

# SUT balancing procedures

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# Phases in the balancing process I

- A fully populated version of the SUT must exist before the balancing can take place. A set of initial targets for the column totals of the use-table must exist.
- The balancing will usually start with automatic adjustments that removes differences to targets where it is possible without unacceptable distortions to known structures. This can include an initial adjustment that removes differences between supply and use for as many products as possible.
- The next phase is manual balancing. Here a number of unsolved problems will need to be investigated leading to correction to the initial product balances.
- People who participate in the balancing exercise should have knowledge on the reliability of the different parts of the tables as well as the reliability of each of the targets for column totals.



# Phases in the balancing process II

- The software used by the balancing staff should provide easy access to the data they are working on. It should be easy to enter corrections into the SUT environment and to see the consequences of corrections. Documentation of corrections should not require too much extra work.
- It is recommendable that constant price version of the SUTs is updated together with the SUTs in current prices. Finalization of the constant price SUTs should, however, wait until the final balancing in current prices has taken place.
- The manual balancing shall remove differences between supply and use at basic prices for each product. Differences between column totals and their targets shall be brought within an acceptable distance. A number of targets will usually be revised as a result of this process.
- The final balancing must ensure that identities are observed. It shall also ensure that distances to reliable targets for column totals are either removed or minimized.
- The final balancing will often be performed by automatic procedures. A number of methods are available for this purpose.



# Preparation of data inputs I

- Detailed data from primary statistics should be ready to be entered into the SUT-environment:
  - Imports and exports of goods by product
  - Imports and exports of services by product
  - Accounts statistics is used to calculate the initial estimates for total production, intermediate consumption by industry and totals for changes in inventories by type.
  - Production in manufacturing and specific service industries by industry and products can usually be based on primary statistics
  - Initial household final consumption can be compiled based on information from retail sales indices, grossed up household budget survey and for some specific COICOP groups estimates based on supply side information or other subsystems.
  - Initial GFCF by type must be estimated, even if it is uncertain.



# Preparation of data inputs

- A complete supply matrix at basic prices must be available.
- On the uses side targets must be available for all “column-totals” (intermediate consumption, household final consumption, consumption of NPISH’s and general government etc.) at purchasers’ prices.
- Systems for drawing up targets for the totals mentioned above are found in all national accounts offices. Some of these calculations may also provide the distribution of production by products for their respective industries.
- The word “targets” is used to show that these values are usually not the actual column-totals of the initial version of the SUT, nor are these totals necessarily equal to their targets in the final balanced version of the SUTs.



# Subsystems

- Changes in inventories by products should preferably be compiled in a special subsystem.
- A number of other subsystems may be used to calculate production and distribution of use by industry of specific products such as energy, other motor vehicle related expenses, construction, financial services (including FISIM), insurance, repair and maintenance, fringe benefits and hidden economy.
- Taxes and subsidies on products should be distributed by product . In special cases a full distribution by industry / consumption group / other category of use can be calculated in a subsystem.
- Other taxes and subsidies on production will also need to be distributed by industries in a subsystem, but they are part of the GVA-table.



# Populating the uses side

- Typically subsystems produce figures for uses by product and industry within specific areas of the economy. These figures can be entered directly into the SUT and may be treated as predetermined values, which means that their values are never changed automatically by software.
- Some categories of use can be entered into the SUT as predetermined only at purchaser's prices. Among those are collective consumption, changes in inventories, and some types of GFCF and exports.
- The next step is to complete the initial unbalanced version of the SUT. Before any balancing or distributive procedures can begin we need to have some plausible figures in all relevant cells on the use side.



# Completing the initial use-table

- The cells that should have values, but could not be entered directly based on source data will now need to be filled with initial estimates. Survey data on inputs, household budget surveys or information from government accounts provide structures that can be utilized for this purpose.
- Trade and transport margins must be given initial values and taxes on products should be distributed by uses.
- VAT by products and industries / final uses should be calculated in accordance with VAT-legislation.
- If SUTs are available for a previous year, the default solution is to use previous year's structures and relations inflated into prices of the actual year to fill the gaps where no other information exist for the actual year.



# The SUT environment

- The SUTs should be stored with a standardized file-format. Supply values are stored at basic price, the uses side should contain space for basic prices as well as all valuation layers that together will sum up to purchasers' prices.
  - In the Danish SUT-environment, each record has a field that can show the value that has actually been reported to primary statistics. Where such values are present, they are often lower than the corresponding basic or purchasers' price values that include the distributed values of supply or use that was not specified by products in primary statistics. The primary-statistics field is shown as useful information for the people working with manual balancing; it is not a part of the SUT itself. Furthermore the record-format now includes fields for quantum-data and the unit used for quantities, usually tons. They are prepared for use in material-balances. It also contains a code that may show origin from a subsystem, ID of the person who entered the last correction and date and time for the last correction.
- The SUTs that are being balanced may be stored in various ways depending on the type of software used in the balancing process. It can be as a database, as matrices for SAS-IML, GAUSS or "R", as SAS datasets, flat text files or Excel-worksheets.



# What should be balanced I

- The balancing process should end up with:
  - In basic prices total supply must be equal to total use for each product except for products that are fully or partially distributed as margins in the margin layer/s.
  - Total use of trade and transport margins must be equal to the supply of such margins.
  - Taxes and subsidies on products must be equal to the values based on government finances for each product.
  - The grand total of the VAT-layer must equal the VAT-revenue based on government finances.
  - Input at purchasers' prices shall equal the target values for intermediate consumption for each industry. Some of these targets may, however, be considered less reliable than others. In such cases deviations can be accepted.
  - Input in General government at purchasers' prices will usually need to be equal to the totals based on government finances.



# What should be balanced II

- Household final consumption at purchasers' prices should come close to the targets for consumption groups. These targets are, however, less reliable than targets for intermediate consumption based on accounts statistics.
- If final consumption of NPISH is based on reliable statistics the targets should be met, otherwise differences may be acceptable.
- Final consumption of general government at purchasers' prices should be equal to the targets based on government finances
- GFCF may be known for a number of industries. The totals for specific types of investment, for instance civil engineering projects, may be reliable, but in general the initial estimates are uncertain, and investment is in the end determined by the availability of products used for GFCF.
- Inventory changes are often uncertain, but deviations from the initial estimated targets at purchasers' prices should usually only be used to balance the system when this is the most credible solution to a specific problem.



# At which level shall balancing take place?

- The choice of value level for balancing differ between countries.
  - Balancing at basic prices has the advantage that supply and use for each product can be balanced without taking into account, that subsequent balancing of margins and taxes to their targets will create new differences to the column targets at purchasers' values.
  - Balancing at purchasers' prices requires that margins and taxes by products are fixed before the product balances are finished. A difficulty is here that VAT may change as a result of corrections on the uses side and may also change during the final balancing to the total VAT-revenue.
  - Balancing at purchasers' prices less non-deductible VAT will reduce this problem. The "true" distribution of VAT should, however, be influenced by corrections to the redistributions between uses during the balancing procedures. Hence purchasers' prices exclusive of VAT ought to be recalculated during balancing to take such changes into account.
  - Balancing at producers' prices is not recommended here, as SNA does not recommended to have a producers' price layer on the supply side.



# Simultaneous balancing in all value levels

- The problem that needs to be solved is:
  - rows must balance at basic prices and
  - columns shall be adjusted to targets at purchasers' prices.
- An ideal system shall adjust all value layers simultaneously when corrections are made to either basic or purchasers' prices. This implies that:
  - When manual adjustments are entered into the SUT environment at basic or purchasers' prices the other value layers are automatically recalculated using the relations from the original SUT. VAT is recalculated using a model of the VAT-legislation.
  - The software used for automatic balancing recalculates all values in a way that - as far as possible - preserves the relations between value layers. Column sums should be adjusted to meet their targets at purchasers' prices while use should be adjusted to supply at basic prices for all products.



# Manual balancing.

- The size of the balancing staff will need to depend on the dimensions of the SUTs as well as available resources.
  - In the Danish case the SUTs have some 2.350 products. The manual balancing is here performed by 4 to 6 people that use approximately one month to balance the annual SUT. Each person is responsible for a complex of related products, industries and final uses, but they are all working on the same master file that contains the latest updated version of the SUTs. The starting point is an initial SUT where most differences between supply and use at basic prices have been removed automatically.
  - Other countries may organize their division of labour differently and their software may limit access to those parts of the SUTs that are within the responsibility of each member of the balancing staff.

# Simultaneous updating of SUTs in current and constant prices

- Every time the SUTs are updated with corrected values, it is possible to calculate a new SUT at constant (previous year's) prices using the price-indices that are available.
- The final version of the price indices may not be ready at this time. Nevertheless the balancing staff can get an impression of the resulting product balances in constant prices. It may lead to revision of price indices and constant price margins, taxes or subsidies.
- It is, however, the Danish view that finalization of the SUTs at constant prices should not be attempted until the product balances at current prices are finalised, as the final balancing can affect the distribution at basic prices as well as margin-, tax-, subsidy- and VAT percentages. (The Dutch software solution may solve such problems by a simultaneous final balancing of both SUTs)



# Effects of the manual balancing

- Experience shows that the manual balancing will reveal several serious problems in the primary statistics behind the values entered into the initial version of the SUTs. Such problems should preferably be solved in cooperation with the producers of the statistics in question.
- During the manual balancing it is important to look at time series and to detect incredible developments.
- Manual balancing is finished when incredible figures are corrected, column totals are brought within an acceptable distance to their targets. (In Denmark it is required that all products are balanced, but it may in some systems be sufficient that differences between supply and use are small).



# Final balancing

- Final balancing must ensure that identities are observed and that column totals are adjusted to those targets that are considered reliable.
- After manual balancing it is necessary to remove remaining differences between supply and use of trade- and transport margins and the difference between the VAT-total and the target for VAT-revenue.
- Final balancing may be performed manually, but in a system with many product balances this will usually require that corrections are made within limited areas within the SUTs. In the long run this can result in unwanted distortions.
- A number of methods for automatic final balancing exist. Some are mentioned below. Some methods require that information is supplied on the relative reliability of the individual cells of the SUTs. Others only distinguish between predetermined values and values that are allowed to change during automatic balancing.



# Automatic balancing

- RAS method.
  - In its simple form, it can be performed by repeated proportional adjustments of a matrix to targets for row- and column totals. It cannot treat negative entries in a sensible way.
  - GRAS, Generalized RAS, allows elements of the matrix to be predetermined. It can be used when some entries are negative.
  - TRAS allows constraints arbitrary subsets of the matrix elements
  - KRAS includes the features of GRAS but allows for conflicting data.
- Stone method.
  - adjusts data in order to satisfy a number of linear constraints.
  - It uses information on the relative reliabilities of the initial data in form of a covariance matrix. Its practical problem is, that the covariance matrix is often unavailable. It must be estimated either by specialist knowledge, by observations of earlier variations or by using simple assumptions in a trial and error process until the result is acceptable.



# A Dutch system

- Convex quadratic constrained optimization.
  - A method that is used for simultaneous balancing of SUTs in current and constant prices as well as price and volume ratios using a loss function that must be minimized under a set of linear constraints. The loss function minimizes the quadratic sum of weighted differences between initial and balanced data. The constraints are either strong or weak.
  - The minimization problem is solved by mathematics packages. In the Netherlands the system requires participation of four mathematicians that are employed outside the national accounts division.
  - The Dutch SUTs contain figures rounded to one million euros. The balancing is done primarily in purchasers' prices exclusive of non-deductible VAT.



# A Danish system

- The Danish system, a variety of generalized RAS.
  - Values SUTs are here either predetermined or not. Predetermined values are never changed by automatic balancing, other values can be adjusted within certain restrictions. They are not allowed to change sign and adjustments take place within some limits.
  - The Danish system perform a simultaneous balancing of all valuation layers.
  - One subroutine balances a product balance by a proportional adjustment to all non-predetermined values at basic prices and recalculates non-predetermined values of other layers. VAT is recalculated using the VAT-model based on Danish VAT-legislation, but the VAT-rate may be adjusted.
  - Another subroutine performs a similar adjustment of a column-total at purchasers' values to a target for this total. Like the row-adjustment it leaves predetermined values untouched. The percentages used in these calculations may be adjusted by a small correction factor.
  - Calls to the two subroutines replace traditional row- and column adjustments of the generalized RAS. Repeated calls are used to balance the SUT as far as possible. Final balancing of margins is done by small adjustments to global adjustment factors. for A few systematic guesses are needed to meet the target for each type of margin. Finally VAT is balanced by adjusting the VAT-rate for specific uses.

