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**The previous year's prices supply and use tables: Estonian experience**

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***Abstract***

This paper deals with the Estonian experience in the compilation of the supply and use tables at the prices of the previous year. Statistics Estonia published previous year's prices estimates produced within the detailed supply and use framework since 2010. The established system follows mostly the principles and standards for estimating annual national accounts aggregates in previous year's prices in the European Union. This paper gives an overview of the system (i.e. integration of current, and price and volume data, level of product detail and price information used for deflation, estimation procedures for the main national accounts variables, e.g. double deflation method, balancing). The paper discusses the key principles of the price and volume estimation such as consistency of valuation and consistency in deflation and provides examples of consistent deflation undertaken for domestic output and export sales within output, and for domestic and imported components of intermediate consumption and GFCF. Some further improvement of methods for price and volume estimates of service activities and implementation in practice is discussed.

## **1. Introduction**

The supply and use tables (SUTs) form an integrating part of the Estonian National Accounts. Starting from reference year 2000, the current price SUTs are compiled regularly on an annual basis. The constant price SUTs are compiled since from reference year 2001 and were incorporated into the regular SUTs compilation process in 2010. SUTs in constant prices are compiled by deflating SUTs at current prices.

The final SUT based GDP estimate comes available 36 months after the end of reference year. The product-by-product input-output tables are available on a fifth yearly basis of frequency (2000, 2005, 2010, 2015 etc.).

## **2. General principles of constant price estimation**

A Commission Decision on Constant prices (98/715) specifies three main principles related to the compilation of constant price annual national accounts: (1) the elementary level of aggregation, (2) the choice of index formula, (3) the choice of base year. Of the other principles that price and volume measurement should follow, the key one - the need for the double deflation for the production estimates. Some other important principles are consistency of deflation and consistency in valuation. CD also introduces a classification of methods, defining “good” (A), “acceptable” (B) and “unacceptable” (C) methods. A Commission Decision (2002/990) further clarifies a classification of methods into the most appropriate methods and defines a timetable of implementation of the classifications.

The established system follows mainly the principles and standards for the measurement of constant price data in the European Union.

Constant price estimates are in line with general principles of Commission Decisions:

1. The requirement for the product detail (CPA P64) for deflation of output and all categories of use are achieved;

2. The recommended Laspeyres volume and Paasche price index formulas for national accounts aggregates are used;
3. Chain-linking approach based on the previous year's weights from the SUT is applied;
4. The double deflation within the SUT framework is introduced;
5. Consistency of deflation over the accounts, (i.e. balancing GDP by production and expenditure at constant prices) is achieved;
6. Appropriate consistency in valuation, as between the basis of current price figures and the price series used for deflation is fulfilled.

### **3. Compiling supply and use tables at constant prices of the previous year**

Calculation of the supply and use tables at constant prices of the previous year is closely linked to the calculation of the current price SUTs. The starting point of compilation process is a balanced system of supply and use tables at basic prices for the current (t) and previous (t-1) years. The constant price supply and use figures are calculated by deflating current values by the price indices at the product level. The initial deflation is undertaken at basic prices, including separate deflation for imported and domestic market production components in the use side. The product detail is 161 product groups, that is more highly aggregated level compared to the supply and use tables at current prices (about 250 product groups). Valuation matrices for taxes less subsidies on products, trade and transport margins at constant prices are calculated by applying the rates of the previous year to the volumes at basic prices. This ensures that the supply and use of each product at prices of previous year is balanced both at basic and purchasers' values. SUTs at purchasers' prices in previous years' prices are derived as sum of SUTs at basic prices and the valuation matrices in previous years' prices.

#### **3.1. Deflation of supply of goods and services**

##### **Market output**

In accordance with the methodological recommendations of the Eurostat Handbook and with the legal acts on constant price measurements, the preferred approach for market output is:

- deflation product-by-product;
- separate deflation of domestic and export sales, and of sales and inventories, within output;
- the use of appropriate producer price index (PPI) for each product, which satisfy three criteria: it is an index with quality adjustments, valued at basic prices and consistent with the national accounts concepts.

The quality of the constant price estimates depends much more on the availability and quality of the indices. If appropriate PPI required for deflation is not available, alternative types of indicators are applied, for instance, the consumer price index (CPI) or output volume indicator.

Market output at constant prices is calculated by deflating current year value with the price index or by extrapolating basic year output value by a volume indicator (main example is freight transport). Deflation of market output is performed at the level of 139 product groups (CPA 2008) and 69 activities (NACE Rev.2) that are split up into 66 activities of non-financial corporations and households sectors and 3 activities of financial corporations.

For deflation of output in the national accounts, the following price data are available from the price statistics: the producer price indices of industrial production for the domestic and export markets by economic activities, the service producer price indices (SPPI), the consumer price indices, the construction and agricultural price indices.

Manufacturing output by activity is deflated at the product level using PPI (reflecting changes at basic prices) and including separate deflation for domestic and export sales, and for inventories of finished goods and work in progress. The domestic market production and changes in inventories are deflated with the domestic market PPI, the

export component of output - with the export market PPI or actual export price index EPI. Three components of output are then added together to obtain constant price production value for each product. The implicit price deflator for total output is then derived as a weighted average of the price indices for three output components.

For deflation of market services, the available deflators are the CPI (at purchasers' prices) and SPPI (at basic prices). For a number of business services, such as transportation, legal and accounting, courier, storage and warehousing, architectural and engineering services, employment, investigation and security activities, services to buildings and landscape, SPPI are developed and used for the deflation of output. For remaining services, for instance, rental, scientific research, advertising services SPPI are not yet developed. CPIs are applied for those service activities where SPPI are not yet available. CPI can be used as approximate indicators for deflation of services if they fulfil a number of requirements<sup>1</sup>: (1) a considerable part of the output of a product is consumed by households; (2) if trade and transport margins and taxes play a modest part in the value at purchasers' prices of a product; (3) in case of the changes in the tax rates (e.g. VAT), a correction for the tax rate movements is made.

For construction output, the construction price index is used, which expresses the price changes of basic inputs (labour force, building materials and building machines) and also changes of other costs and profit margins of the construction companies.

The extrapolation method is used for freight rail transport services. Output at constant prices is derived by extrapolating base year value by a volume indicator of tonne-kilometres. The implicit price deflator is calculated as output value at current prices divided by output at constant prices. Passenger transport services are deflated by CPI.

Output at constant prices for agriculture is calculated in the Agricultural Statistics Department within the Economic Accounts for Agriculture. The results are taken over into SUT system without changes.

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<sup>1</sup> Eurostat Manual of Supply, Use and Input-Output Tables, page 259.

Indices for deflation of distributive services (i.e. trade and transport margin output) are not directly collected by the price statistics. The distributive trade and transport services in the production estimates are deflated with the implicit price deflators for margins compiled from the use side. Thus trade and transport margins at constant prices are calculated by applying the base year margin rates on the different uses of each product at constant basic prices.

### **Non-market output**

The input method is used to calculate the output of non-market activities of general government and NPISH. Calculations are made for 15 non-market activities of general government and 6 non-market activities of NPISH. Output at previous year's prices is calculated as sum of costs: intermediate consumption + compensation of employees + consumption of fixed capital + taxes on production (each component is deflated separately). For general government, estimates of compensation of employees and taxes on production at constant prices are derived by projecting base year figures by a volume indicator of employment. For NPISH, compensation of employees and taxes less subsidies on production are deflated by overall CPI. Consumption of fixed capital is deflated by CFC deflators derived from GFCF estimates. Intermediate consumption at constant prices is deflated at the product level (see paragraph "intermediate consumption").

### **Imports of goods and services**

Imports of goods are deflated with actual import price indices at cif prices. The price data are collected directly from main importers and available on the 2-digit level of NACE. For imports of services, the official price data are not available. In national accounts, therefore, a "foreign" price deflator is estimated for deflating imports of services (calculated as a weighted average of CPIs of main importers and corrected for exchange rate movements). Tourism consumption expenditures of residents abroad are also deflated with the foreign price deflator.

### **Taxes less subsidies on products**

The preferred approach is volume projection rather than deflation, mainly because deflation could not be used where a tax or subsidy in the base year ceased to exist in the subsequent year. Taxes less subsidies on products are calculated by applying the tax rates in the base year to the taxable base at constant prices.

## **3.2. Deflation of use of goods and services**

### **Intermediate consumption by activities**

In accordance with the Commission Decision 2002/990, the preferred method for estimating intermediate consumption at constant prices is:

- deflation product-by-product;
- separate deflation of domestically produced products and imported products;
- the use of actual price data on intermediate consumption, or, for domestically produced products, the PPI for each product (taking into account the different valuation basis) and, for imported products, the actual import price indices.

While official actual price indices (at purchasers' prices) required for deflation of intermediate consumption are currently not available from the price statistics, the same price data as for deflating output and imports in the supply side are used.

Deflation of intermediate consumption is first carried out at basic value, using the detailed product breakdown and including separate deflation for imported and domestic market production components of intermediate consumption:

- domestically produced intermediate consumption is deflated with the domestic market PPI, for manufacturing goods, and with the CPI, SPPI, implicit price deflator for freight transportation services, agriculture and construction price indices, outside manufacturing;

- imported intermediate consumption at c.i.f. prices is deflated with the import price index, for goods, and with the foreign price deflator, for services.

The use table at basic prices is derived as sum of the domestic use table and the imports use table both in constant prices.

Valuation components (VAT, taxes, subsidies and margins) are deflated separately. The constant price taxes and margins for each product are calculated by applying the base year tax and margin rates on the intermediate consumption at constant basic prices (i.e. volume projection method). The constant price intermediate consumption at purchasers' prices is then estimated as sum of all valuation components. As a result, a "composite" price deflator (at purchasers' prices) for each product of intermediate consumption matrix is calculated as a weighted average of the basic price indices for imports and domestic market production plus implicit deflators for taxes less subsidies on products and trade and transport margins.

Similar calculation procedure is used for the estimating intermediate consumption at constant prices of market and non-market activities.

### **Deflation of household final consumption expenditure**

For household final consumption, comprehensive and reliable consumer price indices (consistent with the national accounts valuation concept) are available from the price statistics. In particular, the CPI provides information on changes in the purchasers' prices paid by households for different product groups.

In the SUT compilation system, constant price HFC estimate for each product groups involves: (1) separate deflation of imported and domestic market production components at basic prices with the import price index and with the domestic market PPI correspondingly, and calculation of taxes less subsidies, trade and transport margins at constant prices by applying the base year rates on the HFC at constant basic prices, (2) deflation of household final consumption at purchasers' values with the consumer price

index and, at the final stage, re-calculation of the trade margins on HFC at constant prices, obtaining an estimate for changes in the trade margin rates residually.

### **Deflation of exports**

For deflation of goods, the export market PPI or actual export price indices are available from the price statistics. The price data are collected directly from main exporters. There are no official price indices for exports of services.

There are three factors to be considered in the treatment of exports – valuation, re-exports and tourism consumption of non-resident in Estonia. The valuation of exported products is f.o.b. price at the border. This valuation includes trade and transport margins involved in transferring the goods from the place of production to the point of departure from the country (if exporter is a trader). In some cases, where exporter of the goods is a producer, transactions are valued at basic prices including transportation costs. It is assumed that valuation of transactions with imported goods entering the border and re-exported without processing are valued at purchasers' prices including trade and transport margin valuation component.

For estimating exports at constant prices, the following steps are taken:

- deflation product-by-product at basic prices;
- separate deflation of domestically produced goods and of re-exports of imported goods;
- the use of the export market PPI or actual export price indices at basic prices to deflate domestically produced exports and of the import price indices, for deflation of re-exported goods;
- the calculation of trade and transport margins at constant prices by using volume projection method;
- the use of output deflators from the supply side for deflation of exports of services.

For the constant price estimates, non-resident tourism consumption expenditures in Estonia are deflated with the weighted CPI deflator calculated for 10 main tourism product groups (product composition of tourism consumption is obtained from TSA).

### **Gross capital formation**

For capital goods, the price indices at purchasers' value are not available from the price statistics. In general, the estimation methodology for gross fixed capital formation and changes in stocks is similar with deflation methodology used for intermediate consumption. First, gross fixed capital formation (at basic prices) is deflated on a product-by-product basis for the different asset groups:

- dwellings, construction of buildings and structures are deflated using the construction price index;
- machinery, cars and other transport equipment are deflated using the domestic market PPI for deflation of domestically produced products, and the import price indices for deflation of imported products;
- computers are deflated using the domestic market PPI for deflation of domestically produced products, and the import price indices for deflation of imported products;
- software are deflated by CPI;
- the transfers costs (commission charges, intermediation fees, legal services, notarial services) are deflated by the corresponding CPIs;
- cultivated assets are deflated using the agricultural price indices.

Changes in inventories (at basic prices) are deflated by products and by type of stocks, using the domestic market PPIs, the import price and agriculture price indices. Taxes on products, trade and transport margins at constant prices are calculated based on volume projection approach. The constant price GFCF and changes in inventories (at purchasers' value) are compiled by adding constant price net taxes on products, trade and transport margins to the constant price GFCF and stocks at basic prices.

## **Government final consumption**

Estimates for government final consumption are derived from the output data, by adding social transfers in kind and by excluding market sales. For constant prices, market sales by products are deflated by the output deflators (PPI, CPI, SPPI or implicit price indicator). Social transfers in kind by products are deflated either by the output deflators or by the import price indices.

### **4. Calculating GDP at constant prices of the previous year**

Constant price estimates are compiled for both the production and expenditure sides of GDP within the detailed SUT framework. Supply and use tables provide a tool for compiling constant price GDP estimates in consistent way. This means in practice that “same” figures in different parts of the SUT accounts for each product are deflated consistently. The main areas are:

- Consistency between figures of domestic market production within output in the supply table, and their inclusion as components of intermediate consumption, HFC, GFCF and stocks in the use table;
- Consistency between export sales which appear in output in the production estimates and in exports in the expenditure side of the account;
- Consistency between the components of the changes in inventories in the use tables, and the corresponding figures in output (changes in finished goods and work in progress);
- Consistency between figures of imports in the supply table, and their inclusion as components of intermediate consumption, HFC, GFCF, stocks and re-exports in the use table;
- Consistency between variables: own-account production of construction and software, production for own consumption, income in kind, which are included identically, in the supply and use sides of the accounts;
- Consistency between components of government non-market output and government final consumption (similarly for NPISH);

- Consistency between figures of taxes less subsidies on products in the use table, and the corresponding figures in the supply table;
- Consistency between supply and use side trade and transport margins.

As a result, the constant price supply and use data of each product are balanced at basic and purchasers' prices. Furthermore, the production and expenditure estimates of GDP at constant prices are automatically balanced at the detailed product level.

Estimates of production-based GDP are derived by the double indicator method (deflation or extrapolation of output and deflation of intermediate consumption) for market activities and by the input method for non-market activities of general government and NPISH sectors. The value added at constant prices is obtained as the difference between output and intermediate consumption valued at constant prices. GDP from production side at constant prices is calculated by adding taxes less subsidies on products to gross value added.

## **5. Further improvements**

Further improvements in the constant price estimates depend much more on the developments in the collection of new price data for business services and the availability of price indices for those services.

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