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COMPILING SUPPLY AND USE TABLES IN CONSTANT PRICES  
THE NORVEGIAN APPROACH

Invited Paper submitted by Statistics Norway\*

**SUMMARY**

1. This paper will give a description of the structure of the Norwegian Supply and Use tables and the methodology used for the compilation of price and volume measures.

2. The Norwegian National Accounts have been revised according to the new guidelines SNA93 and ESA95. New, revised and detailed Supply and Use tables in current and the previous year's prices are compiled back to 1970. The Supply and Use tables (SUT) are first balanced at a disaggregated product level in current prices and then converted to constant prices. The SUT provide an accounting approach to constant price calculations and give a framework for integrated price and volume measurement.

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Price and volume calculations are initially compiled for transactions of products (goods and services).

3. For each of the products, separate price indices are used for:

- Domestic production of the product (at basic value)
- Imports of the product (at CIF value / basic value)
- Exports of the product (at FOB value / purchasers' value)
- Household final consumption expenditure (at purchaser' value)

4. The balancing of the Supply and Use tables in constant prices is carried out at a detailed product level. Balanced Supply and Use tables at basic values is ensured by distribution of total domestic use (total domestic supply plus import minus exports) in constant prices proportionally with the domestic uses in current prices.

5. Constant price estimates for each of the value classes, i.e. basic value, taxes and subsidies on products, producers' values; trade margins, VAT and purchasers' values, all specified by products, are integrated in the complete deflation process. Price and volume indices are also calculated for value added (double deflation).

6. Based on time series for the Supply and Use tables in current prices and the previous year's prices, annual chained Laspeyres volume indices and Paasche price indices are compiled. By using detailed Supply and Use tables, the consistency of the price and volume indices is maintained.

## **THE NORWEGIAN SYSTEM OF NATIONAL ACCOUNTS**

### **The Norwegian core accounts**

7. Statistics Norway has fifty years of experience in compiling annual Supply and Use tables integrated with the national accounts, as well as using the tables for economic planning. When SNA 1968 was implemented in 1973, the full SNA matrix was used as the framework for the Norwegian National Accounts. Detailed Supply and Use tables (SUT) in current and constant prices were compiled annually from 1970 by a computerised routine.

8. A comprehensive revision of the national accounts was undertaken during the period 1992-1995. With this, Norway was the first country who adopted the new guidelines SNA93 and ESA95. An important aspect of the Norwegian main

revision, was the development of a new integrated data processing system with an application called the SNA-NT (for the computing of the Norwegian National Accounts, see Annex 2).

9. The core accounts of the present Norwegian National Accounts comprise the "Integrated economic accounts with institutional sector accounts" and an integrated set of annual "Supply and Use tables" in current and constant prices.

#### **The Input-output tables and the Tourism satellite accounts**

10. The Norwegian application (SNA-NT) contains procedure for converting the "Supply and Use tables" (SUT) at basic value to an "Industry format input-output table" (I-O) by distributing the Supply and Use of products. The I-O tables are compiled in current and constant prices.

11. The Satellite accounts, such as the "Tourism satellite accounts" in SUT format, are developed with a direct link to the SUT. The classifications introduced for the SUT specify both industries and products of particular interest for tourism. As part of the final household consumption expenditure, "Non-resident tourism consumption" and "Resident household tourism consumption" are specified. The "Tourism satellite accounts" are compiled in current and constant prices and can also be converted to I-O tables in current and constant prices.

#### **The Norwegian Supply and Use tables (SUT)**

##### The structure

12. The Supply and Use tables (SUT) developed as an integrated part of the annual national accounts represent an important quality check on the national accounts figures. They also represent a valuable tool for compiling national accounts price and volume measures in an integrated fashion (the double deflation technique).

13. *The Supply table* describes the sources for the supply of products to the economy. *The Use table* describes the use of the products, as well as the derivation of value added as the difference between output and intermediate consumption. The SUT also gives production accounts (with detailed breakdown by industries and products), generation of income accounts and capital formation accounts, with establishment (local kind of activities) as the statistical unit.

14. The metadata for the Norwegian SUT cover classifications for industries, types of final use and of products. There exists no "ideal" size of the SUT, but it has to be designed as a compromise between what should be done to be very accurate and what can be done with the data and resources available.

15. The industry classification is an aggregated version of NACE with three-digit codes, specifying 180 industries. The 180 industries are decomposed into 139 industries for Market producers and the same grouping of industries where it is relevant, for Own account producers and Other non-market producers. Other non-market producers are divided between Producers of central government services, Producers of local government services and the NPISHs.

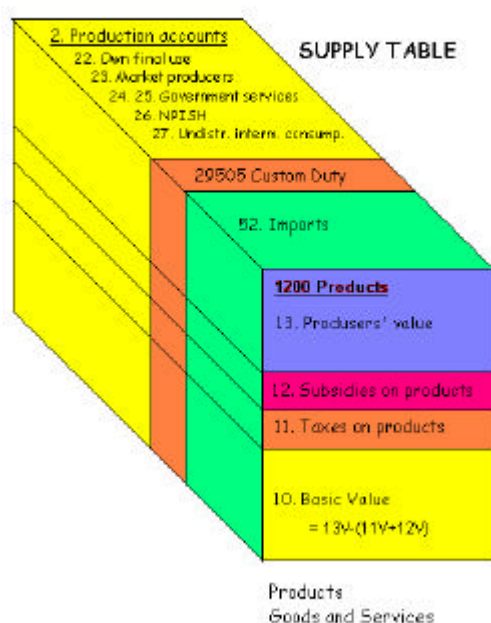
16. The classification for final consumption expenditure (COICOP and COFOG) and fixed capital formation by type, follows the SNA93 classification.

17. When starting a SUT project, it is especially important to decide the relevant product classification to be used. A goal is to specify rather homogenous products. Another goal is to specify a product in such a detail that only one tax rate for VAT, product taxes and subsidies apply for one type of use of the product. In the Norwegian SUT, about 1200 NA-products, specified by six-digit codes, are defined with a link to the CPA-codes or as aggregates of the CPA-codes.

18. A conversion table giving the link between the NA-product classification and the detailed HS-classification used for the external trade statistics, was constructed at the same time as the NA-product classification was established and has to be updated annually. Conversion tables are also established to give the link to codes used in different accounting or production statistics.

The Supply table

Figure 1. Overview of the Supply table



*The Supply table gives detailed information about the supply of products (goods and services) from:*

2. Production accounts

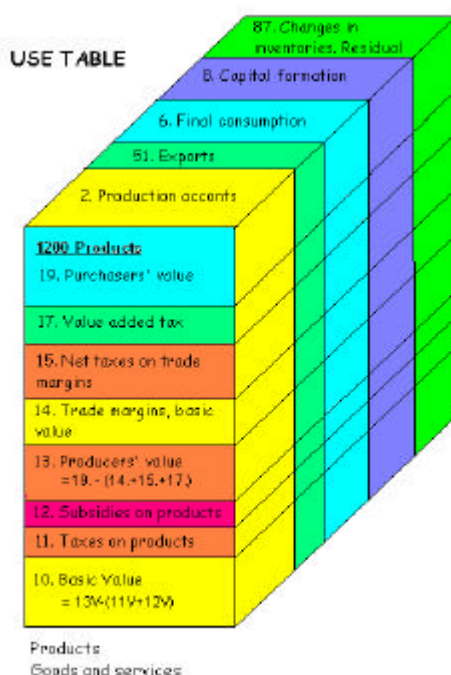
- Account 22. Production accounts, Own final use
- Account 23. Production accounts, Market producers
- Account 24. 25 Production accounts, Non-market producers, Government services
- Account 26 Production accounts, Non-market producers, NPISHs
- Account 27. Technical accounts for undistributed intermediate consumption (to facilitate the commodity balancing)
- Account 28. Fixed capital formation by type of asset.
- Account 29. Technical accounts for Custom duty, product taxes and product subsidies

52. Imports

- Account 52. Imports, specified by type of imports

*The following account types show which value classes are used for the product flows:*

- Account type 10. Basic value
- Account type 11. Taxes on products (paid by the producers)
- Account type 12. Subsidies on products

The Use table**Figure 2. Overview of the Use table**

*The Use table in Purchasers' value (Account type 19) is during the compilation process, decomposed into:*

Non-refundable VAT (Account type 17)

Net taxes on trade margins (Account type 15)

Trade, transport margins, basic value (Account 14)

Producers' value (Account type 13)

*The producers' value is further decomposed into:*

*The Use table gives information on the intermediate use of products by industries and the final use, specifying domestic final use and exports:*

2. Production accounts. Intermediate use of products:

- Account 22. Production accounts, Own final use, specified by industry
- Account 23. Production accounts, Market producers, specified by industry
- Account 24. 25. Production accounts, Non-market producers (Government) Account 24. 25 & 26. Production accounts, Non-market producers Non-profit institutions serving households), specified by industry

Final use of products:

- Account 51. Exports, specified by type
- Account 6. Final consumption expenditure, specified by the COICOP and COFOG classifications
- Accounts 82-86. Fixed capital formation accounts for industries,
- Account 87. Change in inventories and residuals

*The complete Use table shows the following value classes:*

- Account type 10. Basic value
- Account type 11. Taxes on products (paid by the producers)
- Account type 12. Subsidies on products (paid to the producers)
- Account type 13. Producers' value
- Account type 14. Trade and transport margins
- Account type 15. Taxes less subsidies on products (paid by

Subsidies on products

(Account type 12)

Taxes on products (Account type 11)

Basic value (Account type 10)

*Balancing and correcting changes in inventories*

In the first phase of the balancing of supply and use of each product, the change in inventories is residually determined. The residuals are then corrected to an acceptable level. The corrections are first manually, based on an evaluation of data and statistical sources, and finally by "RAS" computation.

**CONSTANT PRICE CALCULATION OF THE SUPPLY AND USE TABLES**

**Integrated set of price and volume measures and double deflation**

19. A consistent and integrated set of price and volume measures covering all flows of goods and services are compiled within the framework of the annual Supply and Use tables (SUT), as recommended in the SNA, chapter XVI.

20. The Supply and Use tables (SUT) with detailed product flows for the year  $t$  are converted from current prices to prices for the previous year ( $year\ t-1$ ). This requires that the SUT in current prices have been compiled for both the year  $t$  and the year  $t-1$ . The format of SUT in constant prices will be identical with the format in current prices, specifying the same number of industries and products. This ensures that the definition relationships inherent in the current price SUT will be maintained in the constant price SUT.

21. The constant price figures for flows of products (goods and services) are computed by deflating current values by price indices at the product level. Different price indices are developed for products supplied from domestic production, from imports and to exports. This results in integrated Paasche price indices and Laspeyres volume indices.

22. Value added for the different industries will be calculated by "double deflation" as the difference between output at constant prices and intermediate consumption at constant prices. When value added accounts for only a small proportion of output, the constant price estimates have to be evaluated with care.

### **Annual chaining**

23. Statistics Norway has compiled detailed SUT in the previous year's prices since 1987. Based on the time series of the SUT in current and the previous year's prices, chained Laspeyres volume indices and Paasche price indices are compiled.

24. The change to annual chaining was discussed with main users as Statistics Norway's Research Department, and they supported the decision. Some concern was expressed about the failure of a chained Laspeyres index to pass the "time reversal" test. Regarding the problem of non-additivity, it was pointed out that this also existed in the old figures, which had to be chained every five years.

25. Before the main revision of the National Accounts, chained time series were published as volume indices only, partly to discourage users from adding up details and fail to get the aggregates.

26. The reasons for annual chaining and the resulting non-additivity have been explained and accepted by users, and the constant price figures are now published in million kroner from a reference year, currently 1990.

### **Homogeneous products and shift effects due to price discrimination**

27. Problems related to "shift effects due to price discrimination" may occur when a homogeneous product, received from different suppliers and/or delivered to different users, is sold at different prices.

28. Taxes and subsidies on products are often differentiated according to the user group who purchase the products. The basic values are therefore more homogeneous than producers' and purchasers' values. When basic value per unit is the same for the whole range of users of a NA-product, changes in use of the product will not affect the calculated constant prices value in basic value, even if taxes differentiated according to use have been levied on the product.

29. Using different price indices for products supplied from domestic production, from imports and to exports, we have found that the "shift effect" has little significance compared to the statistical errors associated with the calculations of constant prices. Except for the calculation of taxes and subsidies on products at constant prices, we have therefor chosen to neglect the "shift effect".



## **The price index material used**

### An overview

30. In the first stage of the constant price compilation of the flows of products, three different price indices are used for each NA-product to deflate the corresponding current price figures

- The NA-product supplied from domestic production (Price indices for basic or producers' value).
- The NA-product supplied from imports (Basic/CIF value). Price indices based on unit values from foreign trade statistics and other price information for capital goods and services.
- The NA-product delivered to Exports (Purchasers'/FOB value). Price indices based on unit values from foreign trade statistics and other price information for capital goods and services.
- The constant price figure for the NA-product delivered to Household final consumption at Purchasers' value will in the final stage be corrected by deflating with the consumer price index.

31. Capital equipment, machine tools and several varieties of consumer goods are often unique in the sense that they are goods, which due to their characteristics cannot be matched over time with similar goods. Statistics Norway is now giving priority to evaluate and improve methods for calculating indices of capital goods by using hedonic price indices or improved methods for direct price collection.

### Price index material for deflating domestic production

32. *Producer price indices (PPI) and Consumer price indices (CPI)*. A price index has to be calculated /estimated for every NA-product supplied from domestic industries. This gives approximately 1200 price indices for products classified after the NA-product classification. Using different types of price data or volume indicators, price indices for each of the domestic produced products are calculated. Where relevant, the price indices are calculated from the price data collected for the producer price or the consumer price index compilation. The consumer price indices express changes in purchasers' prices

and are mainly used for constant price estimates for the type of services, which are used for private consumption.

33. Price indices for domestic production cover, for most products, only domestic use. To form an index for total domestic supply of a product, the price index for domestic supply of the product to domestic users is combined with the price index for the same product to exports. The combined index is used to deflate domestic supply of the product from the various industries.

34. *Unit value price indices.* The unit value price indices or the implicit price indices, based on value and volume data, are used where no direct price observations are available. Unit value data are calculated from the production statistics at a detailed product level, but are to be used with caution. They might be poor indicators of the price development for capital goods where changes in the composition of products may occur from one year to the next.

35. *Volume estimates.* For some service industries, volume estimates giving implicit price indices are applied.

36. *Input price indices.* For non-market industries such as general government and business services, for which no price or volume indices exist, input price indices are applied. The input price indices measure the price of production by means of the price of the production factors (intermediate consumption, consumption of fixed capital and labour) and are compiled by the Paasche formula.

#### Price index material for deflating imports and exports

37. In Norway, the calculation of constant prices for imports and exports of goods have for years been co-ordinated with the calculation of the official indices for the price and volume changes in the Norwegian foreign trade statistics. Constant price figures for imports and exports of ordinary products are computed by deflating current values with unit value price indices. For imports and exports of certain capital goods and services, price indices are estimated for each imported and exported product.

#### **Deflating the Supply table**

38. The constant prices are initially computed in the Supply table for flows of products, at basic values.

#### Domestic production at basic value

39. Domestic production in constant prices (excluding custom duty) is calculated by dividing current basic values by a set of price indices for domestically produced products. A price index is calculated for every single product supplied from domestic industries. The SNA-NT application gives a possibility for using price indices for producers' values or basic values. The price indices for producers' values are converted into price indices for basic values before the constant price compilation.

#### Imports at basic value

40. Imports and customs duties in constant prices are calculated by dividing current values by a set of price indices. A price index is calculated for every single product imported. The same import price indices are also used to deflate customs duties specified by products.

#### Constant price estimates for taxes and subsidies on products

41. "Tax rates" from year  $t-1$  are used for the calculation of product taxes and subsidies in constant prices. The "Tax rates" give taxes and subsidies on products in percentage of the product flows in basic values. Constant prices figures for the product taxes and subsidies in year  $t$  are compiled by multiplying the "Tax rates" from year  $t-1$  with the constant price figures for the supply of products in basic values in year  $t$ .

#### **Deflating the Use table**

#### Exports at purchasers' value converted to basic value

42. Constant price figures for exports are initially computed for flows in purchasers' values (FOB-value).

43. The following steps convert exports from purchasers' value to basic value:

*Constant price figures for exports, in purchasers' values, specified by products*

*minus constant price figures for trade margins in basic values, specified by products*

*minus constant price figures for taxes and subsidies related to trade margins, by products*

*Equals to constant price figures for exports in producers' values, specified by products*

*minus constant price figures for taxes/ subsidies on products, specified by products*

*Equals to constant price figures for exports in basic values, specified by products*

Domestic use in basic value

44. The various domestic use of a product covers intermediate consumption, final consumption expenditure, gross fixed capital formation and changes in inventories.

45. The constant price figure for total domestic use of a product in basic value is calculated as the difference between the constant price figure for the total supply of the product minus the constant price figure for exports of the product.

46. The constant price figures for the various domestic uses of a product in basic values are calculated by distributing total domestic use in constant prices proportionally with the domestic uses of the product in current prices. This means that in basic values, the same price index is used for deflation of all domestic use of a product, inclusive changes in inventories. This balancing process establishes equality in constant prices between the supply and use of each product.

Constant price estimates for trade margins in basic values

47. Trade margins include margins for retail trade, wholesale trade and transport. For the calculation of trade margins in constant prices, a set of "Trade margins rates" are used, based on the product by user categories recorded in the Use table from the year t-1. For each product by user category, we get the result that the volume changes of the trade margins are proportional to the

volume changes of the basic value. The total constant price figures for trade margins calculated in the Use table are transferred to the Supply table.

Constant price estimates for taxes and subsidies on products

48. "Tax rates" from year t-1 are used for the calculation of product taxes and subsidies in constant prices. The "Tax rates" give taxes and subsidies on products in percentage of the product flows in basic values. Constant price figures for the product taxes and subsidies are compiled by multiplying the "Tax rates" from year t-1 with the constant price figures for the product by user category in basic values.

49. "Tax rates" are calculated in the Supply table for the supply by product categories (see 3.5.3) and in the Use table for the product by use categories. The differences between the constant price figure for taxes and subsidies on products calculated from the Supply table and from the Use table are recorded as shift effects in a special Account.

Constant price figures for domestic use in purchasers' value

50. Constant price figures for domestic use in purchasers' value, specified by product, are calculated by adding the constant price figures for trade margins, taxes and subsidies to the domestic use in basic values. If there are empty cells for the tax or trade margins, values from the current year are used.

Correcting constant price figures for household final consumption expenditure

51. After having calculated the complete Use table in constant prices, a final correction is made of the estimated constant price values for household final consumption expenditure. The consumer price indices are used for compiling revised constant price figures for the flow of products to household final consumption expenditure.

52. Changes in the purchasers' value in constant prices for household final consumption expenditure, follows by changes in all the other values in constant prices in fixed proportions.

53. The previously established price indices between current and constant prices in basic values, will remain unaltered. When basic values in constant

prices for final private consumption expenditure is changed, the basic value in current prices for final private consumption expenditure is also changed.

54. *To keep the previously established purchaser's values for final household consumption expenditure in current prices, revised values are calculated for trade margins in current prices. This revision is an important source for the updating of the trade margins in current prices.*

55. Finally, new balancing of the Supply and Use tables in current and constant prices, results in new values for Changes in inventories.

**ANNEX I**  
**SNA-NT Handbooks**

The Norwegian methodology for implementing the SNA93 with SUT for a country, is described in the forthcoming Documents (by Liv Hobbelstad Simpson, Statistics Norway):

*SNA-NT.1 "STRATEGY"*, describing:

A strategy for implementing SNA 1993 with SUT for a country and also the different phases of implementing the "Integrated economic accounts" (IEA) for institutional sectors.

*SNA-NT.21 "SUT / Starter" for Supply and Use Tables (SUT) in Current prices*, describing:

Format for the catalogues with codes for Suppliers, Users and Products. Format for tables with input- data for establishing, correcting and updating the SUT in current prices. Format for tables with rates for calculating trade margins and taxes/subsidies on products.

Annex 1. User's guide to SNA-NT with an overview of the dialog boxes for running the SNA-NT

Annex 2. Classification for industries & final use. Examples for Norway and a Caribbean country.

Annex 3. Figures showing the procedure for establishing the Supply and Use tables.

*SNA-NT.22 "SUT / Equations" for Supply and Use Tables in Current price*, describing:

The compilation process and the set of equations, programmed to calculate SUT in current prices.

*SNA-NT.3 "SUT / Prices" for Supply and Use Tables in Constant prices*, describing:

The procedure for the SUT compilation process and the set of equations used to convert the SUT from current prices to constant prices.

*SNA-NT.4 "I-O" for "Industry format" INPUT-OUTPUT tables*, describing:

The procedure for converting the Supply (Industry by Product) table and the Use (Product by Industry) table into an "Industry format" Input-Output table (I-O) in current and constant prices.

*SNA-NT.5 "Tourism" for Tourism Satellite Accounts*, describing:

The compilation of "Tourism Satellite Accounts", diverted from the SUT.



**ANNEX II**  
**The Norwegian SNA-NT application**

The objective of *the SNA-NT application* has been to construct an efficient set-up with respect to routines for creating, balancing and annual updating of the National Accounts for a country.

The SNA-NT application follows the compilation methodology of the Norwegian National Accounts, but is developed so other countries of different size and economic structure may use it. The methodology, definitions, accounting structure and classifications are based on the international guidelines of the *SNA93* and the *ESA95*.

The integrated National Accounts system has been developed as a Client-Server-System, where the "Clients" are Windows PCs and the "Server" is a relational database. The application was developed between 1994 and 1999, using Microsoft Visual C++ and the Oracle relational database management system. The graphical user interface consists of a number of dialog boxes. The SNA-NT application contains modules to establish, balance and update Supply and Use Tables (SUT) in current prices. The SNA-NT also converts the SUT in current prices of the particular year to the prices of the previous year. A procedure is developed to convert the Supply and Use Tables into "Industry format" input output tables (I-O) in current and constant prices. The SNA-NT also contains a module for compiling Tourism Satellite Accounts.

The SNA-NT application can be made available to be used by other countries, as part of a consultancy contract with Statistics Norway.

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