

Measuring GDP E in volume terms

Foreword

The following guidelines are based on the Eurostat guide “Building the System of National Accounts – volume measures”. The Eurostat guide has been reduced to omit material which is not relevant to the economies in the CARICOM region, and the text has been edited to make it accessible to all members of national accounts production teams in the National Statistical Offices (NSOs) of CARICOM. The material has also been reduced where the technical issues require a treatment beyond the scope of a set of guidelines.

1. Introduction

1.1 Volume measures enable analysis of real growth over time to be carried out. It can answer questions such as “how is GDP growing this year compared to previous years?”. In order to measure real change, the value changes for economic aggregates need to be split between those changes arising solely from changes in price and those from volume changes. In other words, we must strip the effect of inflation out of the value changes.

2 The main uses of price and volume measures (or constant price estimates) in SNA are the following:

2.1 Analyse the general economic growth

Volume measures of national accounts indicators enable analysis of the long term development of the economy. It is usual to present the growth of an economy based on aggregated indicators such as GDP, but national accounts also provide important measures of final consumption, international trade and investment which should also be considered in the analysis of volume change.

Important changes in the structure of the economy are best analysed in the framework offered by the accounts in constant prices. Data in constant prices are required not only to measure the way whole-economy production increases, but also to estimate the growth of specific industries and sectors of final demand.

2.2 Analyse economic cycle

Presenting the long-term movements which accompany the changes in economic growth, the accounts in constant prices serve to record and analyse economic cycles. The fluctuations of economic activity are important information for a market economy. Moreover, besides the recording of the economic cycle, it is necessary to analyse the causal factors, based on decomposition, as completely as possible. These causal factors are provided by the detail of the national accounts in constant prices. Data and amplitude of cyclic movements of various aggregates such as capital formation, exports and final consumption, etc. can be analysed for interdependence. The compilation of quarterly accounts in constant prices along with the annual ones is most useful in analysing cyclical changes.

The changes in private consumption or total consumption of the population recorded in constant prices are used extensively to measure changes in living conditions. It is possible to decompose

aggregates and to analyse the real consumption of particular goods and services such as, for example, food, housing, education, etc., or general expenses by household or inhabitant. This information indicates changes in welfare level.

3. Conceptual background

3.1 The changes in the values of flows of goods and services can be directly factored into two components, one reflecting changes in the prices of the goods and services concerned, and the other, the changes in their volumes.

3.2 Changes in value can be broken down into price and volume components only for variables that have price and quantity elements. All transactions involving the exchange of goods and services and the levels of stocks of non-financial assets have this characteristic, but income flows and financial assets and liabilities do not. Some balancing items have this characteristic but others do not and so they need to be considered individually.

3.3 Price and volume measures should be made within an integrated system of price and volume indices. An integrated system of volume measures must meet three requirements:

- a. The goods and services account must be balanced for two successive years both in current and constant prices when the values of the second year are expressed in terms of the prices of the first year;
- b. In this case, each flow at the level of the total economy must be equal to the sum of the corresponding flow of the various industries at current and constant prices
- c. Each change in the value of a transaction must be due to either a change in price or a change in volume, or a combination of the two.

3.4 The value of a homogeneous product is defined by:

Value is equal to price multiplied by quantity

$$v = p \times q \quad (1).$$

For example, where chicken is sold by weight, the value of a piece of chicken is the weight in kilos of the piece multiplied by the price per kilo

4. Periods

An important issue in volume measure is the choice of the base year. The SNA favours the use of a moving base year. In practice, this means that movements between two years will be measured in volume terms when the prices of the first year are applied to the second year. The advantages of this are as follows:

- 4.1 An up-to-date price-weighting scheme provides better estimates of aggregate growth rates by reflecting more closely the relative importance of the components of the price index used to remove the effects of inflation;
- 4.2 introduction of new goods or disappearance of old ones is simplified;
- 4.3 no burdensome one-off rebasing of time series – the rebasing is continuous

5. Base year

A base year is the year for which prices and values are available at the most detailed level as part of a balanced set of national accounts. These values serve as benchmark data to weight different quantities together to obtain a single volume index. The change of a base year affects measures of the real rate of growth, due to the different weights used in applying prices to deflate current values, and in the use of different value weights to produce single measures of volume growth.

7. Reference year

7.1 A reference year is any year selected with which to compare a time-series of estimates. If the volume estimates are in index form, then the reference year is assigned the value 100 and then other periods are measured as an index to reveal the growth relative to the reference year. So if a later year has grown relative to the reference year by 5%, the index associated with the later year is 105.

7.2 There is the need to re-reference (or chain-link) whenever data is calculated with the previous year as the base year and data is to be expressed with respect to a fixed reference year. This system which always uses the previous year as the base year in deriving the growth into the next year, is also known as chain-linking.

8. Example of base year and reference year, and chain linking.

The following table shows an index series of volume growth, where the base year (the benchmark year) is 2010. The weights used in aggregating the components and in the measures of prices over the corresponding period are those of 2010.

Index 2010 = 100 (base year and reference year are both 2010)

Year	2010	2011	2012	2013	2014
Index	100	105	108	112	120

The reference year can be change to 2013 by assigning a value of 100 to that year and then recalculating the other indices so as to preserve the growth rates between each year. So for example, the index for 2014 is calculated as $100 * 120 / 112 = 107.1$.

Index 2013 = 100 (base year 2010, reference year 2013)

Year	2010	2011	2012	2013	2014
Index	89.3	93.8	96.4	100	107.1

If we have enough information to measure the next year in the prices of the previous year (assuming the prices have been constructed by using the underlying changed weights of component for the previous year), we have the following sets of indices

Year	2010	2011	2012	2013	2014
Base 2010	100	105			
Base 2011		100	102		
Base 2012			100	103	
Base 2013				100	106

It is now possible to chain-link the separate indices so that the growth from each base year to next year is preserved, calculating the growth with reference to 2010, as

$$2011 \text{ index} = 105 / 100 * 100 = 105$$

$$2012 \text{ index} = 102 / 100 * 2011 \text{ index} = 102/100 * 105/100*100 = 107.1$$

2013 index = $103 / 100 @ 2012 \text{ index} = 1.03 * 107.1 = 110.3$

2014 index = $106 / 100 * 2013 \text{ index} = 1.06 * 110.3 = 116.9$

So the chain-linked index series with reference year 2010 is given by the table below.

Index 2010 = 100 (annual chain-linking, reference year 2010)

Year	2010	2011	2012	2013	2014
Index	100	105	107.1	110.3	116.9

Where the price weights are not updated between years, but rely on a historic pattern reflecting the value weights of a base year, then no information is added by chain-linking volume indices measured at the most detailed level in the accounts.

And if current values are obtained through a simple updating of the structures and balances underlying the base year of national accounts when supply and use are balanced through a supply-use framework, again there is little information added through annual chain-linking, as the new value weights will largely reflect the structure of the base year.

In this situation, volume estimates can be obtained by “deflating” current values by price indices weighted to base year structures, to obtain Laspeyres style (base weighted) indices reflecting growth from the base year without the need to carry out annual chain-linking.

However, if the accounts are rebalanced each year with significant changes in structure of output and final demand components, then annual chain-linking will ensure that these structural changes are reflected in aggregate indices

9. Index numbers

9.1 The index numbers of interest within the SNA are designed to decompose changes in value aggregates into their overall change in price and overall change in volume components. A price index can be written and calculated as a weighted average of the proportionate changes in the prices of a specified set of goods and services between two periods of time, say a reference period 0 and current period t.

9.2 Similarly, a volume index can be written and calculated as a weighted average of the proportional changes in the volumes of a specified set of goods and services between two periods of time, reference period 0 and current period t.

9.3 The most widely-used in the compilation of volume changes in national accounts are Laspeyres and Paasche indices.

9.4 The Laspeyres indices are weighted with a base period values, so that they give measures of growth into the future, under the assumption that the relative weights remain the same.

The Laspeyres index is given by the general expression

$$L_q = \sum (w_0 \cdot (q_t / q_0)) \quad \text{where } w_0 = v_0 / \sum (v_0) \quad (1)$$

a series of Laspeyres indices created by weighting together according to their relative base year values, indicators of volume growth of the individual products.

$$\begin{aligned} &= \sum (v_0 \cdot (q_t / q_0)) / \sum (v_0) \\ &= \sum (p_0 \cdot q_0) \cdot (q_t / q_0) / \sum (p_0 \cdot q_0) \\ &= \sum (p_0 \cdot q_t) / \sum (p_0 \cdot q_0) \end{aligned} \quad (2)$$

a series obtained by valuing the quantities which occur at time t by the prices observed in the base year 0, expressed relative to the base year value. If this series is not expressed in index form, then this gives rise to a series of values using the prices of the base year – a set of constant price estimates.

$$\begin{aligned} &= \sum (p_0 \cdot (v_t / p_t)) / \sum (v_0) \\ &= \sum (v_t \cdot (p_0 / p_t)) / \sum (v_0) \\ &= \sum (v_t / (p_t / p_0)) / \sum (v_0) \end{aligned} \quad (3)$$

a series of estimates obtained by deflating the current year value by the price deflator, and then converted to index form by expressing it relative to the base year value. This process of stripping out the effect of inflation by dividing product values by the respective price indices is known as deflation.

9.5 Another index form can be obtained by considering the situation from the point of view of the current year. This index, which uses the current year weights, is known as the Paasche index.

9.6 A Paasche index gives the growth from the current year looking back to the old year. So the equivalent growth looking forward from the old year to the current year is the reciprocal of this measure. A bit of mental gymnastics is called for here. Consider the situation where the new year is taken as the reference, and standing here, the backwards growth “into” the base year is now calculated. Then to convert the answer into a growth from the original base year to the new year, the reciprocal must be taken.

$$\text{Paasche} = 1 / L$$

$$\text{where } L = \sum (v_t \cdot (q_0 / q_t)) / \sum (v_t)$$

Note therefore that there is no inherent difference in the index form of the Laspeyres and Paasche indices – it is simply a question of the viewpoint you are taking of growth in the series.

The Paasche index is the appropriate form for prices

$$\begin{aligned} P_t &= \text{sum}(v_t) / \text{sum}(v_t \cdot (p_0/p_t)) \\ &= \text{sum}(p_t \cdot q_t) / \text{sum}(p_0 \cdot q_t) \end{aligned}$$

9.7 Notice that

$$\begin{aligned} L_q * P_t &= \text{sum}(p_0 \cdot q_t) / \text{sum}(p_0 \cdot q_0) * \text{sum}(p_t \cdot q_t) / \text{sum}(p_0 \cdot q_t) \\ &= \text{sum}(p_t \cdot q_t) / \text{sum}(p_0 \cdot q_0) \\ &= V_t / V_0 \end{aligned}$$

and this is the value index.

We note that Laspeyres volume indices and Paasche price indices form a useful pair, in that at aggregate index level,

$$V = P \cdot Q$$

So deflating values at an aggregate level by Paasche style price indices will give Laspeyres volume indices.

9.7 Although we have established that there is no fundamental difference between the Laspeyres and Paasche index form, the practical difference becomes apparent when we establish a time series of indices for a growth or prices series. In the Laplace viewpoint, we remain stationary at one base year and look forward weighting together the different product growth or price changes using the base year weights. For a series of Paasche style views, we have to change the weights each time for the current year to give the change from the reference year in the past.

9.8 In practice, true Paasche price indices are difficult to compile because of the requirement to use current year weights. Often the available price indices will be annual chained Laspeyres – in other words not the current weights for the year, but the weights of the year before are used in weighting together the relative price changes of the goods in the basket. Experience has shown that where there are no dramatic swings in relative prices from year to year, this price index form provides a close approximation to the desired Paasche index form.

10. Principles

The main principles applying to the measurement of price and volume changes are:

- 10.1 Work at the most detailed level of aggregation of products possible. Price and volume changes of non-homogeneous goods should in theory be treated separately, otherwise non-observed changes in relative values of components will generate false measures of aggregates in volume terms.
- 10.2 Volume measures available at the elementary level of aggregation shall be aggregated using the Laspeyres index form (base year weighting). Price measures available at the elementary level of aggregation should in theory be aggregated using the Paasche index form (current weighting). In practice, most price indices are of the form of annual chain-linked Laspeyres indices,. However, given that the working level at which volume estimates are made, where inflation is stripped out of value (deflation) is sufficiently detailed, experience suggests that the resulting estimates are acceptable.
- 10.3 Volume measures derived at the elementary level of aggregation shall be aggregated using weights derived from the previous year.

11. How to measure volume estimates in the SNA

Price and volume measures are of major importance in national accounts, but the principal focus of users is on the growth rates of volume measures, rather than prices. The compilation of national accounts in volume and current value terms reflects this priority. Quantities of different products cannot, however, be aggregated without a certain weighting mechanism. For aggregate products, the term volume is used instead of quantity. The SNA provides a framework on which to construct a system of price and volume indices, which enables a coherent data set to be compiled which maintains consistency between components over time.

There are three basic methods to calculate volume measures in the national accounts:

- 11.1 Quantity revaluation – collect quantity data and revalue it using base year prices. It is essential that homogenous products are identified and measured. In most countries this method is used for agricultural goods and for goods produced for own final use.
- 11.2 Deflation – divide the current price estimate by a price index to calculate the volume index (constant price estimate). Each period current price value is divided by a relevant price index referenced to the reference year of the national accounts. Deflation should be carried out at the most detailed (disaggregated) level possible. Typical prices used are prices of goods as they leave the production site (Producer Price Indices), prices paid by final users reflected in components of the Consumer Price Index (CPI), charge-out rates for some services, and unit values for international trade where no separate price indices are collected. Price indices should in theory be adjusted to take account of quality change, but in practice only the simplest cases are likely to be identified and adjusted for.

11.3 Volume extrapolation – the current value in the base year is updated using a volume index (constructed based on indicators of real inputs or output).

12. With the exception of products showing rapid quality change (e.g. personal computers, internet services, mobile telephone services), deflation can be expected to give more accurate results than volume extrapolation or quantity revaluation, since the variation in relative prices for a product in a particular period are usually less than the variation in relative quantities.

13. Main sources for price and volume measures

The following price indices are the minimum required for deflation:

13.1 Producer price indices (PPIs) which cover both goods and services. PPIs are indices of basic prices in SNA terminology. The most widely-compiled and widely-used is the industrial production price indices. PPIs for services are more difficult to estimate. PPIs are calculated for agriculture products, measuring the change over time of the prices received by farmers for the sale of their products.

13.2 Consumer price indices (CPIs): the price reflects the actual payments by households. It is the SNA purchasers' price, and may also include imputed expenses, such as for owner-occupied housing. In many countries, only transactions in urban areas are considered in the calculation of CPIs, which may not be representative of price changes in rural areas.

13.3 Construction price index which provides measures of price changes in either inputs to, or outputs of construction activity. These are often used as part of a commodity-flow method of estimating the construction element of GCF.

13.4 Import and export price indices: price indices measure the change over time in transaction prices (the market sale price) of goods and services exported from or imported into a country. Those prices are measured c.i.f., including duties, freight and insurance costs. Export prices are measured f.o.b. excluding duties, freight and insurance costs. Where no prices are available, then Unit Value Indices (UVIs) can be used to deflate imports and exports of goods. This measure of price change is sensitive to product mix within the international trade classification.

Other price indices which can be useful are the cost of labour, - the rate of change of compensation of employees, where the unit is typically an hourly or daily rate classified by occupation / employing industry.

14. Final Consumption expenditure

14.1 Final consumption expenditure of households

Final consumption expenditure of households is primarily made up of goods and services purchased in the market but also includes consumption of household production for own final use, such as consumption of goods produced within households for the households' own consumption, the services of owner-occupied dwellings, and goods and services received as income in kind. It does not

include social transfers in kind, intermediate consumption or gross capital formation, acquisitions of non-produced assets, payments to NPISHs, taxes other than taxes on products, or voluntary transfers.

14.2 Methods based on deflation of household expenditure using appropriately detailed CPIs (valued at purchaser prices including expenditure taxes such as VAT) are recommended.

14.3 The volume measure of some specific components of final consumption expenditure of households is estimated as follows:

(a) Consumption of own-produced goods and services is not included in the CPI calculation; the general rule here is that products produced for own-consumption should be valued at the prevailing basic price for equivalent products, or at costs of production if market prices are not available. Where output for own final use is a significant part of total consumption of a certain product, it will be necessary to separately deflate it by a suitable basic price index; otherwise use of the CPI is appropriate.

(b) Goods and services received as income in kind are valued at basic prices if they are produced by the employer, and at market prices if the employer has to purchase them from a third party. If the former types of products are significant, then deflation should be undertaken using a suitable basic price index.

(c) Goods and services purchased abroad by resident households is not included in the CPI calculation, because it covers all purchases made by resident and non-resident households on the economic territory of a country. If purchases abroad by residents represents a significant part of total household consumption, and prices are evolving differently from domestic prices, one method that can be undertaken to deflate the prices is to use the CPI data from countries where the purchases are usually made. Adjusting for exchange rates would imply that the effects of exchange rate movements feed through into prices fully and immediately.

(d) Services of owner-occupied dwellings is a special case of the products for own consumption and represent a high proportion of final consumption of households. The recommended method for deflating this element in national accounts is by a suitable index of actual rent levels.

15. Final consumption expenditure of government and NPISHs

The principles applied in the general government sector and to NPISHs sector are similar. By convention, the final consumption expenditure of general government and NPISHs consists of:

15.1 The value of non-market goods and services produced by government or NPISHs other than own-account capital formation and sales;

15.2 Purchases by general government and NPISHs of goods and services produced by market producers that are supplied, without any transformation, to households as social transfers in kind.

Final consumption expenditure consists of both individual and collective consumption, whose value is measured by convention as the sum of costs.

Final consumption of non-market goods and services in volume measures is usually obtained using the input indicators method (as the output is compiled as sum of costs), by deflating the value of

inputs by suitable deflators. For individual services such as health services and education, the recommended methods are output indicator methods. However, this method can throw up difficulties of interpretation in derived prices, and an acceptable method is by deflation of input costs.

15.3 For social transfers in kind consisting of goods or services purchased by government from the market, deflation is made by suitably detailed CPIs, adjusted for:

- (a) any discounts which the Government may have negotiated directly with suppliers;
- (b) Any contributions which are payable by those receiving the transfers.

16. Gross capital formation

16.1 Gross fixed capital formation

Gross fixed capital formation (GFCF) covers a wide range of products. GFCF can be measured from either the supply or demand side. The supply side approach is commonly used, because of the general availability of necessary data: domestic output less exports plus imports of capital goods, at a detailed level. Where the commodity flow method is used, then the expenditure estimates in volume terms should reflect the supply-side estimates, adjusted for trade margins where this information exists. Normal practice is to assume constant margins.

16.2 The availability of appropriate price indices for GFCF varies considerably between different types of asset:

- (a) For new dwellings CPIs are used, and for new buildings and structures PPIs are used. The costs of ownership transfer should be deflated separately. The current value and volume estimates are derived from separate estimates of the constituent parts, legal fees, transport and installation costs etc.
- (b) For standard products such as machinery and equipment, PPIs are likely to be available but a lot of capital formation is specific to the purchaser and appropriate indices may have to be developed using the best information available. Price indices for equipment vary considerably in their growth rates (such as, for example, the case of computers, whose prices have fallen rapidly year after year, whereas the prices of transport equipment have increased). It is necessary in such cases that the different types of equipment are deflated separately using the matching price indices (or, equivalently, an appropriately weighted Paasche price index is used to deflate the aggregate).
- (c) Software included in GFCF represents, in a large proportion, own-account production; the deflation could be done by choosing between a pseudo-output price index and an input price index, obtained by weighting together price indices of the inputs. In the absence of a better alternative, the most obvious option is to use the price index for custom made software.
- (d) Research and experimental development (R&D) is another activity that is often undertaken on own account. However, given the heterogeneous nature of R&D, the choice for deflation lies between deriving pseudo-output price indices and using input price indices.

16.3 The matter of new products has particular importance in the Gross fixed capital formation. There are two approaches in cases of new products for estimating the price for the previous year:

a) the first supposes that the price of the new product changes like the price of similar products using a price index calculated on the basis of a sample of homogeneous products existing in both successive years;

b) the second is the hedonic method which consists of determining the price of a product on the basis of its main characteristics and the input method which uses the cost of a product to calculate its price

The large range of different products calls for estimating GFCF volume at the detailed product level to ensure good quality estimates. The following list of products is desirable.

- (a) construction products: Dwellings; Other buildings and structures including Buildings other than dwellings, Other structures, Land improvements;
- (b) machinery and equipment: Transport equipment as: Air- craft, Ships, Railway trains and carriages, Other transport equipment; ICT equipment; Other machinery and equip- ment;
- (c) weapons systems;
- (d) cultivated biological assets, e.g. trees and livestock;
- (e) intellectual property products: Research and development; Mineral exploration and evaluation; Computer software and databases; Entertainment, literary and ar- tistic originals; Other intellectual property products. The prices for IPPs are usually based on input cost prices, due to the unique nature of many of the products)

17. Changes in inventories

17.2 The calculation of changes in inventories in volume terms is a challenging task. Changes in inventories can take positive, negative or zero values; in these conditions, a chain index can not be derived directly. Chain volume estimates of changes in inventories should be derived by first deriving chain volume estimates of the opening and closing stocks of inventories and then taking the difference.

17.3 There are four types of inventories: materials and supplies; work-in-progress (includes livestock raised for slaughter); finished goods; and goods for resale. It is important to note that change in inventory represents part of the output and intermediate consumption calculations as follows:

Output = sales + changes of inventory of finished products + change in work-in-progress

Intermediate consumption = purchases - changes of inventory of materials and supplies

For a wholesale or retail trader:

Output = sales - purchases (of goods for resale) + changes of inventory of goods for resale

17.4 Closely related to the calculation of changes in inventories are holding gains. Holding gains are the results of price changes during the period for which the inventory is held. Such gains are not part of output. Holding gains can be negative, in which case they are called holding losses. If there are no price changes during the accounting period, the holding gain is zero. Holding gains can be calculated using the following identity:

Value of inventory at end of accounting period

- value of inventory at beginning of accounting period

= change in inventory + holding gains (10)

17.5 The price indices should be in accordance with the four kinds of inventories, by products:

- (a) for inventories of finished products: PPIs at basic prices;
- (b) for inventories of materials and supplies, similar indices as used for intermediate consumption (genuine intermediate consumption prices, or PPIs adjusted to purchasers' prices);
- (c) for inventories of goods for resale: PPI (for retailers, strictly speaking, a PPI should be adjusted for wholesale trade margins);
- (d) for works-in-progress: deflation carried out in a consistent way with the deflation of output, i.e. with output price indices at basic prices.

18. Imports and exports

18.1 Exports and imports consist of both goods and services, valued when change of ownership between a resident unit and a non-resident owner takes place and include or exclude transportation costs according to whether the supplier does or does not include transportation to the purchaser in the amount charged.

18.2 Foreign transport and insurance services between the importer's and the exporter's frontiers should not be included in the value of goods, but recorded as services. However, it is not always possible to obtain f.o.b. values at the detailed product level and details of foreign trade are then shown valued at the importer's frontier. In this case, all transport and insurance services to the importer's frontier are included in the value of imports, referred to as cost, insurance and freight (CIF). This is the valuation used for imports in the supply and use tables. Where the price of exports and imports includes an element of transport or insurance service, these should be dealt with in the price and volume measures.

18.3 A good estimation of import and export volume implies considering goods and services separately.

There are a number of methods suitable for goods volume estimation such as:

- a) Actual export and import prices

Export and import price indices can be compiled based on the prices actually charged by exporters of goods (exports), or paid by consumers (imports). The main advantage is that they cope better with the problem of heterogeneous products as the price index is constructed to reflect a fixed specification that allows price effects to be isolated and quality changes to be controlled.

Disadvantages are

- (i) they are costly to produce and represent a burden on respondents;

- (ii) they can have an incomplete coverage of the actual exports and imports of products to which they are applied as deflators;
- (iii) (price indices may also reflect inadequately the actual prices paid by purchasers. The price indices are compiled using data from surveyed establishments on the prices of representative items exported and imported. The surveyed prices will be of items that are defined according to detailed specifications so that the change in price of the same item specification can be measured over time

b) Unit value indices (UVIs)

UVIs are readily available from trade statistics being derived as the ratio of value to volume (weight or quantity). They do not generally control for changes in the product mix within one item, leading to quality changes mistakenly included in the price component. Their coverage of products is generally complete, but even at the most detailed level of trade classification they can often include a range of different products and there is no still homogeneity. It may be possible to construct more homogeneous UVIs if the country of origin (or destination) is also taken into account. UVIs are clearly unsuitable for products that are unique or change quickly in specification.

c) It could be also a mixed approach that involves compiling establishment survey-based price indices for some product groups and customs-based unit value indices for others.

19. Adjusted PPIs

It is possible to use domestic PPIs to deflate current price estimates for exports and imports in the same way that actual export and import prices may be used. PPIs reflect prices on the domestic market and may not be a good reflection of the prices charged for exports or imports in some circumstances, where competition between domestic producers and imports exists. However, there may be little difference between domestic prices and those of imports or exports where these compete directly with each other in the market. In these conditions, the use of PPIs for exports or imports may be acceptable.

20. Export prices of a foreign country

20.1 The export prices from a foreign country are used to deflate imports, broken down by product group and country (a process necessary to make best use of this method). This approach is most suited to unique products of a specialised nature. Adjustments may be done:

- (a) by accounting for exchange rate movements, on the assumption that movements in exchange rates impact directly and immediately on the price of the imports;
- (b) by taking account of other factors that affect prices between the exporting and importing countries, such as transport margins.

21. Exports and imports of services consist of a large range of different services. The current data sources for price indices for international trade in services are less comprehensive than in other areas, and methods to estimate price and volume are less well developed.

21.1 If actual prices are available for exports and imports of services, they can be readily used to derive the required volume estimates. If they are not, methods for exports and imports of services should be guided by those recommendations for similar domestically produced or consumed

services. Methods to be used for domestically produced services are, in general, the same as those used for market output of services: charge-out rates, output indicator methods, input indicator methods. For example:

- a) volume estimates of freight transport services could be derived using PPIs according to the form of transport;
- b) volume estimates of accommodation services could be derived using the appropriate CPIs;
- c) for other imported services, price indices of the countries exporting the services, adjusted for changes in the exchange rate, may have to be used.

21.2 Actual price indices are the preferred method for deflation. For exports and imports, these prices need to reflect the actual prices charged in the case of exports and the prices paid for imports. These prices will differ from those in the domestic market because of exchange rate influences and potentially different pricing policies in the case of domestic and export sales. A further difficulty associated with the collection of export and import prices is the identification of the sampling frame necessary for the collection of prices.