

Price and volume measures in national accounts

by

A. Faramondi, S. Pisani

16-20 march 2014



Scope

Price and volume measurement relates to the decomposition of transaction values in current prices into their price and volume components.

The price components should include changes arising solely from price changes, while changes relating to quantity, quality and compositional changes should be included in the volume components.

The aim is to obtain "constant price" measurement, implying the analysis of economic transactions valued at certain fixed prices.



The distinction between price, volume, quantity (1)

Current price accounts can be considered as the aggregation, within an accounting framework, of transactions that took place and can be evidenced.

Constant price accounts describe an economic situation of a particular year in the prices of another year.

The price of a product is defined as the value of one unit of that product

For a single homogeneous product, the value of a transaction (v) is equal to the price per unit of quantity (p) multiplied by the number of units of quantity (q), that is:

$$v = p \times q.$$



The distinction between price, volume, quantity (2)

Quantities of different products cannot be aggregated without a certain weighting mechanism.

For aggregate products, the term volume is used instead of quantity.

Price and volume measures have to be constructed for each aggregate of transactions in products within the accounts, so that:

$$\text{value index} = \text{price index} \times \text{volume index}$$

This means that each and every change in the value must be attributed either to a change in price or to a change in volume or to a combination of the two.



The distinction between price, volume, quantity (3)

Price changes for a given transaction flow can occur only as a result of changes in price for individual products. All other changes should be reflected in changes in volumes.

Products of different quality are sufficiently different to each other to make them readily distinguishable from an economic point of view. However, they are similar enough to be described by the same generic term.

Physical characteristics are the most readily identifiable measure of different qualities. Differences in quality can also be reflected by deliveries in different locations or at different times of the day or at different periods of the year. Differences in the conditions of sale, the circumstances or the environment in which the goods or services are supplied are also aspects of quality.



The distinction between price, volume, quantity (4)

Changes in quality, in a transaction flow, resulting from a shift from or to higher quality products and shifts between markets with different prices should be recorded as changes in volume. The volume index can therefore in principle be broken down into the following changes due to:

- the quantity of the products,
- characteristics of the products,
- compositional changes in an aggregate.



The A/B/C classification

The EUROSTAT handbook describes possible methods that can be used for the estimation of prices and volumes.

They are classified according to their suitability:

A methods: most appropriate methods;

B methods: those methods which can be used in case an A method cannot be applied;

C methods: those methods which shall not be used.



The A/B/C classification (2)

The A/B/C classification is aimed at improvement of current practice. It sets out in what direction improvements can be made.

It is therefore important that the criteria for distinguishing A, B and C methods are absolute criteria, i.e. that they do not depend on the present availability of data.

In this way, it becomes clear where the biggest problems exist in terms of missing data.

It also make clear how far current practice is away from good practice. It may well be that in some cases A methods are difficult to attain in practice.



The A/B/C classification (3)

The classification of methods can differ from product to product. E. g., the use of unit value indices can only be accepted if the products to be deflated are homogeneous.

There can be several A or B methods for one product. Institutional differences between countries may lead to different data sources being available and therefore different applicable methods.

The A/B/C classification shows which methods are considered to give comparable results. It gives the framework for a harmonised approach to improvement of reliability and comparability of price and volume data in national accounts.



Issues that concern all transaction categories and all products

GDP in current prices can be approached from the: output, the expenditure or the income side. In the end there is only one GDP, which should be established by balancing the data from the three approaches.

In constant prices, direct measurement of GDP can be obtained only from the output and expenditure sides.

The income approach cannot be used to measure GDP volume, since one of its components, the operating surplus, cannot be measured directly at constant prices.



Issues that concern all transaction categories and all products (2)

GDP at market prices is equal to

Output at basic prices

-/- intermediate consumption at purchasers' prices
+ sum of taxes minus subsidies on products.

Issues that concern all transaction categories and all products (3)

Following the expenditure approach, GDP can be obtained as:

Final consumption expenditure by households
+ final consumption expenditure by government
+ final consumption expenditure by NPISH
+ gross fixed capital formation
+ changes in inventories
+ acquisitions less disposals of valuables
+ exports of goods and services
-/- imports of goods and services.

Issues that concern all transaction categories and all products (4)

To measure GDP volume, it suffices to breakdown the flows covered by the supply/use framework in price and volume components.

The supply/use system is an excellent framework through which price and volume measures can be established in a consistent and systematic way. This framework is based on two accounting constraints:

Per product: output + imports = intermediate consumption + final consumption expenditure + gross capital formation + exports

Per industry: output = intermediate consumption + gross value added.



Three main principles concerning the measurement of prices and volumes in national accounts (1)

Principle 1. The level of aggregation:

In the measurement of prices and volumes a detailed level of aggregation of products shall be used.

This level of aggregation, which is referred to as the elementary level of aggregation, shall be at least as detailed as the P60 level of ESA 95, for output as well as all categories of (intermediate and final) use.



Three main principles concerning the measurement of prices and volumes in national accounts (2)

Principle 2:

Volume measures available at the elementary level of aggregation shall be aggregated using the **Laspeyres formula** to obtain the volume measures of all national accounts aggregates.

Price measures available at the elementary level of aggregation shall be aggregated using the **Paasche formula** to obtain the price measures of all national accounts aggregates.



Three main principles concerning the measurement of prices and volumes in national accounts (3)

Principle 3:

Volume measures derived at the elementary level of aggregation shall be aggregated using weights derived from the previous year.



Criteria for appropriate price and volume indicators

- There is duality in the measurement of prices and volumes: one can either deflate a current year value with a price index, or alternatively extrapolate a base year value with a volume index to arrive at an estimate in prices of the base year.
- Therefore, only one of the two possible measures is required, and the other can be derived as a residual.
- The two alternative approaches are in practice however not entirely equivalent. Deflation with a price index is generally preferred.



Unit values versus price indices

In some cases, a choice can be made between a 'unit value index' and a price index. Traditionally, unit value indices appear in foreign trade statistics and the discussion on the pros and cons of unit value indices and price indices takes place in the context of deflation of exports and imports.



Unit values versus price indices (2)

A **price index** is based on the observation of prices of a fixed sample of products in two different periods. The reliability of the price index depends to a large extent on how representative the sample is. If the sample misses out a significant portion of the universe of products, and the missing part has a price trend that is significantly different from the sampled part, the resulting price index will be distorted. Also, the sample needs to be kept up-to-date by introducing new products and removing products no longer available in a timely way.



Unit values versus price indices (3)

A 'unit value' is calculated by dividing the total value with the total quantity. It is based on a, usually, exhaustive observation of the total value and the total quantity of a group of products. Comparing this unit value in two different periods gives a unit value index, which can be used as a measure for the price trend.

The problem in this method is the heterogeneity of the products, which can cause a large variability in the index. Furthermore, any changes in the composition of the products can influence the unit value index resulting in a price change although such changes should in fact be included in the volume component.

It is not possible to adjust unit value indices for quality changes in the products in the same way as can be done for price indices.

