

Regional Workshop on Supply and Use Tables

2-4 October 2018, Chisinau, Moldova

Short description of construction of Supply- and Use- and IO- tables using Danish methods.

Software used in Statistics Denmark.

Danish national accounts are compiled using different types of software for different purposes.

Source data is transformed, corrected, grossed up and made ready as input to the Supply- and Use matrices using the SAS package. New systems are expected to make more use of database tools in the treatment of basis statistical data.

Reconciliation takes place in a "SUT-environment" where data is stored in a few flat text-files, but to the people, who are working with the SUT-data, the SUTs appear as tables in Excel-spreadsheets. This is made possible by a system of Pascal-programs that perform all the heavy calculations and Visual Basic macros that are used to extract data into Excel-sheets and to enter corrections from Excel-sheets into the files where the SUTs are stored. The common SUT files are kept on a network server, where they are available to those people who are simultaneously working with manual adjustments to the figures.

Manual correction of the SUT's content is supplemented by tools that perform automatic balancing of product-balances and tools that can make more comprehensive adjustments to selected areas within the matrices. Finally when The SUTs are sufficiently close to being balanced, final adjustment are done by programs written in Pascal.

The SUT environment for annual final figures contains approximately 2300 product-balances, a number that is huge compared to the SUTs of most other countries. The tradition to use of this level of detail goes back to the year 1966 and it is the most important reason behind the "hybrid" nature of the balancing software. Its latest version is prepared for balancing of physical product balances as well as the balances in values.

SUTs in previous year's prices are compiled by deflation of all product-balances of the SUTs in current prices. An initial SUT-file in previous year's prices is compiled by automatic deflation of the current-price file. There is, however, still a need for further control and adjustment before deflation can be considered to be final. To the extent that manual corrections are needed here, the same system is used as for SUTs in current prices.

Statistics Denmark compiles only industry by industry input-output tables based on the "fixed product sales structure" assumption. One of the good things about this method is that it is rather easy to do with appropriate software once the SUTs are final. At this moment IO-tables are compiled using the "Gauss" package, but it is considered to switch to the use of "R".

The balanced SUTs constitute the core of the Danish final national accounts, but they do not themselves provide tables for publishing or figures in chained values. SAS-programmes are used for this purpose.

A down-scaled version of the system used in Statistics Denmark.

A system very much like the system used in Statistics Denmark is used in Greenland where the number of product balances is 680. This system is somewhat simpler than the newest system used in Statistics Denmark, but it is still a “hybrid” using Excel as the user-interface, Excel macros to extract and save data and Pascal-programs to do the heavy calculation work. The system keeps the SUTs on a file server and manual balancing takes place in a similar multi-user environment. Tables for publishing in current, constant and chained constant prices are here calculated in an Excel-workbook. “SAS-IML” has been used for compilation of symmetric IO-tables, but is now being replaced by “R”.

Alternative used in countries assisted by Danish consultants.

In other countries where source data made it possible to create SUTs with 250 to 800 product balances, we have created systems where an Excel-workbook contains the matrices for a year. This solution has the advantage that the SUT-tables are visible to the users as matrices, but in practice it may still be difficult to overview the entire system as the majority of cells are empty. To facilitate the process of manual corrections, a macro-sheet with Visual Basic programs provides the most important functions known from the Danish System. This includes procedures for extraction of product-balances and industry outputs and inputs to separate sheets, saving of corrected data into the SUT-matrices as well as a number of procedures for automatic balancing of whole matrices or selected areas within the matrices.

It should be noted that the systems have been tailored to the specific conditions of each country. The dimensions of the system depends on available data sources and formulas for calculation of the distributions of trade and transport margins, taxes on products and VAT should as far as possible reflect the actual legislation and practises of the country in question.

What is required by each of the solutions mentioned above?

Thus “the Danish system” may mean – at least – three different pieces of software. The software used in Denmark and Greenland relies on both Visual Basic macros and executable programs written in Pascal. The latter can be compiled with “Embarcadero Delphi” or with the open source software “Lazarus” that is available for free on the internet. These systems can process large data files very fast. However, adjustments to the programs do require some programming skills. At this moment both systems produce listings in the Danish language. From earlier experience we know that some changes to variable-names are needed if the Excel macros shall work correctly in an English Excel-environment.

The purely Excel based systems do not require access to other compilers. They are probably easier to understand to unexperienced users. The macros work with a reasonable speed if the matrices have modest dimensions. They were originally written with English texts and comments, and they have been tested on computers with English versions of Windows and Excel. The texts can be translated into other languages without big efforts. There may, however, arise some needs for adjustments when future versions of Excel introduce changes to its macro language.

Phases in construction of a SUT-system:

Initially it is necessary to look into the available data to get an impression on the level of detail that will be feasible for the new system. These considerations should lead to decisions on the number of rows and columns in the SUTs and appropriate codes for products, transaction types, industries and consumption groups. Decisions must also be made on the number and content of valuation-layers. The usual layers in our systems have been: Basic prices, wholesale and transport margins, retail trade margins, taxes less subsidies on products, VAT and purchaser’s prices.

When such decisions have been made, an initial empty system can be established. If the system shall replace an older existing system, it will probably be possible to use the existing classifications as the starting point for the new codes.

Independently of the kind of software, source data need to be brought on a standardized format with a common coding before it can be entered into the SUT-framework. In the systems mentioned above, specific formats are defined for Excel-sheets with inputs to the SUT-framework. If the system shall replace an older existing system, the inputs to the old system can probably rather easily be transformed into the standardized format used in the new system. Otherwise Experience shows that this phase may be rather time consuming, as problems are often revealed during the process.

“Targets”, initial estimates of total use, for each column on the uses side will usually be based on primary statistics, for instance SBS-statistics or household budget surveys. Source data may need to be grossed up to cover the economy as a whole.

The – hitherto – empty SUT-framework is now be populated by the contents from standardized input-sheets. This will include domestic production, imports and exports by products, known inputs in specific cells etc. Some values should be marked as “predetermined”, other values will represent best possible guesses, and are allowed to change in automatic balancing procedures.

Changes in inventories should as far as possible be calculated according to national accounts definitions excluding holding gains and -losses. The values will need to be distributed by products.

Estimates on trade-margins/trade margin percentages by product groups should be calculated. Taxes on products should be broken down by products based on legislation. Method for distribution by uses must be chosen. The distribution of VAT by products and uses should be “programmed” based on the country’s VAT-legislation. Formulas that are chosen for calculation of margins and taxes should include adjustment-factors that can be used for final adjustment of these values to their corresponding “supply”-values.

When the SUT is populated by those values that are more or less known, it will be necessary to provide initial estimates of values for remaining cells that should have a value.

The following phase consists of manual balancing of the SUTs. Typically this work is done by a few persons, each with specific responsibility for a complex consisting of industries and final uses that have a significant interaction (for instance agriculture, food-manufacturing, restaurants and household consumption of food products). Each complex is examined and – when necessary – adjustments are entered into the common file or workbook that contains the updated version of the SUTs. If we are going to replace an older system, the new balancing-method may differ from the old method. In the above mentioned “Danish” systems balancing is typically done simultaneously in all value levels. For each product (“row”) the target for total use is supply at basic prices. For each use (“column”) the target is estimated total use at purchaser’s prices!

When adjustment have removed differences between supply and use of each product and reduced differences between actual totals for uses and the corresponding “targets” for these totals, the final balancing of the system can be performed by a number of automatic adjustments that ensures that margins on the uses side equal supply of such margins and that VAT sums up to total revenue from VAT.

SUTs in previous year’s prices (or constant prices using another base-year) can be calculated when price indices are available for all products for the relevant years. At least one price index is needed for each product, but it is preferable to use separate indices for domestic production and imports if they can be

assumed to be different. Similarly there may be known differences between price changes for different categories of use.

IO-tables can be compiled using the results from the balanced SUTs with appropriate software for matrix-calculations.

Possible use of Danish SUT systems in other countries:

When another country will consider the use of Danish system and methods, a first step can be to have a meeting, where Danish experts can get some knowledge on the national accounts of the country in question. If an existing SUT-framework already exists we will need some knowledge on its properties, before giving advice on how it may be replaced by a new system.

In any case it will be useful for us as experts to collect some knowledge on the data sources behind national accounts calculations if we shall make a proposition for the dimensions and size of a SUT-system.

Before any decisions are made, an introductory meeting should be arranged where we can exchange information on existing SUTs and data sources as well as the Danish systems and methods.