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**METHODS FOR BALANCING SUPPLY-USE TABLES IN NORWAY**

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## METHODS FOR BALANCING SUPPLY-USE TABLES IN NORWAY

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### 1 Introduction

Supply-use tables (SUT) have been an integrated part of the Norwegian national accounts system for more than 30 years. Detailed SUT in current and constant prices are compiled as part of the final annual accounts, and published with a delay of about two years. GDP and other important macroeconomic aggregates are derived directly from the SUT.

### 2 The SUT framework

The SUT has about 150 activities specified in terms of NACE, and an additional 30 when cross-classified by producer type (own account, market, central and local government, and NPISH). This classification is used for output, intermediate consumption and gross fixed capital formation.

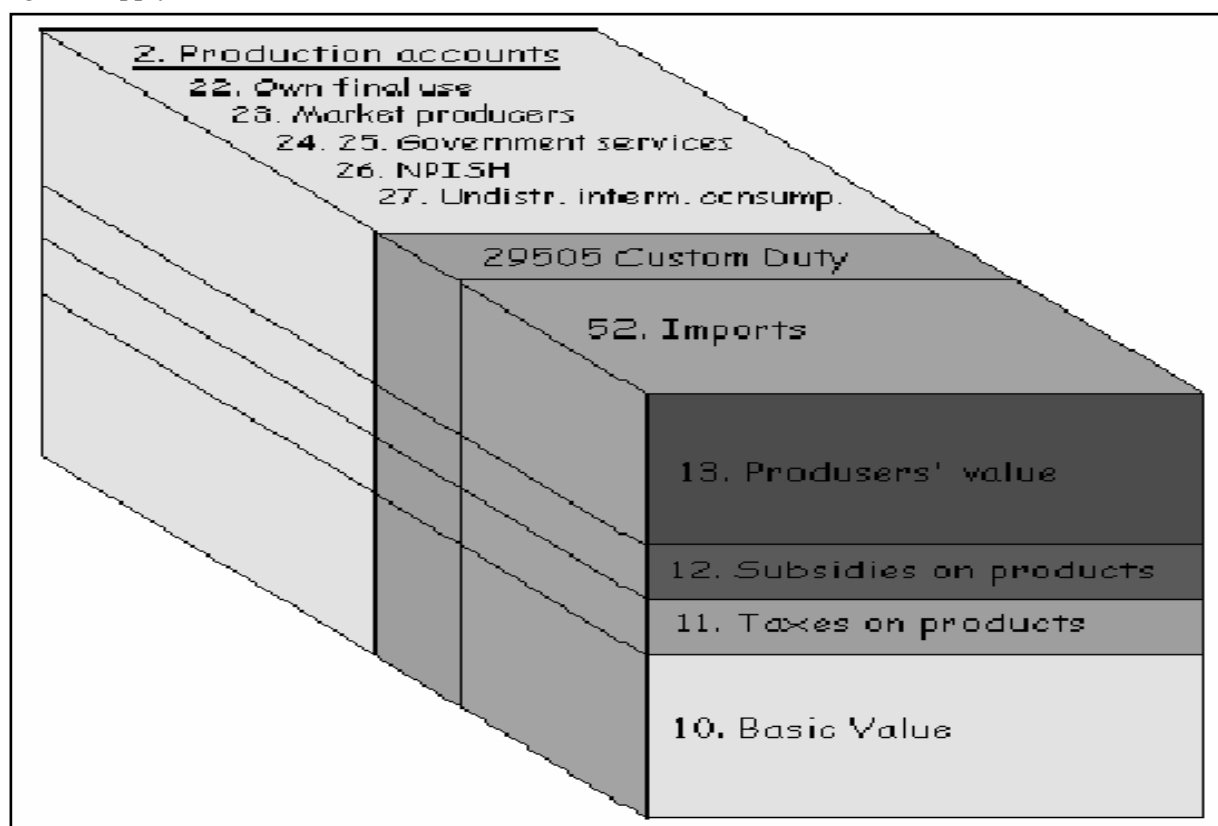
There are around 1000 products specified in terms of CPA, of which 700 goods and 300 services. In addition there are 250 supporting products of a technical nature, which are used for asset types, undistributed intermediate consumption, etc. These will be described below.

#### *2.1 The supply table*

The supply table has four layers, each corresponding to a value component:

- 10 Basic value
- 11 Taxes on products (paid by producers)
- 12 Subsidies on products (paid to producers)
- 13 Producers' value

Fig. 1: Supply table

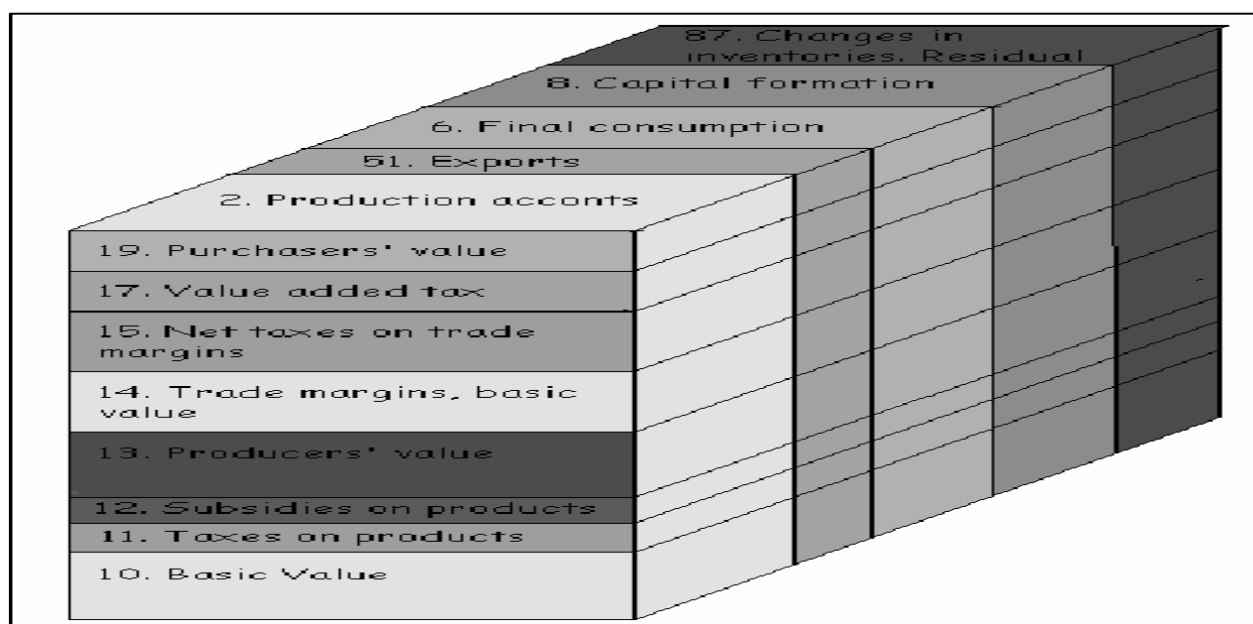


## 2.2 The use table

The use table has 10 layers:

- 10 Basic value
- 11 Taxes on products (paid by producers)
- 12 Subsidies on products (paid to producers)
- 13 Producers' value
- 14R Trade margins
- 14T Transport margins
- 15 Taxes on products (collected by traders)
- 16 Subsidies on products (paid to traders)
- 17 Value Added Tax
- 19 Purchasers' value

Fig. 2: Use table



### 2.3 Use of aggregation accounts

Aggregation accounts for asset types are used in the Norwegian SUT to provide the link between GFCF by asset type and by detailed CPA product. An aggregation account will receive several CPA products and supply only one “asset product”, which is allocated to GFCF in the various industries. There are about 60 asset types in the SUT.

Similar aggregation accounts are also used for intermediate consumption, in order to limit the details needed in the use table. This is a way of combining the detailed CPA product information on the supply side with the more limited information available for intermediate consumption. An aggregation account will receive several detailed NA-products, and supply only one “Aggregation product”. This aggregate product is then allocated to intermediate consumption in the various industries.

Aggregation accounts are used mostly for services that tend to be used by all or most industries. In the Norwegian SUT there are about 35 aggregate products for intermediate consumption. The main ones are:

- Business travelling and business entertainment
- Catering services for internal canteens etc.
- Safety equipment, canteen equipment, tools etc.
- Offices equipment, cleaning material
- Food used in institution, ships, etc.
- Government fees
- Transport of goods, loading and storage
- Hotel services, personal tours, travel expenses, etc
- Hotel services, domestic personal tours
- Telephone and telefax services
- Travel expenses, not otherwise specified

- Postal- and bank services, education etc.
- Hiring/Renting
- Public administration and compulsory social security activities

The others are related to repairs and to military equipment. In 2003, about 33% of total the total value of intermediate consumption was recorded using these aggregate products. This reduces the size of the use table significantly.

### **3 The balancing process**

#### ***3.1 IT system for SUT***

When one is working with large scale supply and use tables it is important to use an efficient IT system. The SUT application used in Statistics Norway is based on SAS, with a graphical user interface, and data in SAS datasets. The finished SUT is copied from the SAS datasets to an Oracle database for permanent storage.

The current application was developed in 2005, based on our previous SUT application, called SNA-NT, which was written in Visual C++ and used Oracle for data storage. The functionality of the new SAS application is the same as in SNA-NT. SAS was chosen for the new system since it is one of the main software tools used in Statistics Norway.

The application is a multi-user system with data stored on a central UNIX server, and several clients (Windows PCs) connected to the server. It is also possible to install both the server and the application on a stand alone PC as a single user system.

#### ***3.2 Establishing the current price SUT***

The following data are the starting point for the current price SUT:

- Output at producers' value, by industry and product
- Intermediate consumption at purchasers' value, by industry and product
- "Undistributed intermediate consumption" at purchasers' value less VAT, by aggregate and detailed product (these will be described in more detail below)
- GFCF at purchasers' value, by industry and asset type
- GFCF at purchasers' value less VAT, by asset type and product
- Final consumption at purchasers' value, by category and product
- Imports (cif), custom duties and exports (fob) by product
- VAT rates, differentiated by product and use category
- Taxes and subsidies on products, time adjusted and allocated to products and to producers or traders

The inputs are loaded into the SUT application as text files with a fixed format. It is possible to provide inputs in the form of an index showing the change from the previous year for an industry or use category. In this case the product structure of the previous year will be used also for the current year.

The supply table in current prices is first established in producers' value. Taxes on products are distributed between domestic suppliers and imports of the products. Subsidies on products are distributed between domestic suppliers of the products. Finally, the supply table is calculated in basic value by deducting net taxes on products from the producers' value.

The use table in current prices is first established in purchasers' value. The VAT rates and trade and transport margin rates are applied to form the various layers described in section 2 above. Taxes and subsidies on products are distributed among the domestic uses (proportionally with some exceptions). The use table in basic value is calculated by deducting VAT, product taxes and subsidies, and trade and transport margins from the purchasers' value. Changes in inventories by product are by the commodity flow method, as the difference between supply and other uses.

The result of this first phase is a SUT with all the required cells filled in, but with a number of imbalances:

- There will be changes in inventories on products that cannot be stored (most services and some perishable goods).
- Changes in inventories on products that can be stored (mainly goods) may be too big.
- The sum of trade and transport margins in the use table will not be in line with the output of trade and transport services.
- The aggregation accounts for asset types and "undistributed intermediate consumption" will not balance.

### ***3.3 Manual balancing***

The balancing of the current price SUT is mainly a manual process. It takes place over a period of about one month, with two persons (the "balancers") working more or less full time. The persons responsible for preparing the inputs are involved on a part-time basis.

Changes to the inputs can be made either interactively in the application or by loading a text file with a fixed format (the same as the format used for establishing the SUT in the first phase). When a variable (e.g. consumption of a product in purchasers' value) is changed, all dependent variables (taxes, margins, changes in inventories etc. are recalculated automatically.

The first step in the balancing process is to print out detailed reports where the SUT data for the current year is shown next to the finalised data for the previous two years. This is useful for identifying missing data and other errors in the inputs, and to see if the development over time looks reasonable.

Work then starts on the changes in inventories. For most services and perishable goods they are set (close) to 0, while the other products are adjusted to "reasonable" levels. Since changes in inventories are calculated as residuals in the product balances, the adjustment process involves changing other components of use or supply. Where the adjustments are made depend on the strengths and weaknesses of the various source statistics. If large adjustments are necessary, the person responsible for preparing the inputs is contacted, and possible errors and estimation problems discussed. Depending on the reason for the adjustment, an offsetting change may be made to other products in order to keep the sum of the activity or use category unchanged, or the sum may be allowed to change.

The next step is to adjust the aggregation accounts for asset types and "undistributed intermediate consumption" so the sum of the CPA products going into the account equals the value of the supply of the aggregate product.

Smaller discrepancies between the sum of trade and transport margins in the use table and output of trade and transport services are eliminated by adjusting output. Larger discrepancies may require adjustments to the margin rates.

After the larger adjustments have been made manually, the fine-tuning is done with an automatic procedure, a simplified "RAS" method involving only the use table.

The use of the commodity flow method for estimating changes in inventories means that they include a "statistical discrepancy" item of unknown size. It is likely to be large in relation to the "real" inventory changes, but small compared to total supply and use. Not having independent data for changes in inventories is not ideal, and we are now investigating the possibility of using company accounts data to calculate them directly.

VAT is calculated in the SUT by applying rates and exemptions to uses in purchasers' value, so the result is a theoretical VAT. This is compared to actual (time-adjusted) VAT recorded in the government accounts, as a check for exhaustiveness. In the later years, theoretical VAT has been around 4 per cent higher than actual VAT. Until now, the theoretical VAT has been used in the national accounts, but from December 2006 onwards, we will apply a correction item on the use side, so that total VAT in the SUT will be equal to actual VAT.

### ***3.4 SUT in constant prices***

The constant price SUT have the same structure as the SUT in current prices, and are compiled by deflating the current price SUT by price indices at the product level. This results in integrated Laspeyres volume indices and Paasche price indices.

Deflation is from the supply side. The balancing of the supply and use tables in constant prices is first carried out at the detailed product level in basic values. Integrated in the deflation process is constant price compilation for each of the value classes, i.e. taxes on products, VAT, trade margins etc, all specified by product.

Each of the 1000 CPA products has three price indices:

- Domestic production (basic or producer prices)
- Imports (CIF value)
- Based on foreign trade statistics (Unit value, for homogenous products) and other sources
- Exports (FOB value)
- Based on foreign trade statistics (Unit value for homogenous products) and other sources

The three price indices are used to deflate the corresponding current price figures.

Exports and imports are deflated with the corresponding price indices. The constant price figures for exports are calculated at basic value by applying tax rates and trade margins from the previous year. If there are empty cells in the tax or margin matrices, the values from the current year are used.

To form an index for total domestic supply of each product, the price index for exports is combined with an index for domestic production supplied to domestic users (based on the PPI, CPI, input price calculations and other sources). The combined index is used to deflate domestic supply from the various industries.

For each product, total domestic use at constant prices is calculated at basic value as total domestic supply plus imports minus exports.

Constant price values for the various domestic uses are calculated by distributing total domestic use in constant prices proportionally with the domestic uses in current prices. This ensures that the supply and use of each product in constant prices will balance.

The constant price domestic uses in purchasers' value are calculated by applying tax rates and trade margins from the previous year to the product flow at basic prices and adding up. If there are empty cells in the tax or margin matrices, the values from the current year are used.

Household consumption is the only area, except exports, where we have price indices for purchasers' value. The constant price figures are adjusted to reflect the change in the CPI for the goods in question. The current price basic values are adjusted, in order to preserve the price indices in basic value. Finally, the trade margins in current prices are recalculated, and a corresponding adjustment is made to the output of trade services.

## References

A detailed technical description of Statistics Norway's SUT is provided in the following documents, which may be downloaded from Statistics Norway's web site: [http://www.ssb.no/english/publications/etter\\_serie/doc/](http://www.ssb.no/english/publications/etter_serie/doc/)

*Liv Hobbelstad Simpson*: Documents 2005/5. National Accounts Supply and Use tables in Current Prices "SNA-NT SUT/STARTER". Statistics Norway

*Liv Hobbelstad Simpson*: Documents 2005/4. National Accounts Supply and Use tables in Constant Prices "SNA-NT SUT/CONSTANT". Statistics Norway.

*Steinar Todsén*: Documents 2005/6. SNA-NT User's guide for Supply and Use tables in Current and Constant Prices. Statistics Norway.

A shorter technical description may be found in Annex 1 of this paper, available from <http://www.iariw.org>

Liv Hobbelstad Simpson, Haavard Sjoeli, Statistics Norway and Lizzie Chikoti, NSO, Malawi:

Experience from Africa, developing Supply and Use Tables integrated with the Annual National Account. Paper Prepared for the 29th General Conference of The International Association for Research in Income and Wealth, Joensuu, Finland, August 20 – 26, 2006