

## **Price and volume measures in national accounts - Resources**

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## **A/B/C METHODS BY TRANSACTION CATEGORY (1)**

### **Market output and output for own final use**

“Output for own final use is to be valued at the basic prices of similar products sold on the market”. Therefore, the principles for deflation of output for own final use are the same as for market output of similar products.

To deflate total output of a branch, its output should first be classified into the various (primary and secondary) products produced, as is done in a supply table. Each product should then be separately deflated by an appropriate procedure



## **A/B/C METHODS BY TRANSACTION CATEGORY (2) - Price deflation methods**

### **Market output**

Methods based on the construction of a price index (PPIs).

The term PPI will be used exclusively for an index of the price change of output of a product. Output includes both domestic uses and exports.

The standard PPI compilation method is to observe the price of a sample of representative products produced by a local kind-of-activity unit or enterprise over time.

The observed price changes are weighted by the shares these units or enterprises represent in the total output of the product.

Indices for aggregate product categories (or industries) are derived by weighting with shares of the individual products in the value of total output (often national accounts data).

This standard method is well established for manufacturing products, but data for many services remain scarce.



## **A/B/C METHODS BY TRANSACTION CATEGORY (3) - Price deflation methods**

### **Market output**

Deflation by PPIs can normally be considered to be the preferred method, since they directly measure product prices, and quality changes can be taken into account. However, PPI compilation requires specific surveys, which can be expensive and difficult to organise, especially for services.

PPIs are often compiled as Laspeyres price indices. As in national accounts Paasche price indices should be used. At the "elementary level of aggregation", the assumption is made that the indices are elementary indices, i.e. that Paasche and Laspeyres indices give the same result.

**Clearly, the more detailed the level of aggregation, the more plausible this assumption is.**



## **A/B/C METHODS BY TRANSACTION CATEGORY (4) - Price deflation methods**

### **Market output**

PPIs are usually compiled as monthly or quarterly indices.

To deflate annual data with PPIs it is therefore necessary to take the structure of the flow through the year into account.

If the volume of products produced is reasonably constant during the year, a simple average of monthly or quarterly indices can suffice. If, however, there are large fluctuations in the volume through the year, the subannual

indices should be weighted by the volumes in each month or quarter concerned. Monthly information might be difficult to gather in practice though.



## **A/B/C METHODS BY TRANSACTION CATEGORY (5) - Price deflation methods**

### **Market output**

#### **Consumer price indices (CPIs)**

CPIs are compiled for almost all goods and services consumed by households.

If CPIs are to be used to deflate output (rather than household consumption), it has to be considered that business consumption and exports can differ significantly from household consumption in both mix of products and price changes.

The appropriateness of using CPI information to deflate output depends therefore on the share of household consumption in total output and on the difference in price changes and composition between intermediate use and final use of the product group in question.



## A/B/C METHODS BY TRANSACTION CATEGORY (6) - Price deflation methods

### Market output

#### Consumer price indices (CPIs)

CPIs normally measure the change in the purchasers' price of a product rather than the basic price, and therefore have to be adjusted to The adjustment has to take account of changes in trade and transport margins, and changes in the rates of taxes and subsidies on products. For example:

	Purchasers' price	Taxes on products	Trade margin	Basic price
Year T - 1	17	2 (rate 20%)	5 (rate 50%)	10
Year T	19	3 (rate 30%)	6 (rate 60%)	10

In the example, the change in the purchasers' price is entirely due to changes in the tax rate and the margin rate.



## A/B/C METHODS BY TRANSACTION CATEGORY (7) - Price deflation methods

### Market output

#### Consumer price indices (CPIs)

Obviously, if no distribution margins exist, no changes in tax or subsidy rates occur, and if households consume all output, then a CPI becomes fully equivalent to a PPI.

***This can for example be the case for personal services.***

For CPIs the same Laspeyres/Paasche issue exists as for PPIs (see above). Also, the same principles apply regarding weighting infra-annual changes.



## **A/B/C METHODS BY TRANSACTION CATEGORY (8) - Price deflation methods**

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### **Market output**

#### **Unit values**

Unit values are derived by dividing value information by quantity information

Deflating a value of output in current prices by a unit value index implies using the underlying quantities as the indicator. For these indicators, the same remarks are valid as those made for output volume indicators below.

#### **Input prices**

One could take prices of inputs (e.g. the price of labour or a weighted average of prices of intermediate inputs) as an approximation for the price of the output. However, if the output would have a different path than the input, e.g. due to productivity changes, this method would have a clear bias. These methods should be avoided.



## **A/B/C METHODS BY TRANSACTION CATEGORY (9) - Volume extrapolation methods**

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### **Market output**

In these methods indicators are collected that describe the trends in the volume of output directly.

Volume indices are constructed and applied to the value of output in the base year to arrive at the volume of output in the current year.

Output volume indicators In situations where price measurement does not seem possible or feasible, the direct measurement of the volume of output can be considered. This can be the case, for example, for service areas where consumers are implicitly charged for services provided, such as in banking and insurance.



## **A/B/C METHODS BY TRANSACTION CATEGORY (10) - Volume extrapolation methods**

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### **Market output**

In general there are major disadvantages of volume indicators relative to price indices. To overcome these disadvantages, volume indicators should:

- be collected at a very detailed level, so as to distinguish homogeneous products that do not change over time, and
- be representative for all outputs in question.

## **A/B/C METHODS BY TRANSACTION CATEGORY (11) - Volume extrapolation methods**

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### **Market output**

The use of output volume indicators might also be necessary in cases of high inflation. When prices change very rapidly, price indices become increasingly unreliable. To describe the real economic developments in such situations volume indicators might give better results. For a more elaborate discussion on high inflation see "Inflation Accounting: A Manual on National Accounting Under Conditions of High Inflation", published by the OECD in 1996..

## **A/B/C METHODS BY TRANSACTION CATEGORY (12) - Volume extrapolation methods**

### **Market output**

### **Input volume indicators**

In these methods, indicators on the volume of inputs (e.g. the number of employees or the volume change of intermediate inputs) are used to approximate the volume of output. The use of such methods means that the resulting data are biased when productivity changes occur. As for input price methods, these methods should be avoided.



## **A/B/C METHODS BY TRANSACTION CATEGORY (12) - A general classification of methods for measuring prices and volumes of market output**

### **A method:**

In principle, using appropriate PPIs will be an A method. An appropriate PPI satisfies the following criteria, based on the following general criteria:

- it is an index of the (domestic and export) price(s) of the output of exactly that (group of) product(s);
- it takes account of changes in quality of the product(s);
- it is valued at basic prices;
- its underlying concepts are consistent with the national accounts concepts.

Any method that can be shown to be fully equivalent to the use of PPIs can also be seen as an A method. This could for example be a CPI for a service that is only used by households. Or it could be output volume indicators that are fully representative, available on a detailed level and quality-adjusted.



## A/B/C METHODS BY TRANSACTION

### CATEGORY (13) - A general classification of methods for measuring prices and volumes of market output

#### B methods:

If an appropriate PPI is not available, several alternative types of indicators exist. For example the following will usually be B methods:

- a less appropriate PPI, e.g. an index without quality adjustments, or having a smaller or larger coverage than the product heading;
- a Consumer Price Index (CPI). The same three criteria as for PPIs apply (CPIs will normally have to be corrected for taxes, subsidies and margins in order to obtain valuation in basic prices), and in addition the weighting should be appropriate and the concepts should correspond to national accounting concepts;
- output volume indicators that are not fully representative, lack quality-adjustments or are lacking sufficient detail.

Such indicators do not in general respect all four of the criteria for A methods.



## A/B/C METHODS BY TRANSACTION

### CATEGORY (14) - A general classification of methods for measuring prices and volumes of market output

#### C methods:

The use of some other possible indicators, as follows, will usually be C methods.

- input methods (both input prices and input volume indicators);
- secondary indicators, i.e. indicators not directly related to the output;
- PPIs, CPIs or volume indicators that do not correspond at all with the product(s) in question, e.g. the overall CPI.

Such indicators will, in general, fall a long way short of respecting the four criteria, much more so than the B methods do.





## **A/B/C METHODS BY TRANSACTION CATEGORY (15) - non-market output**

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The total value of output of a non-market producer is defined by convention as the total costs of production (i.e. the operating surplus is assumed to be zero). In the case of a local KAU with secondary market output, non-market output is defined as a residual item, i.e. as the difference between the total costs of production minus the revenues from market output.

It is important to note that this valuation principle (calculating current price output as sum of costs) is applied to the producer rather than the product.

Non-market producers are either public producers or non-profit institutions, classified in the sectors government or NPISH respectively.

## **A/B/C METHODS BY TRANSACTION CATEGORY (16) - non-market output**

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The problem of measuring prices and volumes for non-market output arises from the fact that by definition no market prices exist (this implies that the value of output is defined as the sum of costs).

There are only two options for constant price measurement: deflating inputs and direct volume measurement.

Current practice for constant prices is mostly based on deflating inputs. This implies assuming that the change in the volume of inputs is representative for the change in the volume of output.

However, it is not at all certain that more or better inputs lead automatically to more or better output. Using this assumption makes it impossible to analyse changes in productivity, and will wrongly estimate the true output change if this is different from the change in inputs.

## A/B/C METHODS BY TRANSACTION CATEGORY (17) - non-market output

Volume indicators can relate to:

### **Inputs,**

for example the number of employees. This would simply assume that twice as large a public service would mean twice as much output, irrespective of how those additional personnel were deployed. The advantage of the method is the ease of implementation, and the ready availability of data. This method however ignores all changes in productivity.

Even if input methods are not perfect, they could at least be the basis for comparable estimates for the Member States

## A/B/C METHODS BY TRANSACTION CATEGORY (18) - non-market output

Volume indicators can relate to:

### **Activity,**

for example number of operations in hospitals or number of patrols carried out by the police.

Activity indicators reflect what the non-market units are actually doing with their inputs and are therefore closer to output.

However, suppose for example that new improved forms of medical treatment reduce the number of operations necessary. Taking the number of operations as an indicator would imply a decrease of output and productivity, which does not seem appropriate in this case.

Using activity indicators often does not lead to reasonable productivity numbers. However, for some collective services, activity indicators may be the only indicators that can be found.

## A/B/C METHODS BY TRANSACTION CATEGORY (19) - non-market output

Volume indicators can relate to:

### ***Output,***

the preferred approach. However, it is not always easy to define exactly what the unit of output is.

For individual goods and services it is in principle possible to define the output, since an actual delivery of that output takes place from the producer to the consumer(s).

For example, for education, the output is the amount of teaching consumed by a pupil. For hospital services, the output is the amount of care received by a patient. For cultural services, the output is the number of theatre plays consumed.

## A/B/C METHODS BY TRANSACTION CATEGORY (20) - non-market output

Volume indicators can relate to:

### ***Outcome,***

for example indicators of the level of education of the population, life expectancy, or level of crime.

Such indicators might be influenced by factors that are unrelated to the activity, and therefore are generally not representative of the output. In some cases, however, outcome indicators can be used as indicators for the quality of the output

## **A/B/C METHODS BY TRANSACTION CATEGORY (21) - non-market output**

### **A, B and C methods”**

#### ***Individual services***

For individual services, the only methods that will be able to meet the criteria for A or B are methods that measure output.

Input methods are C methods. If the level of detail could be improved or if they do not take changes in quality into account, the method becomes a B method.

If a volume indicator method does not really measure output but rather input, activity or outcome (unless outcome can be interpreted as quality-adjusted output), and/or if the coverage of the output is not representative, this method is a C method.

## **A/B/C METHODS BY TRANSACTION CATEGORY (22) - non-market output**

### **A, B and C methods”**

#### ***Collective services***

For collective services, the classification of methods is broadly the same as for individual services, with two important exceptions that are due to the difficulty in defining the output of collective services:

- input methods are B methods for collective services;
- the use of volume indicators of activity is a B method.

The use of a single input volume indicator is not a B method: if input methods are used, they should estimate the volume of each input separately, taking quality changes of the inputs into account.

Applying productivity or quality adjustments to the sum of the volume of inputs is not recommended. Such adjustments contribute neither to the quality of the results nor to their comparability.

## **A/B/C METHODS BY TRANSACTION CATEGORY (23) – Intermediate consumption**

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Intermediate consumption includes the value of goods and services consumed as inputs by a production process (excluding the use of fixed assets).

Deflating intermediate consumption is necessary when double deflation is used to measure value added in constant prices, or more generally when price and volume measures are estimated in a system of supply and use tables.

Intermediate consumption consists of the use of domestically produced products and imported products. For both parts different price indices should be used, unless it can be assumed that the price changes of domestic output and imports are similar.



## **A/B/C METHODS BY TRANSACTION CATEGORY (24) – Intermediate consumption**

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Intermediate consumption should be deflated product-by-product.

This requires first of all a breakdown by product of intermediate consumption in current prices.

This breakdown can be made in the use table.

The advantage of employing the use table for this purpose is that intermediate consumption of all branches is described in the same product classification, so that the various deflators used for a particular product can be compared systematically.

The total volume of intermediate consumption for each individual branch is derived by adding up the volumes of inputs of all products (this of course only works in a Laspeyres volume framework because this is additive).



## **A/B/C METHODS BY TRANSACTION CATEGORY (25) – Intermediate consumption**

Ideally, genuine price data on intermediate uses, collected from the purchasers (and reflecting purchasers' prices), should be used to deflate.

Such data is rarely collected however.

As an alternative, intermediate consumption of domestically produced products can be deflated using the same methods as described in chapter 4 for the output of that product, taking into account that intermediate consumption is valued at purchasers' prices (i.e. adding back changes in taxes and subsidies on products where appropriate). In doing so, differences in prices for different users should be taken into account. An example is electricity, for which large price discrimination can exist between different user branches.

Intermediate use of imported products should be deflated by import price indices



## **A/B/C METHODS BY TRANSACTION CATEGORY (26) – Intermediate consumption**

A, B and C methods

An A method for deflating intermediate consumption satisfies the following criteria:

- Deflation takes place product-by-product;
- Domestically produced products and imported products are deflated separately;
- Either genuine price data on intermediate consumption are used, or, for domestically produced products, the A methods described in chapter 4 (taking into account the different valuation basis) and for imported products the A methods described in section 3.8;

B methods may fail to distinguish between domestic produce and imports, or they use methods that are classified as B methods in chapter 4 or section 3.8.

If intermediate consumption is deflated at the aggregate level, without product detail, this is a C method.



## **A/B/C METHODS BY TRANSACTION CATEGORY (27) – value added**

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Value added at current prices is defined as the difference between output (at basic prices) and intermediate consumption (at purchasers' prices). Value added is therefore a balancing item in the system of national accounts.

There is conceptually no price or volume component of value added, since it is essentially an income concept.

If GDP volume growth is calculated according to the production approach, the value added of all branches is summed (plus taxes less subsidies on products), so that it is necessary to have a measure of value added at constant prices.

## **A/B/C METHODS BY TRANSACTION CATEGORY (28) – value added**

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Value added at constant prices has to be defined by convention as the difference between output and intermediate consumption at constant prices.

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.

## **A/B/C METHODS BY TRANSACTION CATEGORY (29) – value added**

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The alternative is a "single indicator method" in which an output or input indicator is directly applied to value added.

Single indicator methods use either (input or output) price indices to deflate current year value added or (input or output) volume indicators to extrapolate base year value added.

In the first case it is assumed that prices of input and output develop in the same way, in the second case it is assumed that volumes of input and output are changing at the same pace, i.e. the ratio between volumes of input and output is constant.

Single indicator methods are therefore not useful for analyzing input/output ratios, for example for productivity analyses.

## **A/B/C METHODS BY TRANSACTION CATEGORY (30) – value added**

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In practice, double indicator methods can create problems when intermediate consumption is a large share of output and the reliability of the price or volume data is not very high. In such cases, the estimate for the volume of value added can become erratic, and the use of a single indicator might become necessary.



## **A/B/C METHODS BY TRANSACTION CATEGORY (31) – value added**

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A negative value added at constant prices is conceptually possible. Although value added in current prices increased from 50 to 100, the ratio between the volumes of intermediate consumption and output has dropped significantly, showing a large decline in the input/output ratio (18% more input required to produce only 6% more output). At the same time, the prices of the inputs fell, while the price of the output increased.

Whilst these situations may be theoretically conceivable, it can be assumed that this will not happen very often in practice. If data like in the example were found in practice, there is good reason to check if the price and volume indices used are correct.

## **A/B/C METHODS BY TRANSACTION CATEGORY (32) – value added**

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A, B and C methods

The A method for value added is the use of a double indicator method. The indicators used for output and intermediate consumption should follow the guidance given in sections 3.1 and 3.2 and chapter 4.

A single indicator method can be used as a B method if intermediate consumption is a large share of output and the data required to apply a double indicator method are not reliable enough.