6. The balancing or integration procedure and validating the estimates

6.0 GDP balancing procedure

6.0.1 Target total module

Before the balancing of GDP can take place in the supply and use tables, so-called target totals for supply and use are compiled. This is done by collecting the information from intermediate system 2 and other systems in the target total module. The codes in the target total module and how they are defined from the intermediate system 2 are shown in table 6.2. The TRANS codes correspond to transaction codes, and are those used in the supply use tables. The interpretation is:

Table 6.1 Codes in the target total module

0100	Production
0700	Imports
0900	Customs and duties on imports
2000	Intermediate consumption
3110	Household final consumption
3130	NPISH consumption
3141	Government individual consumption expenditure, market
3142	Government individual consumption expenditure, non-market
3200	Collective consumption
5110	GFCF in Residential Buildings
5121	GFCF in Non-residential Buildings
5122	GFCF in Structures
5131	GFCF in Transport equipment
5132	GFCF in IT equipment
5133	GFCF in Communication equipment
5139	GFCF in other machinery and equipment
5140	GFCF in Weapons systems
5150	GFCF in Changes in cultiv.assets
5171	GFCF in Research and development
5172	GFCF in Mineral exploration
5173	GFCF in Computer software
5179	GFCF in Entertainment, literary or artistic originals
5210	Changes in inventories, Materials
5221	Changes in inventories, work-in-progress on cultivated biological assets
5223	Changes in inventories, Finished goods
5251	Changes in inventories, Goods for Wholesale trade
5252	Changes in inventories, Goods for Retail trade
5263	Changes in inventories, specially compiled
5264	Changes in inventories,
5300	Acquisition less disposals of valuables
6001	Exports of goods and services, danish production
6007	Exports of goods and services, re-exports

Total supply is defined as: 0100+0700+0900
Total use is defined as: 2000+3110+3130+314x+3200+51xx+52xx+5300+600x

Rearranging the variables gives GDP:

0100-2000= GDP from the production side
3110+3130+314x+3200+51xx+52xx+5300+600x(net) = GDP from the expenditure side

After the balancing, which takes place at the product level (2350 products), the two expressions for GDP equal. It must be noted that 0100 and 2000 are compiled at the 117 industry level and 3110, 3130 and 314x at the level of 74 individual consumption groupsand 3200 is subdivided into 10 groups according to purpose.

Table 6.2 National accounts target totals - functional system

TRANS	Intermediate system code		Definition/comment
0100	Domestic production		
	=	1003	Output of originals
	+	1005	Hidden economy output
	+	1007	Fringe benefits, output
	+	{1008}	{FISIM (financial industries only)}
	+	1009	Work for processing
	+	1011	Repair and installation work for others
	+	1012	Manuf.e of plant and machi. for own use
	+	1013	Other net sales, own products
	+	1014	Output for own consumption
	+	1015	Own account software
	+	1016	Sales of goods for resale
	-	7019	Consumption of goods for resale
	+	1017	Income from licenses and royalties
	+	1018	Other operating income
	+	1059	Other turnover
	+	2065	Changes in inventories, finished goods
	+	2099	Total price correction, goods for resale
0700[1]	Imports of goods and services		
0900[1]	Customs and duties		
2000	Intermediate consumption		2011+2018
2011	Input, ex. R+M, IPC and FISIM		
	+	2009	Interm. cons., total gen. gov. (OIMA)
	+	2013	Purchases (consumpt.) of fuel and power
	+	2014	Purchases of work for processing
	+	2015	Other consumption of raw materials
	-	2098	Total price corr., stocks of raw materials
2018	Input; R+M, IPC and FISIM =		
	+	7020	Expenditure on rentals, excl. heating
	+	7021	Renting and leasing of machinery
	+	7022	Renting and leasing of transport equipm.
	+	7023	Rent. and leasing of computer equipm.
	+	7024	Other exp. on renting and leasing
	+	7025	Expendit. on consumables
	+	7027	Repair and maintenance; buildings
	+	7028	Repair and mainten.; other constructions
	+	7029	Repair and mainten.; transport equipm.
	+	7030	Repair and mainten.; machinery
	+	7031	Repair and mainten.; buildi. and constr.
	+	7032	Rep. and maint.; machi. and transp. equi.
	+	7035	Rep. and maint.; not specified.
	+	7040	Contributions to the trade
	+	7041	Expenditure on licences and royalties
	+	7042	Other external expenditure incl. in input
	+	7044	Public fees as purchases of services
	+	7050	Financial interme. services directly paid
	+	7051	FISIM
	+	7055	Insurance (negative) corr. from premiums to services
	+	7059	IPC corr. when transf. to/from other MLS-codes

Note: [1] Indicates that data are not derived from the intermediate system.

Table 6.2 National accounts target totals - functional system, cont.

ANVID	Intermediate system code	Definition/comment
3110[1]	Household final consumpti. expen.	
3130[1]	Consumption, NPISHs	
3141[1]	Gov. indiv. consum., market output	
3142[1]	Gov. indiv. consum., non-market output	
3200[1]	Government collective consumption	
5110[1]	Residential buildings	
512.	Capital formation, build. and struc.=	
	+ 6121 (part of)	Acquisitions, existing buildings
	+ 6123	Construction expenditure, new buildings
	+ 6124	Rebuilding, building improvements, etc.
	+ 6125	New construct. and rebuild. of roads etc.
	+ 6126 (part of)	Acquisitions of other real estate
	+ 6140 (part of)	Acquisitions, work in progress
	- 6221 (part of)	Disposals, existing buildings
	- 6223 (part of)	Disposals, roads harbours etc.
	+ 6321	Acqui. and disp. of exist. build. (gen. gov. (OIMA))
513.	GFCF, machin. and transp. equip.=	
	+ 6131	Purchases of machinery and equipment
	+ 6132	Purchase of cars
	+ 6133	Purchase of other transport equipment
	+ 6134	Purchase of other equipment
	+ 6140 (part of)	Acquisitions, work in progress
	- 6231	Disposals of equipment
	- 6232	Disposals of cars
	- 6233	Disposals of other transport equipment
	- 6234	Disposals of other equipment
5140[1]	GFCF in Weapons systems	
5150	Capital formation, breeding stock=	(relevant for agriculture only)
	+ 6127	Purchases of breeding stock
	– 6227	Sales of breeding stock
5300[1]	Net purchases of valuables=	
5171[1]	GFCF in Research and development	
5172	Mineral exploration=	
	+ 6104	Mineral exploration
5173	Purcha. and own account software=	
	+ 6101	Own account software
	+ 6102	Purchased software
	– 6202	Disposal of software
5179	Entertainment, cultural and artistic originals=	
	+ 6103	
	+ 6110 (part)	Originals, own account and purchased
	- 6203	Other acquisitions of intangible assets
		Disposals of artistic originals
5210	Changes in invento., raw materials=	
	+ 2060	Changes in inventories of raw materials
5221[1]	Changes in inventories, work-in-progress on cultivated biological assets	
5223	Chang. in invent., finished produc.=	
	+ 2065	Changes in inventories, Finished products
5251	Changes in inventories, wholesale=	
	+ 2061	Goods for resale, wholesale
5252	Changes in inventories, retail=	
	+ 2062	Goods for resale, retail 1)
5263[1]	Changes in inventories=	
	+ 2063	Changes in invent., sources other than account statis.
5264 [1]	Chang. in inventories=	
	+ 2064	Changes in inventories, based on product balancing
600. [1]	Exports of goods and services	2081 + 2082
6001[1]	Exports of goods and services, danish production	
6007[1]	Exports of goods and services, re-exports	

Note: [1] Indicates that data are not derived from the intermediate system.

When the target totals are compiled, they are subsequently distributed by 2350 products as described in section 6.0.2

6.0.2 Supply and use tables as a framework for balancing

Supply and use tables and the compilation of national accounts

The current system of Supply and Use Tables (SUT) for Denmark was established in the mid-seventies. Since then the calculation of annual SUTs has been a totally integrated part of the compilation of annual National Accounts in both current and constant prices.

The integration of SUT in the compilation of National Accounts implies that a number of NA aggregates are derived directly from the SUT. This in particular relates to all the NA aggregates in the "Goods and services account" and the "production account". The integrated procedure is in contrast to a procedure where SUT are compiled after the production of the NA figures implying a number of restrictions on the totals of the SUT.

In general terms the advantage of having the compilation of SUT as an integral part of the production of national accounts can be formulated as follows:

- It is the most efficient way to incorporate all basic data – aggregated or detailed – into the national accounts framework in a systematic way.

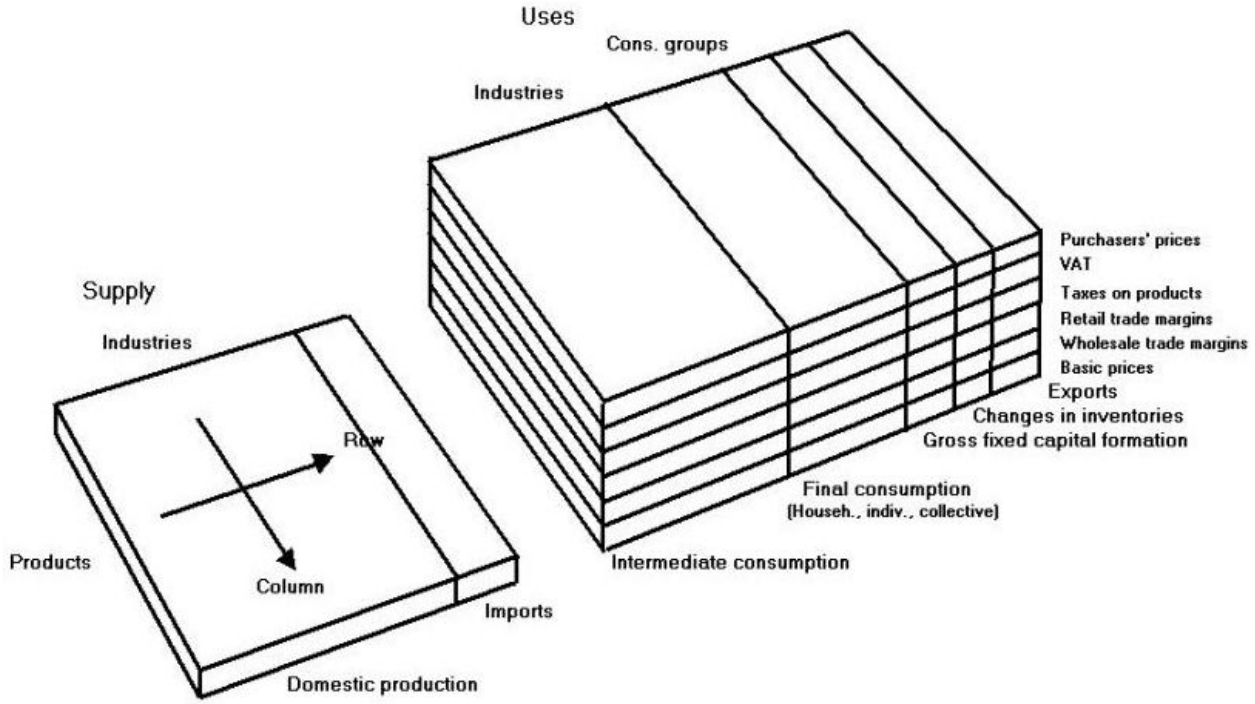
- It is an effective way to ensure consistency at a detailed level and thereby improve the overall quality of the national accounts.

The Danish SUT are compiled in connection with the final annual accounts, which are released with a delay of almost three years. The structural information entailed in the SUT for the latest final year is used in the compilation of preliminary annual and quarterly national accounts but no balanced preliminary or quarterly SUT are produced. The description in the following therefore refers to the compilation of the SUT as a part of the final annual national accounts.

The framework of Supply and use tables in Denmark

The principle of the Danish SUT-system is illustrated in figure 6.1. It shows the supply and use of all products and the treatment of the connection between the different value-levels (basic values, purchasers' values). The sub matrices for basic values, trade and transport margins, net taxes on products, non-deductible VAT and purchasers' values are stacked as "layers" to visualise the transformation from basic to purchasers prices for each cell of the system.

Figure 6.1



Products are shown as rows, categories of use (by industries, consumption groups etc. when relevant) are shown as columns. Notice that what is here referred to as rows and columns consist of the relevant parts of all the “layers” shown in the figure.

As a starting point supply is shown as a matrix of basic values in the left side of the figure. At the right side of the figure the use matrix at basic prices is shown as the bottom "layer". In the balanced commodity flow system total supply at basic prices must equal total uses at basic prices for each product. Trade- and transport margins are here a special case: At the supply side they are shown as output of trade services at basic prices from the industries in which they are produced but they are left out from the basic price level on the uses side. Here they are shown in the margin-matrices where they are distributed together with the basic values to which they are related. The wholesale trade matrix also includes transport margins.

Net taxes on products and non-deductible value added tax are also distributed as matrices uses side.

In the rows and the columns we distinguish between the following groups:

There are at this moment approximately 2350 products, which consist of approximately 1960 goods and 410 services. For goods the categories are defined as one or more 6-digit Harmonized System groups. There is at least one NA-good for each 4-digit HS-group. A key linking the NA-goods to CPA has been established. For services the categories are in principle based on 4-digit CPA. In some areas 4-digit CPA groups have been subdivided (e.g. in the area of business-services) in others a number of 4-digit CPA groups have been aggregated to the NA-categories (e.g. trade) The NA-categories for services are kept almost constant for a number of years. The key defining the NA-categories for goods are updated annually in order to take account of - normally relatively few - changes in the HS-groups.

The number of columns for domestic production is 117 reflecting that we distinguish between 117 activity groups. Those groups are based on the official Danish nomenclature for activities, which have direct links to NACE and ISIC. The classification in to activities is based on establishment units (Local-kind-of activity units). In a few cases we have found it important to have more homogeneous branches defined by activity. This applies to agricultural production, construction, trade and motor vehicle repair. Thus for example we combine all trading activity into the activity-defined trade-industries, regardless of the industry in which the activity is classified in the primary statistics.

The import column is a vector showing import by products. At a later stage we expand it into a matrix including a geographical dimension, but this is not a part of the core SUT-framework.

Intermediate consumption is broken down by the same 117 industries as domestic production. Until recently the uses side had an extra branch showing the intermediate consumption of FISIM; this branch has disappeared as FISIM is now distributed by uses.

Final consumption expenditure of households and NPISH is subdivided into 74 COICOP groups. The classification is based on COICOP.

Final consumption expenditure of general government is divided into three major groupings, collective consumption expenditure, individual consumption expenditure on services produced by general government and individual consumption expenditure on services produced by market producers but paid by general government and supplied to households - without any transformation – as social transfers in kind. The first group is further subdivided into 10 COFOG groups, whereas the other groups are further subdivided into the 74 COICOP groups.

Gross fixed capital formation is subdivided into thirteen groups according to type of investment good (transport equipment, new buildings etc.). In combination with the product-rows this leads to a diagonalistic structure with very few off-diagonal elements. The justification for this subdivision has to do with practical aspects of our systems for preliminary and quarterly accounts. A separate system distributes each type of GFCF by products and 69 industries.

Changes in inventories are classified into 7 groups depending on the kind of stocks (for example stocks of raw materials, inventories in wholesale trade etc.)

Exports are for reasons of deflation divided into two categories, ordinary exports and re-export. At a later stage we expand it into a matrix including a geographical dimension, but this is not a part of the core SUT-framework.

Overview of the balancing process

The process of constructing the SUT for a given year can be summarised into the following steps:

The first step is to gather all the available data on the actual year on target totals and other values that can be entered directly into the system as predetermined.

The next step is to create a complete initial version of the SUT. This version is compiled using automatic processes, but at this stage a number of unsolved problems will remain: For some products supply will not equal uses. For most categories of use the totals will usually differ from their targets. Total trade and transport margins and total VAT may also differ from their respective targets. This step will be referred to as "Automatic balancing".

Then follows a step, where the initial version of the product-balances is adjusted manually. The unsolved problems are examined closely. In many cases such problems will reveal errors in the calculations that produce data-input to the product-balances or in the primary statistics itself. Solutions to such problems may be found in co-operation with the relevant sections of the statistical bureau and may involve changes in supply, predetermined uses or target-totals. A number of products are redistributed between uses to bring the distance between totals and targets within an acceptable range for each category of use. Corrections to the initial balances are entered into the system to create a new - but not yet final - version. This step will be referred to as "Manual balancing"

In the last step the differences between totals and targets are removed except where such differences are considered acceptable. In this step trade and transport margins and VAT are finally adjusted to their targets. This step will be referred to as "Final balancing".

Incorporation of available data on the actual year

In a number of subsystems all available data are prepared by suitable corrections before they are incorporated into the SUT-framework. The available data for a given year is never complete in the sense that it enables us to fill out the full supply and use tables. However it offers – as briefly described below – a sufficiently restrictive frame for the values in the system in order to fill out the complete SUT in a reliable way.

In general terms a short description of the data that on an annual basis is incorporated directly into the SUT-framework would be:

On the supply-side (cf. fig. 1) the available data allows us to fill out the complete supply matrix annually. Data from the agricultural accounts, accounting statistics (from the Structural Business Statistics) and the General government accounts makes it possible to calculate total output in basic values (column totals for industries in fig.1) for almost all industries. Only for a few branches (financial intermediation) separate calculations have to be made.

The distribution of the total output of industries on products is for agriculture and general government derived directly from the primary statistics. For manufacturing the output-totals are combined with the Prodcom statistics to calculate the product distribution. Information on the product-distribution in the service area is somewhat scarcer. For some service industries we have annual information on the output by products, for example transport and IT-industries. For others we might rely on older ad-hoc information on the product distribution. In some cases where it seems reasonable and we have no other information we assume equality between output of a given service industry and the characteristic product. For example we assume that the output of architects consists of architectural services and the output of hairdressers consists of hairdressing. When this assumption is used it is done at the most detailed industry-level (in total 800 industries).

The total and product-distribution of the import column is directly available from the foreign trade (goods) and balance of payments (services) statistics.

On the uses side we have less abundant information, usually only for column totals. Except for final consumption expenditure of general government, exports and change in inventories we only have scattered and often irregular information about the use in a given category distributed by products.

For intermediate consumption by industry the total values in purchasers' prices are extracted from the same sources used for the calculation of total output.

The totals at purchasers' prices for each of the 74 groups of final consumption expenditure of households are estimated using a variety of sources, most important information on the value of retail turnover to households and the household budget surveys. Data on final consumption expenditure of general government are available directly from the statistics on general government accounts both for the totals and the distribution by products.

The subsystem for the estimation of the totals at purchasers' prices for the ten different groups of gross fixed capital formation is rather comprehensive. The accounting statistics together with information on new established firms gives us for each industry a grand total for gross fixed capital formation. Together with information on the total domestic supply of some investment goods (transport equipment, construction, breeding stocks a.o.) the totals at purchasers' values for each of the ten groups can be estimated.

Changes in inventories pose a special problem, first of all because it would be nonsense to assume a distribution by products proportional to the preceding year. Secondly a residual calculation of the change in inventories of each product using the definition that supply equals demand at basic prices is refused in part because we think we can make more reliable estimates but most importantly because this would eliminate the use of the identity between supply and use as a tool for evaluating all the other estimates.

In some cases we have available data on stocks of specific products, notably agricultural and energy products, but the usual data input is information on the value of opening and closing stocks in each industry. These stocks are then distributed by products based on particular assumptions. For example inventories of raw materials in a given industry will be distributed proportional to the intermediate consumption of goods in that branch. Stocks in a given trade branch will be distributed proportional to the supply of goods typically traded in that trade branch. The changes in inventories are then calculated for each product using the usual price-correction-

technique. The result is a column for changes in inventories distributed by products (at purchasers' values) that might be attached a reasonable amount of plausibility.

The total and product-distribution of the export columns (at purchasers' values) are directly available from the foreign trade (goods) and balance of payments (services) statistics.

As it has been seen most column totals will be calculated at the level of purchasers' prices. We have however some subsystems that calculate column totals for other value-levels as well. For example we make calculations for the column total of retail trade margins for some consumption groups. This implies that for those groups we have column totals for two (or more) value levels.

On the use side we also have some subsystems that annually determines parts of the use-matrices. For instance we have subsystems for repair and maintenance of buildings and other construction and a subsystem for energy products. These subsystems determine the complete rows for these products on the use side at all value levels.

Other subsystems determine individual cells or a number of cells on the use side. This includes gross fixed capital formation in construction, railroad rolling stock, ships and airplanes and a few other areas. For a given year there might be ad hoc information in certain areas that is considered suitable enough in order to enter as predetermined.

Furthermore we have subsystems that calculate the total (accrued) net taxes on each product (row totals in the matrix taxes on products) and the grand total of the (accrued) non-deductible VAT based on statistics for General Government.

The above description covers data that are considered to be reliable enough to be classified as predetermined. This means that it will not be changed in the process of automatic balancing but only can be changed later according to a manual decision. It follows from these considerations that there are other information – usually less reliable – that are used in the SUT-framework. This is described in the section on automatic balancing.

The calculations results in coverage of the following parts of the SUT-framework cf. figure 1:

1. A complete supply matrix
2. Target column totals for all uses at purchasers' values
3. Distribution on the use side by products of the columns for exports and changes in inventories at purchasers' values and of the columns for final consumption expenditure of general government at all value levels.
4. Full specification for certain products (rows) at all value levels on the use side.
5. Specification of certain cells or groups of cells on the use side.
6. Total value of net taxes on products by product (Row totals for the matrix "Taxes on products").
7. Grand total for the VAT-matrix.
8. Furthermore the logic of the framework offers the following general information:
9. Total use of products at basic values (row totals for the use part of the basic value matrix) being identical to the total supply of the product. Although this is a simple feature of the system it is probably the most important feature and highly useful in ensuring the overall quality of the national accounts.
10. Grand total for the wholesale trade matrix being equal to the output of the wholesale branch.
11. Grand total for the retail trade matrix being equal to the output of the retail branch.

Initial automatic balancing procedures.

Starting point

The data described in the previous section is directly incorporated in the SUT-framework. It is as mentioned treated as predetermined values which means that it will not be changed in the process of automatic balancing but only can be changed later according to a manual decision.

Before any balancing or distributive procedures can begin we have to have some plausible figures in all relevant cells on the use side. A standard default solution is here to use inflated values and relations from the balanced SUT of the preceding year. In the absence of better knowledge we assume that product structures at basic values and corrected for price movements are constant. This is the same as assuming that the product-structure in a given column at constant prices is unchanged. Further on we assume that trade margin percentages,

percentages of taxes on products and VAT are constant over time or at least are moving in the same direction in a proportional way.

However there are a number of cases were we feel we have better information about the product structure than the standard information from updated last-years-structures. This kind of information is not considered reliable enough or suitable to enter directly as predetermined values but still to have informative value.

An example on this kind of data is the survey on raw materials in manufacturing. Another is in gross fixed capital formation where a sub-system offers a first bid on the product-structure for those cells which are not predetermined. A third example is corrections to the matrices on taxes on products and VAT in order to take account of changes in tax rates and systems.

In addition information from numerous ad hoc investigations have over the years been incorporated in the SUT-framework in this way. This can for example be investigations by the Anti Trust Authorities on the cost structure in particular industries, investigations by Statistics Denmark on building cost structure in relation to a new index for building costs, output of advertising services distributed by customers etc. The list is very long.

As mentioned above all these kinds of data replace the standard information from updated previous-years-structures. Since, however, they are not deemed predetermined they will be changed during the automatically balancing procedures described below.

Column adjustments. "Vertical distribution"

The procedures described in the previous section give us a starting point for the automatic balancing procedures. The matrices will at this point be unbalanced in the sense that total use will not equal total supply at basic values for most products, and the sum of the values in a given column will not equal the calculated target column total.

A first step towards a balanced system is adjustment of the values in the columns so they add up to the target column totals. For most uses targets exist only for totals at purchasers' values, in the full system targets may exist for other levels as well. Trade margins used in certain consumption groups can be an example.

The adjustments are made simultaneously at all price levels without changing any predetermined values. To adjust the values in a column, all non-predetermined purchasers' values are multiplied by:

(target column total - sum of predetermined values)
divided by
(sum of starting values - sum of predetermined values).

In the simple case, with a target for purchasers' values only, the same correction-factor are be used for non-predetermined values in all levels. If targets exist for other levels, the situation is somewhat more complex and there is a need for general corrections to trade margin percentages and/or tax-percentages used in the column. All these problems are solved automatically.

Some restrictions are put on the automatic adjustments to avoid creation of strange values. Automatic changes of sign are not allowed. The appearance of negative basic and purchasers' values are restricted to certain products that may be negative private consumption or disinvestments (examples: scrap, ships, cars) and uses (example: changes in inventories) unless the negative values are entered as predetermined. When both positive and negative uses are present in the same column the results of proportional adjustments can be unpredictable. In such cases we enter all negative uses as predetermined values. The programming ensures that warnings are issued when problems of this kind are encountered.

It follows that automatic adjustment will in certain cases fail to equal column totals to targets. In these cases the columns are written to a list of unsolved problems.

After "vertical balancing" we have a set of columns that (with the exception of the problematic columns mentioned above) represent an initial breakdown of the target value for purchasers' values into products using the initial assumptions about product structure from the starting values. Since all levels are adjusted simultaneously we have also a breakdown of all purchasers' values into the levels from basic prices to VAT.

Total use at basic values of each product will only equal supply in special cases as a result of predetermined values or by pure coincidence. Likewise the sum of the values in the other value levels will usually differ from their target values.

Row adjustments. "Horizontal distribution"

The next step towards balanced system is an adjustment of the values in the rows on the use side to the target totals in the rows.

The procedure starts by adjusting the level of basic values, and the adjustments are again made without changing the predetermined values at basic prises. These include basic values in cells with predetermined purchasers' values to avoid either distortion to trade margin percentages or changes to the original predetermined purchasers' values of these cells. All the non-predetermined basic values in a row (product) are multiplied by

(supply at basic prices - sum of predetermined values)
divided by
(sum of basic values from the "vertical distr." - sum of predetermined values)

and in these uses non-predetermined margins and taxes on products are changed by the same factor.

In the matrix for net taxes on products the non-predetermined values are then adjusted to the target row totals and finally the non-deductible VAT is recalculated to reflect the adjustments in the other levels.

Like in the vertical balancing procedure the computer-program is able to trap adjustments that would lead to strange and incredible values. For the same reasons as mentioned above the automatic balancing will fail to equal supply and use for a number of products. Typically supply is insufficient to cover the predetermined uses of the product. The rows that are left unbalanced in one or more levels can - like the unbalanced columns - be written to a list of unsolved problems.

The use table that is the result of the horizontal balancing procedure will (except for the unbalanced products mentioned above) fulfil the requirement that for every product total use must equal total supply at basic values and that net taxes on products should equal their target row totals.

However the sum of the values in a given column will usually differ from the target column total. Further on the sum of all trade and transport margins on the uses side will be different from the output of the trade industries and the sum of VAT will differ from the calculated total.

Automatic balancing as a repeated process.

For illustrative purposes the description of vertical and horizontal balancing has here treated the automatic balancing as two separate processes. In reality the whole procedure is handled by a single job that uses a few minutes on a PC (with a master file of approximately 50.000 records. Preparation of the data-inputs for the process is far more time-consuming). Every time the job is run, new listings of unsolved problems and resulting totals are produced.

When run for the first time with data for a new year a number of serious problems in the data-inputs will usually be revealed. Often problems can be traced back to errors and inconsistencies in data from the statistical sources. Some of these will need to be corrected because they will otherwise cause major distortions in the initial balances.

Before the system is ready for manual balancing the totals of trade and transport margins and non-deductible VAT should be brought within acceptable distance from their respective targets. Adjustments to total trade and transport margins are done by proportional adjustments to all trade margin percentages of the starting file before the vertical/horizontal balancing except in cells with predetermined trade and transport margins. If total VAT cannot be brought within acceptable limits by small adjustments to rates and assumptions used in the calculations, VAT may be left unbalanced at this stage. A search for a specific explanation of the difference may be more appropriate in this case.

In principle the vertical-horizontal balancing procedure could be repeated in an iterative manner, where each new iteration would use the result from the preceding as the starting point. In this early stage, where many problems are unsolved, this could however be a dangerous method and is therefore not used. Repeating the automatic balancing procedure from the initial starting point with specific corrections to the data inputs should not be mixed up with the iterative RAS-procedure.

Manual balancing

The unbalanced SUT resulting from the automatic balancing procedures is now transferred to the process of manual balancing. This task is conducted by 4 to 6 persons (balancers) within a month. Each person is responsible for an area of the economy. Such areas consist of a complex of industries and categories of final use with a high degree of interaction and their common products on either the uses- or production side. On the other hand all products and categories of use must belong to a complex to ensure, that they all are looked after by a responsible person.

The tasks of each balancer are the following:

Eliminate still existing differences between supply and use of products at basic prices. These differences can have various explanations. As mentioned earlier, serious problems may reveal a need to correct data from primary statistics. However, many remaining differences may be explained by differences in the coding of the same kind of products between production- and foreign trade- statistics, and the problem can then be solved by moving output, im- or exports from one product to another.

To check the credibility of the results from the automatic balancing.

To redistribute products between uses until the sum of values in a column are inside an acceptable distance from their targets.

To evaluate whether the results indicates needs for adjustment of the target column totals. The target-values will usually not be equally well founded on statistical sources. The less well-founded target column totals might be reconsidered in the light of the additional information obtained from the SUT-framework.

To keep the system manageable certain rules are to be followed. One of these is that all products are kept balanced with total uses = supply during the balancing process. This also applies to net taxes on products other than VAT. Another rule is that even though balancers are allowed to make corrections outside their "own" area they must ensure that major changes outside one’s own complex are always negotiated with the “owners” of the other complexes involved, and that information is passed between the relevant persons.

Yet another important aspect of the manual balancing procedures is the need for documentation. Many corrections entered by the “balancers” will be independently motivated with references to statistical and other available sources or with common-sense considerations. It is important that the considerations behind the solutions are visible to other “balancers” and that the solutions can be reproduced, when the same problems are encountered in following years. These comments are entered directly in the spreadsheets where the adjustments are made.

The "balancers" use spreadsheets as an interface to a master file containing the SUT-tables. The master file is placed on a network server and is shared by all “balancers”. Procedures for extracting data from master-file to spreadsheet and transferring corrections from spreadsheet to the updated master-file are available as macros called from toolbars in the spreadsheet environment.

When updating the shared master-file it is important, that no invalid data are allowed as corrections. All corrections are tested for errors before they are accepted. Corrections to the cells need not necessarily be specified for all levels from basic- to purchasers’ prices by the “balancers”. The software used to update the master-file will carry out the calculation of the missing values from default assumptions such as preservation of the trade margin percentages and recalculation of VAT using the same rules as in the original master file.

In the process the “balancers” need access to updated information on the state of the system like remaining differences between supply and uses at basic prices by product and the actual distances between column-totals and their targets. This information is obtained via the macros in the spreadsheet environment. It is also possible to extract information from the master-files of previous years for comparison purposes and to merge data covering several years into spreadsheets as time series.

Final balancing

When all manual corrections have been made, the sum of values in a given column will usually still differ from (the final version of) the target column totals. However such differences will be small for uses whose targets are considered to be based on reliable statistics. Furthermore there will be small differences between the grand totals of the trade margin matrices and their respective target values as well as a difference between the VAT-total and its target.

The first step in the final balancing procedures is to adjust the trade margin matrices to their targets by proportional adjustments of non-predetermined margins and recalculate VAT based on the adjusted values.

This will result in new – but still small – differences between the sum of values in a given column and the corresponding target column total. We now divide the target column totals into two groups: Those that are binding and those where small deviations can be accepted. This division of course reflect to a large degree the statistical sources and the reliability thereof. In our case the target totals where small deviations can be accepted are usually to be found for a number of groups of private consumption expenditure, certain groups of gross fixed capital formation and a few groups of intermediate consumption.

The second step in the final balancing is then to distribute the differences between the sum of column values and their binding targets. The cells that can participate in these corrections without causing inconsistencies in the system can be isolated. The corrections are made at the basic values and create new (small) differences between supply and uses for many products.

These differences are removed in the third step by a new horizontal distribution among the uses without binding targets. In this process trade and transport margins by products are not allowed to change and changes to margin percentages should be kept to a minimum. If these calculations should result in significant distortions the program issues warnings. Some manual adjustments may still be needed where too little value can be moved without creating significant distortions.

The total of non-deductible VAT that is a result of the balancing procedure cannot be expected to exactly match the target that is based on government accounts. It may be preferred to proportionally adjust VAT in specific columns, where the exact share of VAT-liable use is uncertain. A final proportional adjustment of VAT on all private consumption is used to eliminate the remaining difference.

Further automation?

The use of automatic procedures in the balancing of the Danish SUTs has by tradition been limited almost to the minimum needed to manage the amount of detailed data in the system. We have been rather sceptical to proposals to replace manual balancing by an automatic algorithm of some kind. It was mentioned earlier that even though it is possible to proceed in a RAS-like manner when the initial version of the SUT is created, it has been considered dangerous to do so. The initial data inputs usually contain errors and inconsistencies that are revealed during the manual balancing. Further automatic balancing could introduce significant distortions in the system if performed at this early stage. In the final balancing the situation is of course different, as it must be assumed that errors and inconsistencies have been removed before it takes place.

Om the other hand, in some cases where information on the input structure of certain industries is very scarce, as they are not covered by surveys of the use of raw materials or services, t
o avoid unnecessarily time consuming manual balancing, the redistribution of inputs between industries can be performed by a technique similar to the RAS-like procedure mentioned above, with automatic corrections limited to relevant areas at the uses side, and course subject to the usual restrictions i.e. predetermined values, VAT-rules and the like. This seem often to result in more plausible figures than the results from a manual balancing where adjustments have to be kept within a limited number of products with significant values.

Software

Historically programs used in the Danish final national accounts have been written in 3.generation languages as Cobol, Fortran or Pascal as well as some in-house products used on a mainframe that is now being phased out. The programs used for preparation of data inputs to SUTs have now been rewritten in SAS. Programs that need to make many "intelligent" decisions are still written in 3.generation languages, mostly Pascal. Today the Pascal programs are compiled using a Delphi compiler. Such programs are used for setting up the initial version of the SUT and for any kind of automatic balancing used during the final balancing step.

As mentioned above the system used for manual balancing uses Excel as the user interface. Visual basic macros are here used to find the relevant filenames, to export and import data, to format imported data and to call the (very fast) Pascal (Delphi-) programs that do most of the calculation work. As a typical Danish SUT file has approximately 50.000 records, the speed of calculation is not without importance for programs that are executed hundreds of times a day.

6.0.3 Size of balancing adjustments

As described in the previous section, the balancing of GDP from the production side, GDP(P), and GDP from the expenditure side, GDP(E), takes place in an integrated supply-use framework.

Once the initial target totals are compiled and the balancing takes place one can in principle distinguish the balancing adjustments. However, in practice, it is necessary to draw the line between the different steps in the compilation process in order to delimit what exactly is balancing adjustments. This is because the compilation is a process of many minor steps, and sometimes it is necessary to make corrections that relate to earlier steps during the balancing procedure if errors are detected at this stage.

The process table is a tool, which aims at distinguishing between different elements in the compilation and balancing process. In particular, when compiling the process table, all adjustments should be allocated to the proper category regardless whether they are found during the balancing process. This implies that any errors found in the underlying data during the manual balancing process should be allocated to data validation and not balancing adjustment. Therefore, balancing adjustments in the process table in principle shows pure balancing, i.e. pure differences between GDP(P) and GDP(E).

Table 6.3 shows an extract from the process table for 2012. Annex 7 shows the full process table. Table 6.3 shows that the balancing accounts for -0,5% on GDP(P) and +0,9% on GDP(E).

Table 6.3 Compilation of GDP, extract from the process table, 2012

	Total sources	Data validation	National accounts adjustments	GDP before balancing	Balancing adjustments	Balanced GDP
			DKK mill.			
GDP(P)	1 840 308	13 407	38 426	1 892 141	-9 515	1 882 625
GDP(E)	1 847 469	-6 344	25 474	1 866 599	16 027	1 882 625
			pct. of GDP			
GDP(P)	97.8	0.7	2.0	100.5	-0.5	100.0
GDP(E)	98.1	-0.3	1.4	99.2	0.9	100.0

Note: The difference between balanced GDP(P) and GDP(E) is purely due to rounding errors in the process table

GDP from the income side. GDP(I). is not described in the process table. because it is not an integrated part of the balancing in the supply-use framework. It is therefore not relevant to show GDP(I) before balancing and balanced GDP(I) in this context.

6.1 Other approaches used to validate GDP

Apart from all the checks that take place as part of the balancing in the supply use framework, source data, which are generally received electronically and at a detailed level, are always compared at the aggregate level with published figures. If there are any differences, a clarification is made and the error is corrected. When and if new data sources occur they are always assessed before being introduced to the national accounts.

The balanced supply-use tables are also assessed in the process of compiling supply-use tables in previous years' prices. Another validation is the comparison of wages and salaries with value added at the industry level.

As described in chapter 3, a comparison of theoretical VAT revenue with actual VAT revenue is also made in order to assess the coverage of GDP.

Validation of compilation methods and compilation systems are usually made in connection with major revisions or, if necessary, if changes in source data necessitate changes.