, they cover a vast range of activities such as general public services, national defence, foreign affairs, justice and the police, town planning and the environment, economic policy, etc. Since these services are consumed collectively, indirectly and continuously, the volume of their output cannot be measured by the extent to which they are utilised.

10.44.   It may not be possible in practice to obtain reliable quantity indicators for non-market services provided for individuals and these may therefore have to be measured in terms of volume by the same methods as for pure collective services. It is then necessary to

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start from a valuation at constant prices of the different cost elements of this output, i.e.:

(a)   intermediate consumption;

(b)   compensation of employees;

(c)   other taxes on production, less other subsidies on production;

(d)   consumption of fixed capital.

The use of input-measures as proxies for output implies that analysis of productivity is not possible.

10.45.   The calculation of intermediate consumption at constant prices poses no particular theoretical problems base-year since intermediate consumption relates to goods and market services. It can be done either by deflating current values by a price index of intermediate consumption or on the basis of quantities revalued at base-year prices.

10.46.   Calculation at constant prices of the compensation of employees and the consumption of fixed capital in non-market service industries is done by the general methods described in paragraphs 10.53 and 10.54 for example. Other taxes on production are often of a type that can be related to a volume indicator, for example volume of employment, number of cars used.

Taxes and subsidies on products and imports

10.47.   Although essentially limited to transactions involving goods and services, the integrated system of price and volume indices does not exclude the possibility of calculating measures of changes in price and volume for certain other transactions. This possibility exists, in particular, in the case of taxes and subsidies directly linked to the quantity or value of the goods and services which are the subject of certain transactions. In the supply and use tables, the values of these are shown explicitly. By applying the rules described below, it is possible to obtain price and volume measures for the categories of taxes and subsidies which are recorded in the goods and services accounts, namely:

(a)   taxes on products, excluding VAT (D.212 and D.214);

(b)   subsidies on products (D.31);

(c)   VAT on products (D.211).

10.48.   The simplest case is that of taxes which represent a fixed amount per unit of quantity of the product which is the subject of the transaction. The value of the revenue from such a tax depends on:

(a)   the quantity of products involved in the transaction;

(b)   the amount levied per unit, i.e. the taxation price.

The breakdown of the value change into its two components presents virtually no difficulties. The variation in volume is determined by the change in the quantities of products taxed; the price variation corresponds to the change in the amount levied per unit, i.e. to the change in the taxation price.

10.49.   A more frequent case is that in which the tax represents a certain percentage of the value of the transaction. The value of the revenue from such a tax then depends on:

(a)   the quantity of products involved in the transaction;

(b)   the price of the products involved in the transaction;

(c)   the tax rate (as a percentage).

The taxation price is then obtained by applying the rate to the price of the product. The change in value of the revenue from a tax of this type can also be divided into a volume change, determined by the change in the quantities of products taxed, and a price change corresponding to the change in the taxation price (b × c).

10.50.   The amount of tax on products (excluding VAT) (D.215 and D.214) is measured in terms of volume by applying to the quantities of products produced or imported the taxation prices of the base year or by applying to the value of output or imports, revalued at the prices of the base year, the tax rates of the base year. Attention has to be paid to the fact that taxation prices may differ among different uses. This is taken into account in the supply and use tables.

10.51.   Similarly, the amount of subsidies on products (D.31) is measured in terms of volume by applying to the quantities of products produced or imported the subsidy prices of the base-year or by applying to the value of output or imports, revalued at the prices of the base-year, the rates of subsidy of the base-year, taking into account different subsidy prices for different uses.

10.52.   VAT on producs (D.211) is, both for the whole economy and for individual industries and other users, calculated on a net basis and refers only to non-deductible VAT. This is defined as the difference between VAT invoiced on the products and VAT deductible by the users of these products. Alternatively, it is also possible to define VAT on products as the sum of all non-deductible amounts which have to be paid by users.

Non-deductible VAT at constant prices can be calculated by applying the VAT rates in force in the base-year to the flows expressed in the prices of the base-year. Any change in the rate of VAT for the current year will therefore be reflected in the price index and not in the volume index of non-deductible VAT.

The fraction of deductible VAT in invoiced VAT and hence non-deductible VAT may change:

(a)   either because of a change in the right to deduct VAT, resulting from a change in tax laws or regulations, taking effect with or without a time lag;

(b)   or because of changes in the pattern of uses of the product (e.g. increase in the proportion of uses on which VAT may be deducted).

A change in the amount of deductible VAT resulting from a change in the right to deduct VAT will by the method described be treated as a change in the taxation price, as will a change in the rate of invoiced VAT.

On the other hand, a change in the amount of deductible VAT resulting from a change in the pattern of uses of the product constitutes a change in the volume of deductible VAT to be reflected in the index of the volume of VAT on products.

Consumption of fixed capital

10.53.   The calculation of volume measures of the consumption of fixed capital poses few problems when good data on the composition of the stock of fixed capital goods are available. The perpetual inventory method, used by most countries, already implies, for the estimation of the consumption of fixed capital at current prices, the need to pass via a calculation of the stock of fixed capital goods at constant prices. To go from

a valuation at historic cost to one at replacement cost, it is first necessary to value capital goods acquired over a number of different periods on a homogeneous basis, i.e. base-year prices. The price and volume indices derived in the process can therefore be used to calculate the value of the consumption of fixed capital at constant prices and the associated price index.

Where there is no perpetual inventory of the stock of fixed capital goods, the change in the consumption of fixed capital at constant prices can be obtained by deflating the current price data by price indices derived from data on gross fixed capital formation by product. Account has then to be taken of the age structure of the capital goods acquired.

Compensation of employees

10.54.   For the purpose of measuring the volume of input from employee labour, the quantity unit for compensation of employees may be considered to be an hour's work of a given type and level of skill. As with goods and services, different qualities of work must be recognized and quantity relatives calculated for each separate type of work. The price associated with each type of work is the compensation paid per hour, which may vary, of course, between different types of work. A volume measure of work done may be calculated as a weighted average of the quantity relatives for different kinds of work, weighted by the values of compensation of employees in the previous year or fixed base year. Alternatively, a wage rate index may be calculated for work by calculating a weighted average of the proportionate changes in hourly rates of compensation for different types of work, again using compensation of employees as weights. If a Laspeyres-type volume index is calculated indirectly by deflating the changes in compensation of employees at current values by an index of the average change in hourly compensation, the latter should be a Paasche-type index.

10.55.   For the purpose of measuring the real purchasing power of compensation of employees, this flow can be deflated by an index reflecting the uses made of these earnings. The price index normally chosen for this purpose is the implicit deflator for individual consumption expenditure or the consumer price index.

Stocks of produced fixed assets and inventories

10.56.   Constant-price data are needed both for stocks of produced fixed assets and for inventories. For the former, such data as are necessary for the calculation of capital output ratios are available if use is made of the perpetual inventory method. In other cases information on the values of stocks of assets may be collected from producers and deflation made by the price indices used for fixed capital formation, taking into account the age structure of stocks.

Changes in inventories are measured by the value of entries into inventories less the value of withdrawals from inventories, and the value of any recurrent losses of goods held in inventories during a given period. Constant-price estimates can be derived by the deflation of these components. When changes in the volume and the prices of inventories are fairly regular, estimates of changes in inventories can also be obtained by multiplying the volume change of inventories by average prices for the current year or the base year. As a second alternative and as a cross-check, estimates of changes in inventories can also be obtained as the difference between stocks of inventories held at the end and the beginning of the period, respectively. For this purpose the value of inventories minus revaluation according to the accounts of producers has to be revalued and expressed at the average prices, either relating to the current year or to the base-year. If they refer to the current year, the value measures the volume changes in inventories at current prices. If the average prices refer to a base-year, the value corresponds to volume changes in inventories at base-year prices.

Measures of real income for the total economy

10.57. It is not possible to divide income flows into a price and a quantity component and for this reason price and volume measures cannot be defined in the same way as for the flows and stocks described earlier. Income flows can be measured in real terms only if one chooses some selected basket of goods and services on which the income is typically spent and uses the price index for this basket as a deflator of current incomes. The choice is always arbitrary in the sense that income is seldom spent specifically for purchases during the period in question. Some of it may be saved for purchases in later periods or, alternatively, the purchases during the period may be partly financed from savings made earlier.

10.58. Gross domestic product at constant prices measures the total production (less the intermediate consumption) in volume terms for the total economy. The total real income of residents is influenced not only by this volume of production but also by the rate at which exports can be traded against imports from the rest of the world. If the terms of trade improve, fewer exports are needed to pay for a given volume of imports, so that at a given level of domestic production goods and services can be reallocated from exports to consumption or capital formation.

10.59. The real gross domestic income can be derived by adding the so-called trading gain to volume figures on gross domestic product. The trading gain — or, as the case may be, loss — is defined as:

$$T = \frac{X \cdot M}{P} - \left[\frac{X}{P} x - \frac{M}{P} m \right]$$

i.e. the current balance of exports less imports, deflated by a price index P, less the difference between the deflated value of exports and the deflated value of imports. The choice of an appropriate deflator P for the current trade balances should be left to the statistical authorities in a country, taking account of the particular circumstances of that country. In the circumstances in which there is uncertainty about the choice of deflator an average of the import and the export price indices is likely to provide a suitable deflator.

10.60. Various real income aggregates are identified and defined in the way shown in the following.

Gross domestic product at constant prices	
plus	the trading gain or loss from changes in the terms of trade
equals	real gross domestic income
plus	real primary incomes receivable from abroad
minus	real primary incomes payable to abroad
equals	real gross national income
plus	real current transfers receivable from abroad
minus	real current transfers payable to abroad
equals	real gross national disposable income
minus	consumption of fixed capital at constant prices
equals	real net national disposable income.

To be able to express the various national income aggregates in real terms, it is recommended that receivables and payables of primary incomes and transfers from and to abroad should be deflated with an index of gross domestic final expenditure. Real national disposable income is to be expressed on a net basis by deducting from its gross value the consumption of fixed capital at constant prices.

CHOICE OF INDEX NUMBER FORMULAE AND THE BASE YEAR

10.61. The construction of an integrated system of price and volume indices entails a deliberate choice as to the types of indices to be used.

10.62. The preferred measure of year-to-year changes in volume is a Fisher volume index which is defined as the geometric mean of the Laspeyres and the Paasche indices. Changes in volume over longer periods are obtained by chaining, i.e. by cumulating the year-to-year volume movements.

10.63. The preferred measure of year-to-year changes in prices is a Fisher price index. Price changes over long periods are obtained by chaining the year-to-year price movements.

10.64. Chain indices that use Laspeyres volume indices to measure changes in volume and Paasche price indices to measure year-to-year price movements provide acceptable alternatives to Fisher indices.

10.65. Although the preferred measure of volume and price is a chain index, it must be recognized that the lack of additive consistency can be a serious disadvantage for many types of analysis.

An aggregate is defined as the sum of its components. Additivity requires this identity to be preserved when the values of both an aggregate and its components in some reference period are extrapolated over time using a set of volume index numbers.

10.66. It is therefore recommended that disaggregated constant price data, i.e. direct valuation of current quantities at base-year prices, are compiled in addition to the chain indices for the main aggregates.

Estimating accounts data in constant prices has to be done at the finest level of detail possible if the data are to be consistent within the framework of an integrated system of price and volume measures. The supply and use tables form the central, conceptual and statistical framework for all the measures at constant prices. Additional data are found in supplementary tables.

Constant price series have nevertheless to be rebased in the course of time. The ESA has adopted the principle of changing the base year every five years as from 1995. When the base year is changed it is customary to link the data on the old base to the date on the new base rather than to carry the rebasing backwards. When the base year is updated additivity is lost as a result of linking.

10.67. When base-year values are extrapolated by chain volume indices, it will have to be explained to users why there is no additivity in the tables.

The non-additive 'constant price' data is published without any adjustment. This method is transparent and indicates to users the extent of the problem.

This does not preclude the possibility that there may be circumstances in which compilers may judge it preferable to eliminate the discrepancies in order to improve the overall consistency of the data.

INTERSPATIAL PRICE AND VOLUME INDICES

10.68.   Comparisons of prices and volumes between countries have to overcome the difficulty in comparing different national currencies. Since exchange rates are not sufficiently stable for this purpose and do not reflect differences in purchasing power in a correct way, it is necessary to use a methodology similar to the one used for intertemporal comparisons between different periods within a single country. Price and volume indices have therefore to be compiled between pairs of countries, applying the same kinds of index number formulae as when measuring changes between time periods. Either of the two countries A and B can be used to give the weights and, viewed from the angle of country A, a Laspeyres-type index with weights from country A can be calculated as well as a Paasche-type using weights from country B.

10.69.   If the economies of the two countries differ much from one another, the spread between these two indices may be quite large and the results would depend too much on which one is chosen. For binary comparisons the ESA therefore requires an average between the two, in the form of a Fisher index.

10.70.   Direct quantitative comparisons between economic situations that have little in common with each other are inherently difficult and the method of deflation of current values with price indices is therefore the best alternative. This applies even more in international than in intertemporal comparisons. By careful specification and identification of products, price relatives can be calculated from information collected in price surveys in each country. As prices are quoted in national currencies, the interpretation of the price relatives introduces the concept of purchasing power parity (PPP). For a given product the PPP between two currencies of countries A and B is defined as the number of units of country B's currency that are needed in country B to purchase the same quantity of the product as one unit of country A's currency will purchase in country A. PPPs for groups of products and successively higher levels of aggregation up to GDP are obtained by weighting PPPs for products by their share in expenditure. In order to arrive at a price level index between the two countries, the PPP index has to be divided by the current exchange rate between the two currencies concerned.

10.71.   For non-market services, international comparisons face the same problem as intertemporal comparisons. This means that outputs are measured as the sum of inputs. The method used at present in interspatial comparisons is to obtain PPPs on the basis of price relatives for important elements in these inputs. This method, which implies volume comparisons of inputs, fails to take into account differences in productivity in non-market service production in the countries compared. It is important, therefore, to develop methods which instead lead to comparisons of the volume of output of non-market services. This should in principle be feasible for individual non-market services, in the same general way as when intertemporal comparisons are concerned.

10.72.   The need to make international comparisons of prices and volumes between countries is recognized in the ESA. The main objective is volume comparisons of GDP and its uses and the condition of transitivity must be met. Transitivity means that the direct index for country C based on country A is equal to the indirect index obtained by multiplying the direct index for country B based on country A by the direct index for country C based on country B.

10.73.   The approach adopted in the ESA to the calculation of a set of multilateral volume measures and PPPs is to start from binary comparisons between all possible pairs of countries considered. The Fisher indices used for this purpose are not transitive, but it is possible to derive from them a set of transitive indices that resemble the original Fisher indices as closely as possible, using the traditional criterion of least squares for

this purpose. Minimising the deviations between the original Fisher indices and the desired transitive indices leads to the so-called EKS formula.

10.74.   The EKS index utilizes all the indirect indices linking country i to country k as well as the direct index between them. Between countries i and k it is the geometric mean of the direct index between i and k and every possible indirect index connecting countries i and k. The direct index is given twice the weight of each indirect index. Transitivity is achieved by involving every other country in the EKS index for any given pair of countries.

Changes to legislation:
There are outstanding changes not yet made to Council Regulation (EC) No 2223/96. Any changes that have already been made to the legislation appear in the content and are referenced with annotations.
View outstanding changes

Changes and effects yet to be applied to :
–   Regulation revoked by S.I. 2021/1300 Sch. 1 para. 13