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Commodity flow systems and construction of input-output tables in Denmark

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PREFACE

Working Papers on National Accounts (Nationalregnskabsnotater) are a series of working papers from the national accounts division at Danmarks Statistik. They contain documentation or analyses related to the Danish system of national accounts.

The present publication gives a fairly complete and detailed documentation of the functional part of the Danish system of national accounts, both at current and at constant prices.

It does so by bringing together three conference papers on the Danish commodity flow system and on the use of this system as a basis for the construction of annual input-output tables. In chapter 1 it is explained where these papers were first presented and reprinted, and how they have been adjusted and updated to fit into the overall framework of this publication.

Readers are invited to get in touch with the national accounts dividion if they have comments on the papers or if they wish to obtain further information on the system. It is also possible to acquire (against a service charge) individual tables or time series of tables of the kind described in the paper, i.e. input-output tables, matrices of fixed capital formation, energy matrices and employment matrices, which all fit together in a coordinated system of time series.

The original papers as well as the adjustments made for this publication have been worked out by Mr. Bent Thage, head of the national accounts division.

Contents

Chapter 1

INTRODUCTION

The present system of national accounts in Denmark starts with the year 1966. From that year onwards the system and methods are based on the recommendations of the 1968 revision of the United Nations system of national accounts (SNA). There is now complete integration between the contents of the national accounts tables and the annual input-output tables, and both are obtained from the more basic commodity flow system which contains about 2500 commodities and is balanced at this detailed level at both current and constant prices.

So far no collected description of this system has been available in English. To remedy this shortcoming the present publication brings together three papers on the Danish commodity flow system and on the use of this system as basis for the construction of annual input-output tables.

The papers have been presented at international conferences on national accounts and input-output analysis over the period 1981-86, and two of them have been published in conference proceedings, cf. below. For use in this publication the papers have been slightly adjusted and updated, but otherwise they are basically unchanged and they can therefore still be considered reprints of the original papers.

Together the papers give a comprehensive description of the commodity flow system at both current and constant prices, and of the subsequent use af this system in the compilation of input-output tables, also at both current and constant prices. It follows from the nature of the papers that this exposition cannot be taken as a textbook or a complete documentation of the Danish system. For the reader with a basic knowledge of national accounts and input-output tables and analysis, the contents of the papers will, however, give a good insight into the techniques used. In particular compilers and analytical users of national accounts figures and input-output tables will find much useful information in the papers.

In chronological order the three papers are:

1) "Techniques in the compilation of Danish input-output tables: A new approach to the treatment of imports" which was presented at the Seventeenth General Conference of the International Association for

Research in Income and Wealth held in Gouvieux, France in 1981. The paper was subsequently printed in J. Skolka (ed.) Compilation of input-output tables, Springer-Verlag, Berlin, Heidelberg, New York, 1982.

The paper is reprinted here as chapter 3, where the title has been abbreviated and changed somewhat to fit into the logic of the publication. Furthermore two new annexes have been added.

2) "Balancing procedures in the detailed commodity flow system as a basis for annual input-output tables in Denmark" which was presented at the International Meeting on Problems of Compilation of Input-output Tables in Baden, Austria in 1985. The paper is published in the proceedings from the conference: A. Franz and N. Rainer (eds.) Problems of compilation of input-output tables, Orac-Verlag, Wien 1986.

The paper is reprinted here as chapter 2, also with a slightly changed title. On several points it has been extended to include the description of some new facilities introduced in the 1983-balancing where a new terminal based procedure came into use.

3) "Danish input-output tables at constant prices" which was presented at the Eighth International Conference on Input-output Techniques in Sapporo in Japan in 1986.

The paper is reprinted here as chapter 4 with the title "Calculations of commodity flows and input-output tables at constant prices". Apart from the methodological aspects the paper also contains some empirical calculations carried out to illustrate the inhomogeneity along the rows of an input-output table, and it analyses the consequences of using two more aggregated rebasing methods than the one actually applied in change of base year for the constant price calculations.

An important new development in the functional part of the Danish national accounts, namely the completion of annual investment matrices for the period 1966-83 at both current and constant prices, is only briefly mentioned in the papers. These matrices, which are documented in a separate volume of this series of working papers (see inside of front cover), are available both at the commodity flow level, distinguishing about 500 investment goods, and in a transformation to the input-output table format as a set of matrices corresponding to the one available for the detailed groups of private consumption. In the investment matrices 43 owner branches (an aggregation of the 117 branches) are shown. The investment matrices are now produced as an integral part of the annual commodity flow and input-output system.

Finally an introduction to this collection of papers would not be complete without mentioning the role played by the members of the international community of national accountants and compilers of input-output tables as partners in many fruitful discussions and in formal and informal communications on many different occasions. Their encouragement and positive interest have provided much inspiration for the writing of these papers.

Chapter 2

BALANCING PROCEDURES IN THE DETAILED COMMODITY FLOW SYSTEM AT CURRENT PRICES

1. Introduction

National accounts work in Denmark has since its beginning in the 1930s been based on the commodity flow method. In addition to the detailed functional national accounts figures this method also supplies us with a good basis for constructing input-output tables, which have been compiled for the years 1930-39, 1946-47, 1949, 1953, and annually since the year 1966, when the present system of national accounts was established. This system is based on the recommendations of the SNA (UN 1968) and has a complete integration between national accounts and input-output tables.

At present the comparable time series of the Danish national accounts start in 1966, cf. Danmarks Statistik (1986a), and even though the original national accounts figures for the years prior to 1966 were based on the commodity flow method, cf. Bjerke (1956), distinguishing about 300 commodities, comparable revised figures for the period 1947-65 which are now in the process of being finished are not backed by a balanced set of commodity flows,(but the production statistical approach is used). Input-output tables will therefore not be produced in connection with the revised series, and the comparable series of annual input-output tables can consequently not be extended back in time.

This paper will therefore be confined to treating the system which has been in operation since 1966 (or rather used for producing figures for the years since 1966, as it became operative only in 1975 and subsequently made a long catching up period necessary before in 1982 we could declare the work to be up to date, producing final national accounts and input-output tables 2 1/2 - 3 years after the year covered). Only the system at current prices will be discussed here, as it is in this system that the balancing takes place. The calculations at constant prices are described in chapter 4 of this publication where it is shown that that even though the calculations take place within a balanced system of commodity flows at current prices they also require special methods and assumptions . Also outside the scope of this paper is the aggregated commodity flow system used in calculations of preliminary national accounts figures.

The commodity flow system consists of a main system and a number of subsystems, the result of which are fed into the main system. The work is highly computerized as this is the only possible way to cope with data at this level of detail. But the computer is not only used as a means of storing the data, it also plays an important role in the balancing process. The total size of the commodity flow system can be illustrated by mentioning that it contains about 3.5 million elements (inclusive of zero-value cells). The basic philosophy behind the design of this very detailed system was to create a framework which could utilize all kinds of specific information, which could endure rather big definitional changes (as for example the adoption of a new industrial classification) without being fundamentally affected, and which would allow users of the data a maximum of flexibility. After ten years of existence it can be concluded that the system has fulfilled these expectations. This does not mean, however, that the system is not currently being further developed in response to new demands and experiences.

The commodities of the system were originally defined for the year 1966. The most detailed level at which foreign trade statistics and industrial production statistics would fit together was chosen. For agricultural goods etc. similar detailed groups were formed, and services were defined by means of the most detailed service branch nomenclature. Six-digit numbers are used for the identification of the national accounts commodities. For goods the first four digits are identical with those of the CCC nomenclature. For 1966 a total of about 4000 commodities were defined. The master files which translate the foreign trade statistics and industrial production statistics into the national accounts commodities must however be updated annually because of changes in the commodity classifications (yet not the first four digits) in the basic statistics. If in the basic statistics an existing number is just replaced by a new one or further disaggregated, the corresponding changes in the master file are a sheer formality. But if commodities in the basic statistics (still within a four-digit group) are classified according to new criteria or are aggregated, it may be necessary to aggregate national accounts commodities in the master file too, as the earlier level of detail cannot be continued, and as national accounts commodities with new characteristics are not currently being created. During the period

1966-81 such changes caused the number of national accounts commodities to shrink from about 4000 to about 2500.

The following exposition will be closely linked to the flow-chart in diagram 1, where it is illustrated how supply and use are first calculated independently and then brought together in the balancing system, which in several steps takes us from the balancing at basic values[1] to the balancing at purchasers' values.

2. The supply side

The supply side of the system is contained in a 2500 (commodities) by 121 (branches, inclusive of four national branches) matrix for domestic output. Imports and customs duties are aggregated to the 2500 commodities as well. Customs duties are considered part of the basic value of imports of goods, and the supply side is in general only estimated in basic values, as the concepts of output or value added at market prices are not applied in Danish national accounts at industry[1)] level.

The main categories of supply and the way they are treated are set out in diagram 1.

Imports cif and customs duties are fed directly into the national accounts system from the tapes containing foreign trade statistics. The master file used for transformation to national accounts commodities is updated annually and is of course identical to the one used for transformation of exports. The sum of customs duties on the tape usually exeeds the total known from government finance statistics because of refunds etc. which are not distributed by commodities. A proportional regulation eliminates the difference. Imports of services are taken from the balance of payments statistics but some elaboration is required, as the borderline between goods and services in the balance of payments is different from the one needed in national accounts, and also because much more detail is needed here. On the other hand national accounts follow the balance of payments in generally only showing trade in services as net items.

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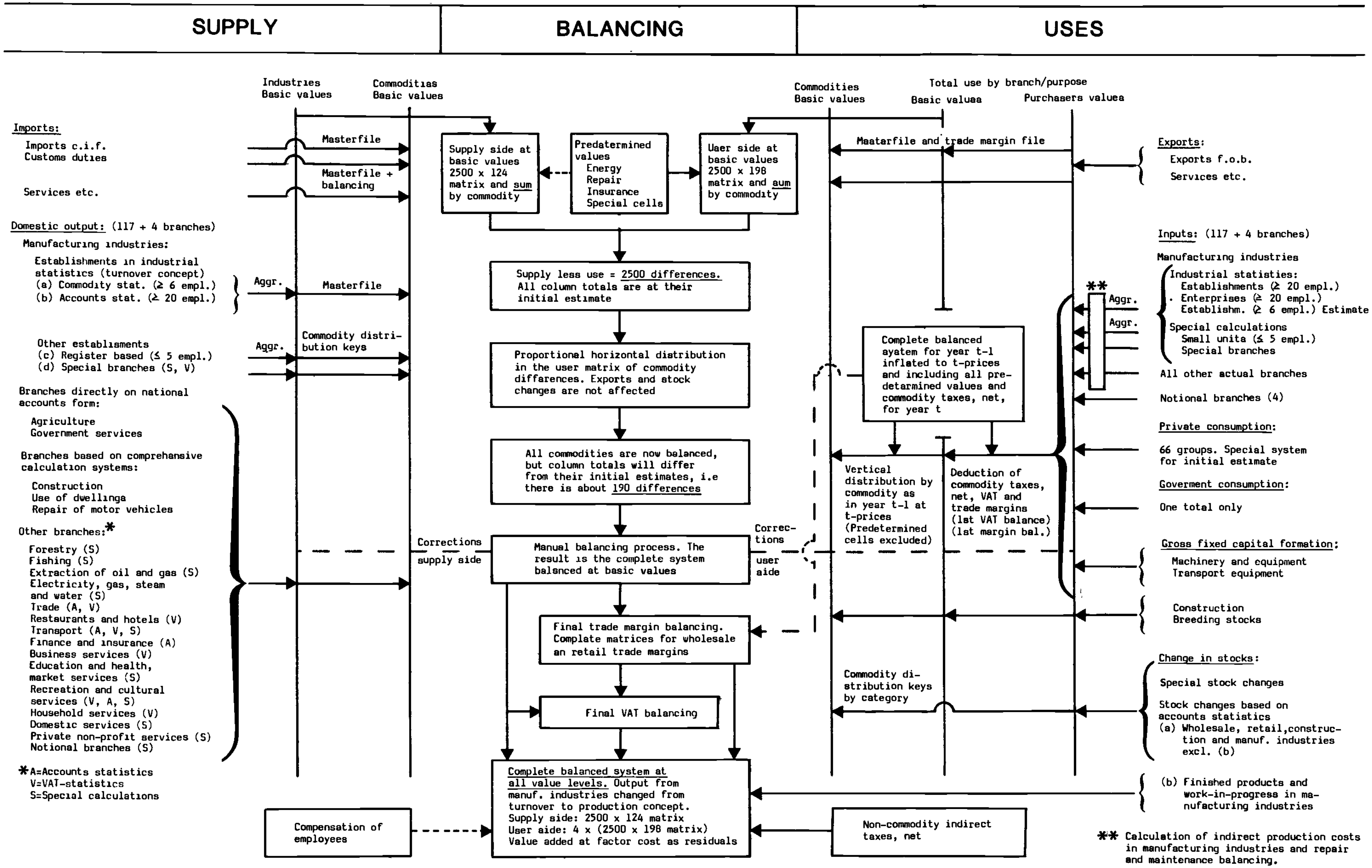
1) The terms values and prices are used synonymously in this paper, and the same is the case with the terms industry and branch.

Diagram 1. Stylized flow-chart for the functional part of the final Danish national accounts



Output from manufacturing industries is calculated in several steps. The quarterly commodity statistics cover all establishments employing more than 5 persons. It contains the turnover of about 7500 commodities (following an 8-digit CCCN-based code) which by a master file are transformed to national accounts commodities. This master file is also updated annually. The data are fed directly from tape into the national accounts system. The fact that the turnover (and not the production) concept is used here has consequences for the treatment of changes in stocks of finished products and work-in-progress, to which we shall later return.

The turnover in establishments employing less than 6 persons (or more precisely: those establishments in manufacturing industries which are not covered by the quarterly commodity statistics) is determined by matching the value added tax statistics (which also contain turnover figures, as there is a single-rate VAT system in Denmark) with the commodity statistics at establishment level. In this way it is possible to remove from the VAT-based turnover those units which are covered by the commodity statistics. As these bigger units are usually also those where the VAT-registration unit may deviate from the establishment concept, we are left with a turnover by branch which it is reasonable to interpret as output in the smaller units. The commodity mix of this output is not known, but for each branch (there are about 100 branches at this stage) a commodity mix is assumed based on the kind of branch and on the commodities known to be produced in the bigger establishemnts in the branch.

Up till this stage the accounts statistics for manufacturing industries, which cover establishments employing at least 20 persons, have not been utilized. These statistics are grossed up to cover all establishments employing at least 6 persons, by using the relations by branch between the turnover in the commodity statistics and the accounting statistics. As will be seen later this is primarily done in order to estimate input by branch. At the output side only three "commodities" are taken from this enlarged statistics, namely

(1) work done on materials belonging to other establishments (until 1982)

(2) repair and installation work done for others (until 1982)

(3) production of fixed investment goods for own use.

From 1983 onwards (1) and (2) are taken from the quarterly turnover statistics as they are no longer shown separately in the accounts statistics.

Finally some additions to slaughter houses, some branches in publishing and machinery repair shops are calculated from other sources, after which total supply from manufacturing industries has been estimated both by commodity and by branch.

For non-manufacturing industries a great number of different sources and estimation methods are used. In diagram 1 three broad groups are distinguished. For agriculture and government services the figures are received from the specialized divisions on national accounts form, and only few adjustments are required. The other extreme are areas as construction, use of dwellings and repair of motor vehicles, for which comprehensive calculation systems are established in the national accounts division. For the third category, which contains almost all services, the most important sources and methods are indicated in diagram 1. It is, however, not possible to go into any detail in describing these estimates, although a good deal of the resources of the national accounts division go into this work.

The national accounts commodities for services are in general defined by the most detailed service branches in the national version of the ISIC 1968. In total we have about 300 services produced by about 30 service industries. All service branches are assumed to be activity defined, i.e. there is no secondary production, and one particular service is produced in one and only one service branch. This on the other hand implies that the goods producing branches as a whole are also activity defined. The trade activity of manufacturing industries employing at least 20 persons is explicitly transferred to trade, but apart from this it is conveniently assumed that the trade activity in small manufacturing establishments cancel out against what production of goods there might be in trade, repair services, etc.

3. The user side

In chapter 2 we saw how the supply of the 2,500 commodities at basic prices was determined. We now have to make estimates of the total use of each of these commodities, also at basic prices, to be confronted with the supply in the balancing process. This involves three steps. Firstly each category of use (input into an industry, a group of household consumption expenditures, etc.) at purchasers prices must be estimated. Secondly the corresponding value at basic prices must be calculated, and thirdly this total at basic values for each category of use must be distributed by commodity.

3.a Estimating categories of use at purchasers' values

Total exports of goods and services are known from foreign trade and balance of payments statistics, cf. what is said above about imports.

Total intermediate consumption in each branch is based on much the same sources as mentioned for supply, but in general the estimation problem is more complicated. Even in cases where the statistical coverage is good, some kinds of expenditures are only given at enterprise and not at establishment level. Furthermore the VAT statistics are not very helpful on the input side because the purchases shown there comprise both current expenditures and expenditures for fixed capital formation.

For manufacturing industries the expenditures for raw materials, energy and a few other items (direct production costs) are taken from the grossed-up establishment-based accounts statistics mentioned above. The direct production costs for establishments employing less than 6 persons are in general estimated by using the same output/cost ratio as for the bigger establishments in the branch. The expenditures for indirect production costs (i.e. mainly services) and repair and maintenance are given only in enterprise-based accounts statistics covering enterprises employing at least 20 persons. These statistics, which also have a detailed breakdown by branch, are aggregated to the natonal accounts branches, and for each branch indirect production costs, and expenditures for repair and maintenance of machinery and buildings, respectively, are calculated as percentages of total turnover of own products, and these percentages are subsequently used in connection with the estimated outputs from the establishment defined branches to calculate these three cost elements for each branch. Having added these to the direct production costs we have arrived at the total purchase of inputs by each branch. As the national accounts definition of intermediate consumption is commodities used rather than purchased the net increase in stocks of raw materials, purchased semi-manufactures etc. must be deducted.

In the establishment-based accounts statistics the value of these stocks at the beginning and end of the year (more precisely: the accounting year, which might deviate from the calendar year) is given. It is assumed that the stocks are valued at the prices at which they have been purchased, and that on average they have been purchased in November (corresponding to the observation that stocks are on average turned over ten times per year). As no commodity details are given, we assume further that the product mix equals the input structure of goods into the branch in the preceding year. As we have price indices for each commodity for November and for the year on average, it is now possible to calculate the complete matrix of stock changes of raw materials etc. in manufacturing industries at both current and constant prices. The column totals of this matrix are deducted from the total purchase by branch mentioned above to arrive at the total uses at purchasers' prices. (The row totals in this stock change matrix form part of total stock changes by commodity - a final demand category).

For branches outside manufacturing industries indirect production costs are not singled out at this stage, but the two categories of repair and maintenance, of machinery (inclusive of transport equipment) and buildings and structures, respectively, are calculated separately for each branch. As repair and maintenance are balanced already at this stage in a separate subsystem, cf. below, the initial estimates might have been changed in this process. Seen from the point of view of the system at large these adjusted values are however still initial estimates of intermediate consumption.

For quite a number of subbranches in the service industries it has been necessary to resort to estimating total intermediate consumption as a rather unfounded fixed percentage of output. Even in cases where there is access to some statistics it can be difficult to utilize them because the extent of intra-industry sales, subcontracting etc. is not known.

As there is only one branch for construction its input ratio will vary depending on the output mix (structures, new buildings, repair work). The initial input total for this branch is therefore of a very preliminary character, and may be changed considerably in the balancing process.

The initial estimates for each of the 66 groups of private consumption are either made directly as an absolute figure (energy, car repair, insurance etc., cf. about special subsystems later) or as estimates of growth rates at current prices which are multiplied by the final figures for the preceding year. These growth rates are the results of several transformation processes which translate the classifications of the retail turnover index, the VAT statistics and the accounts statistics for retail trade into the SNA classification of household consumption expenditures. In this way several different growth rates can be obtained for one particular consumption group, and also taking into consideration the price index for each group it is a matter for the experienced national accountant to choose the most likely growth rate for each group.

Data on the final consumption expenditures of general government are received from the specialized division on government finance statistics. At the same time we receive a detailed breakdown of government sales of commodities, which is the difference between output from producers of government services and consumption expenditures of general government. The breakdown by purpose of government consumption is not applied in the commodity flow system.

For gross fixed capital formation construction and breeding stocks are determined in connection with the estimates of output for the construction branch and agriculture, respectively, and will not be changed in the balancing process. The initial estimates for the two groups, machinery and equipment, and transport equipment, have traditionally been of a rather poor quality, as basic statistics from the user side are scarce. In the balancing process the commodity flow system for investment goods has therefore been allowed to overrule the initial estimates more than in any other category of final demand. However, from the year 1982 a new system for making initial estimates has been established. The system is based on the experience obtained by constructing annual investment matrices for the years 1966-81.

The calculation of stock changes for raw materials, purchased semi-finished products etc. in manufacturing industries has been described above. For finished products and work-in-progress the stock changes in manufacturing industries are calculated in an analogous way, but in this case the output matrix of the preceding year is used to form the distribution by commodity. As the supply side throughout the balancing process is on turnover (sales) basis for manufacturing industries, these stock changes are not introduced into the commodity flow system, but only (as indicated in diagram 1) used at branch level to transform the final figures from sales to production concept.

Stock changes in wholesale trade, retail trade and construction are also based on accounts statistics of the same kind as found for manufacturing industries, i.e. the value of stocks by detailed subbranch at the beginning and end of the accounting period is known.

For wholesale trade and construction each subbranch or part thereof is matched with a branch in manufacturing industries which seems the most likely producer of the kind of commodities held in stocks. Thus the same system as used for calculating changes in stocks of finished products and work-in-progress in manufacturing industries can be used to calculate these stock changes by commodity.

For retail trade the subbranches are matched with the consumption groups (the same transformation key as used in connection with the estimates of consumption groups), and the composition of each group by commodity in the preceding year is used as a distribution key for retail stocks. Again by using price indices for November and the year on average the complete matrix of retail stock changes is calculated at both current and constant prices.

Special stock change calculations are made for agricultural products and energy, physical stock changes being multiplied by average prices.

3.b Estimating categories of use at basic values

Whereas it is obvious that an initial estimate of each of the categories of use at purchasers' prices is necessary, it is less obvious that at this level of aggregation (total intermediate consumption of each industry, totals for each category of final demand) we should calculate initial values at basic prices, as trade margins and commodity composition of each of these (vertical) totals - a composition which is not yet known, as it is determined in the balancing process. Therefore, what we do in this step is based on simplifying assumptions to avoid the complication of explicitly entering into a simultanous balancing procedure where all price levels are open to change at the same time. On the other hand what we do now is labelled the first set of balances for VAT, other commodity taxes, net, and wholesale and retail trade margins, respectively. During the balancing process at basic prices these first differences between purchasers' and basic values might be changed, and after the completion of the basic price balancing the second and final balancing of VAT, commodity taxes, net, and trade margins takes place, cf. below.

The first step is now to calculate non-deductible VAT by categories of use. For each use we know the VAT for the preceding year, and if the VAT rate has not been changed the same percentage is taken of the category at purchasers' prices. If the VAT rate has been changed the percentages are changed in the same proportion. For construction the theoretical VAT rate is used in any case. If the sum of this calculated VAT is within reasonable closeness to the total known from government finance statistics, the difference is left open at this stage. This is usually the case.

Commodity taxes, net, have been estimated by user category and commodity (primarily by using the horisontal distribution known from the preceding year). So at this stage we have a complete commodity-by-use matrix of commodity taxes, net, and these taxes are balanced, although the specific distributions will be changed somewhat in the balancing process.

For a number og commodities the detailed distribution by user of basic value, wholesale, and retail trade margins and commodity taxes, net, is compiled in separate subsystems, cf. below. These predetermined values are not changed during the balancing process except in cases where errors are detected and corrected at a later stage.

Exports f.o.b. of goods are aggregated by means of the master-file to the level of the national accounts commodities and it is then assumed that the percentage rates of wholesale trade margins of the preceding year are still valid (retail trade margins on exports are by definition nil). Commodity taxes, net, on exports are known, and exports at basic values, both total and by commodity, can be calculated.

For stock changes the calculation methods described earlier imply also the link between purchasers' and basic values. Both trade margins and commodity taxes, net, but not VAT, might be part of stock changes. As for exports, the commodity composition of the totals at basic values is immediately known. The same is the case for gross fixed capital formation in construction and breeding stocks.

Still we lack initial estimates of basic values, wholesale, and retail trade margins for most of the commodities in all other categories of use. For this purpose a file containing the complete balanced commodity flow system from year t-1 inflated to year t prices is created. Before 1983 all predetermined values were entered into this file where they replaced the inflated values. This "mixed" system was then added by column, so that for each column we obtained (1) basic values, (2) wholesale trade margins, (3) retail trade margins, and (4) commodity taxes, net.

For intermediate consumption, private consumption, and gross fixed capital formation (other than construction and breeding stocks) commodity taxes, net, are first deducted from purchasers' values exclusive of non-deductible VAT (cf. above). Before 1983 the remaining total for each category of use were subdivided into basic value, wholesale, and retail trade margins in the same proportions as calculated from the inflated "mixed" system for year t-1.

From 1983 onwards this method has been changed in order to avoid the distortions in the breakdown on basic values and trade margins caused by variations in the share of predetermined commodities. Instead of entering the predetermined values into the inflated system for year t-1, all cells containing predetermined values in year t are now removed from the inflated system for year t-1. Commodity taxes, net, have been estimated at an earlier stage and are removed from the system in the same way as the predetermined values. The file now contains inflated basic values, wholesale, and retail trade margins of the preceding year for those cells in the system, where a value for the current year has not been calculated separately.

For intermediate consumption and gross fixed capital formation, residual purchasers' value (exclusive of non-deductible VAT, commodity taxes, net, and also all predetermined basic values and trade margins) is calculated for each category of use. This residual is then subdivided between basic value, wholesale, and retail trade margins in the proportions calculated from the file with inflated values mentioned above. When the predetermined values are added, initial estimates of basic value, wholesale, and retail trade margins are found for each category of use.

For private consumption estimates of retail trade margins by consumption group are calculated in a separate system that utilizes accounts statistics, cf. the description in section 6 of the use of accounts statistics for retail trade. For 16 of the consumption groups wholesale trade margins can be estimated in a similar way. From 1983 onwards these estimates are used, when basic values are calculated for consumption groups.

For government consumption expenditures there is just one figure and no difference between purchasers' prices and basic prices.

When the totals of wholesale and retail trade margins have been calculated for all uses, they can be compared to the total supply of each of these kinds of trade margins. If there are big differences the matter is looked into. This may result in adjustments of trade margins for certain categories of final demand (primarily private consumption), but at this stage a complete balance between supply and use of trade margins is not aimed at, as they will anyway be modified in the balancing process.

We have now arrived at <u>total use by category</u> (industry for intermediate consumption, purposes for final demands) at basic prices.

3.c Commodity breakdown of categories of use at basic values

As results of earlier calculations, exports of goods and services, changes in stocks and, for fixed capital formation, construction and changes in breeding stocks have already been broken down by commodity at basic prices.

For all other categories of use it is now initially assumed that they are distributed by commodity in the same way as in the preceding year, represented by the inflated final commodity flow system for t-1. Before this (vertical) distribution takes place, the predetermined commodities are removed from the totals and the distribution keys, so that they are not overruled by this automatic distribution. For manufacturing industries the totals for indirect production costs are distributed separately, as the goods and services belonging to this cost category might develop differently from the direct production costs.

In fact, what is here carried out is the first step in a modified RAS procedure, and the basic assumption is that the physical input structures composition of final demands from the preceding year is the best point of departure. It has, however, never been tested whether the alternative assumption of constant input structures at current prices would give significantly different results of the whole balancing procedure, and such a test would be almost impossible to carry out in a controlled manner because of all the discretionary decisions taken in the manual part of the balancing process. On the other hand there presumably must be a priory expectation that the procedure followed does bias the final figures towards more constant input structures than those actually found in the real world.

For years where figures are available from censuses on inputs into manufacturing industries or from household budget surveys (about every fifth year) the above procedure is different, as in principle the automatic distribution by commodity can be replaced by the actual values. The figures from these censuses, which have a very detailed breakdown by commodity (in most cases more detailed than the national accounts commodities), must however be grossed up and adjusted in different ways before they can be fed into the commodity flow system. These calculations often happen in ad hoc systems which might also be influenced by the data already in the final national accounts system for the preceding year. An important principle when introducing the new information is to make the maximum use of it while at the same time securing a minimum break in continuity. The needs of the national accounts division are taken very much into consideration in the design of both the input census and the household budget survey, and this facilitates the introduction of the data into the system.

The input structure for producers of government services has originally been estimated by digging down into the details of the accounts for central and local governments, and this procedure is repeated at (many) years interval. For construction the input structure is almost exclusively determined by kinds of commodities in the commodity flow system, as input censuses have never been conducted in this area. So both these important branches are in ordinary years treated together with the other branches in the automatic vertical distribution process.

We have now arrived at the 2500 (commodities) by 198 (uses) matrix at basic prices mentioned at the beginning of this chapter and are now ready to confront the user side with the supply side in the balancing process. Before proceeding to this it will however be useful to say a few words about the predetermined values and the national distribution branches.

4. Subsystems and notional branches

A notional branch is an artificial branch which is created to serve as a distribution instrument for commodities, the use of which we are unable to identify in detail. The output of such a branch is equal to its intermediate consumption so that no value added is created. In the Danish system there are three notional branches:

- notional branch for goods
- notional branch for services
- notional branch for some goods and services for repair and maintenance

(As a fourth notional branch might be mentioned the one which receives the imputed bank service charges. This is however atypical as its input is not later distributed as output and therefore creates a negative value added).

In the calculation sequence from total input at purchasers' prices to breakdown of inputs by commodity at basic prices the national branches are treated in the same way as ordinary branches.

The notional branch for goods receives as input office supplies, things like electric bulbs and some advertising expenditures. Only a small part of the total supply of goods is channelled through this branch and its level and growth rate is not a cause of worry. Not so, however, for the notional branch for services, which receives most communication expenditures, business services and a good deal of household services (to the extent that these are used by business, as notional branches do not deliver to final demand categories). About 25 per cent of all market services other than trade, dwellings and imputed bank service charges are now (1983) channelled through this branch. Its growth rate has been extremely high because of the fast growth in services such as computer services and leasing (in particular financial leasing). As many service industries receive their dominant input from the notional branch for services, its size has some unfortunate consequences in the construction of the input-output table, cf. below.

As mentioned earlier, there is a complete subsystem for repair and maintenance, where supply and use are balanced for each "repair commodity". One of these commodities is "unspecified repair of machinery", which is the "output" of a notional branch. The procedure is as follows: The total expenditures for repair and maintenance of machinery and transport equipment are estimated for each branch. After deduction for repair of motor vehicles, repair done by machinery repair shops, shipyards, repair shops of airlines and public transport companies, etc., the residual is assumed to come from the notional branch, and the sum total of these residuals then defines the total size of the notional branch. Inputs into this branch will be all kinds of spare parts, repair work done for others by branches in manufacturing industries etc., and this input mix will be modified in the balancing process in the system at large - as is the case for all other real and notional branches - and is therefore not part of the subsystem for repair and maintenance, which also contains the final balance for repair og buildings and structures.

In the balanced commodity flow system the notional branches are preserved, as their existence causes no problems in relation to the construction of the ordinary national accounts tables. In principle it would also be possible to preserve them in the input-output table, but in practice it is rather inconvenient for users. Therefore in the calculations which transform the commodity flow matrices to the input-output table, these branches are eliminated by assuming that each element in the output row has the same commodity composition as the input into the particular notional branch. The drawback of this procedure is of course that we pretend to know more about input structures (in particular for services) than we actually do. The long run solution to this problem is obviously to try to distribute more services directly, as even the sole use of common sense can often give us a better distribution than the one calculated on the above assumption.

Apart from the subsystem for repair and maintenance three other subsystems exist. They are: the motor vehicle distribution system, the energy system and the insurance distribution system.

The motor vehicle system contains a distribution of all motor vehicles by owner branch or household. Eleven different kinds of motor vehicles are distinguished. From the official motor vehicles register the total number of each of these categories of cars is known (calculated as the average number for the year), but the distribution by owner is made in the national accounts division and is based on often rather old statistics for certain industries, the type of the motor vehicle and many kinds of indirect information such as the use of fuel etc. All this and a good deal of heroic assumptions make it possible to update the motor vehicle matrix (118 by 11) annually. This matrix is not used directly in the national accounts, but supplies us with a set of distribution keys to be applied to expenditures on fuel for motor vehicles, lubricating oil, tyres, service charges for auto insurance, repair of motor vehicles, and motor vehicle duties.

In most cases it is not just the actual number of motor vehicles which is used as a distribution key. We also take into account the kind of fuel used (petrol, diesel oil or LPG) and the average mileage per year for any particular car in any particular branch (or household). The assumptions necessary to make these submatrices are even more heroic than those used to construct the main car matrix, but it is none the less believed that this system yields a much better distribution of the relevant commodities than could otherwise have been obtained. The basic assumption here as elsewhere in our system is that the more detail you have the easier it becomes to apply all kinds of specialized information, expert knowledge, and - perhaps most important - common sense.

The energy system gives a complete description of the supply and use of about 20 energy commodities. Both physical quantities and values (at all price levels) are calculated. This system is the most sophisticated subsystem, where a comprehensive balancing model at the same time takes account of both quantities and values, depending on which kind of information is available. For manufacturing industries energy censuses are held with two or three years intervals, giving the quantities of each kind of energy, whereas there is annual information about the total expenditures on energy products for each branch. For energy census years this information is combined to calculate the average price paid by each branch for each kind of energy, and for the inter-census years their price relations are used together with the total energy costs for each branch to estimate the physical quantities. To this is added all available information from the energy producing branches and what statistics are available from the Ministry of Energy. The energy consumption of small manufacturing units is determined by a set of differentiated grossing-up methods. For use of energy in other branches, annual information is in some cases available, whereas in other cases specific information is completely absent. Energy consumption by households can be checked against the quinquennial household budget surveys, and it too is based on many kinds of specific information. The energy taxes (other than VAT) are calculated in the system, and the calculated total compared with the actual total from government finance statistics is a useful check. The trade margins on energy products are supervised continually by the Danish Monopolies Commission and are therefore rather well documented.

Although the physical energy matrix is not part of the ordinary national accounts it is published together with them, and also as a separate field of energy statistics. Furthermore, the constant-price data for energy are found by multiplying the quantities by base year prices.

The distribution of energy used by motor vehicles takes place in the car system and is then transferred back to the energy system to make this complete.

In the system for distribution of accident insurance service charges the starting point is about 25 different kinds of insurance, for which the service elements are calculated as gross premiums less claims. For some kinds of insurance it is immediately obvious that the users are some specific branches or households, whereas for the rest a distribution key has been constructed. As mentioned above there is also a connection between this system and the car system as far as motor vehicle insurance is concerned.

All commodity distributions which in this way have been predetermined in the subsystems are fed into the main national accounts system (not just basic values, but also trade margins and commodity taxes, net), and they will only in exceptional cases be changed in the subsequent balancing process.

5. Balancing the system at basic values

We now have the supply matrix (dimension 2,500 x 124) and the use matrix (dimension 2,500 x 198) to be confronted in the central balancing system. Only in very few cases, for example where obvious errors are detected, will changes be made at the supply side. So it almost exclusively is the use matrix which is the object for the balancing work.

The different steps in the balancing procedure can be followed in diagram 1.

5.a The automatic balancing of commodities

The first step is to aggregate both matrices by commodity, and deduct the estimated use from supply. Hereby 2,500 differences are obtained. Of course some of these might be zero, but as the calculations take place in units of 1000 Dkr., that will seldom happen. The predetermined commodities are by definition balanced already at this stage.

Some of the bigger differences appear because changes in the master file from year t-1 to year t have not been taken into consideration in the (vertical) distribution of each user total at basic values (the first step in the modified RAS procedure, cf. above) which is done on the basis of the national accounts commodities existing in year t-1. This technical complication is dealt with by explicitly making corrections in the user matrix depending on the kind of change in the master file (the most usual change being aggregation of national accounts commodities, where the new commodity is given the number of the most important of the aggregated commodities, thereby giving this number a new content). The reason why this aggregation is not made already in the inflated t-1 user matrix is that the change in the master file is often necessitated by some special developments which cannot be introduced into the user side of the system by automatic methods.

Also other big commodity differences are studied, primarily for the purpose of detecting errors either on the supply or the user side. It may be decided that big differences among commodities which have increased dramatically in value since last year (for example in Denmark in recent years commodities used in connection with the construction of the natural gas network) are kept outside the horizontal distribution procedure, cf. below, as they would most likely be allocated to branches which are positively known not to use the increased supply. The differences for the commodities "produced" by the national branches for goods and services, respectively, are always kept outside the horizontal distribution.

Having taken care of these special differences we are ready for the next step in the automatic procedure (the second step in a modified RAS procedure), in which the difference for each commodity is distributed proportionally (horizontally) on to the uses of that particular commodity calculated in the first step. Exports of goods and services and stock changes are not involved in this distribution, as they have been given their final values earlier in the calculation sequence. (Although here as elsewhere such categorical statements are never absolutely true. In fact both exports and stock changes at commodity level can be changed in the balancing process, but not by means of automatic procedures).

The user matrix which results from the horizontal distribution will now have column sums which in general differ from the initially estimated sums, which, however, we still believe to be the best estimates we can produce a priori. So at the present stage the system has all commodities balanced, but hase about 190 differences by user category. It might now be tempting to go on with the RAS procedure, and in as many steps as necessary to balance the system completely. Why don't we choose this easy solution?

The answer is that if we went on with the RAS procedure, the balancing process would lose its character of empirical statistical work and become a pure model exercise where the only way of explaining the particular size of an individual element ex post would be a reference to the system as a whole rather than available statistics and the technical and economic development in that particular industry or category of final demand. To take an example, suppose that a particular national accounts commodity which had two user branches in year t-1 is also consumed by a third branch in year t. A RAS balancing would leave the element in the third branch still at zero, and the effects of this error would in an untraceable way have been spread to the whole system. When, however, we stop after the second step of the RAS procedure, we will most probably find that the first two branches have received more than their initially estimated totals, whereas the third branch is in deficit. In the manual phase of the balancing it is possible to correct this distribution by changing a few elements, as the errors made in the automatic steps have not spread to the whole system. Therefore, stopping after the second step of the RAS procedure gives us a good point of departure for detecting elements which need to be changed, and makes such changes manageable in practice, which they would not have been if we had stopped after the first step of the RAS procedure, where we would have to cope with 2,500 differences without having received the instructive clues about the differences by industry or final demand category which result from the second step in the RAS procedure.

5.b The manual balancing process

Having carried out the second step in the modified RAS procedure the automatic part of the balancing has come to an end, and it leaves us, as mentioned above, with a difference for each category of use - altogether about 190 differences, whereas all commodities are balanced.

As a basis for the manual balancing two kinds of print-outs are produced:

- A print-out showing the supply and use of each commodity (the rows of the supply and use matrices). As illustration this balance for the commodity is shown in table 1. It is seen that also trade margins and commodity taxes, net, are printed. The commodity taxes are those earlier determined, but they must be redistributed if the commodity is redistributed. The trade margins shown have been calculated by using the margin rate from the preceding year on the

Table 1. Row (transposed) for the commodity "pesticides etc." in the user matrix 1981 (1000 Dkr.)

	year 1	Commodity no. 2	Supply/ user id. 3	Branch/ purpose no. 4	Basic values 5	Whole sale trade margins 6	Retail trade margins 7	Commodity taxes, net (excl. VAT) 8	Purchasers values (excl. VAT) 9
Domestic output	81	381107	1010	35110	66.847				
	81	381107	1010	35120	50.790				
Imports c.i.f.	81	381107	1020		285.754				
Customs duties	81	381107	1021		135				
Intermediate consumption	81	381107	2010	11101	265.833	36.171			302.004
	81	381107	2010	11103	33.370	6.288			39.658
	81	381107	2010	35120	19.701	1.316			21.017
	81	381107	2010	98099	9.553	1.173			10.726
Private consumption	81	381107	2030	451	29.412	8.570	4.813		42.795
Stock changes : Raw materials ...	81	381107	2060		123-	8-			131-
" " Whole sale trade	81	381107	2061		1.264-				1.264-
" " Retail trade	81	381107	2062		406-	113-			519-
Exports	81	381107	2080		47.450	8.606			56.056

<u>Comments to tables 1 and 2</u>

Table 1 is printed out after the horizontal distribution in the user matrix at basic values, and this row intersects the corresponding column for branch no. 11.103 (horticulture) shown in table 2 at the element 33.370 which is framed in both tables. The commodity i table 1 is balanced, i.e. all supplies (Id-10) sum to all uses (Id-20).

In table 2 columns 5-7 show the results of the automatic part of the balancing carried out by the first two steps in a modified RAS-procedure. For example the commodity no. 381107 has been reduced from 35.093 to 33.370 in the horizontal distribution of the total commodity difference of - 18.475. After the horizontal distribution the column sum is 1.365.672 to be compared with the original estimate of 1.374.314.

The changes from column 7 to column 8 in table 2 are the results of the manual balancing process. In this case relatively few changes have been made, but the original estimate of total input at basic values has not been upheld, the final figure being 1.407.244. The wholesale and retail trade margins and the commodity taxes, net, shown i columns 9-11 are the results of the final balancing, and the purchasers values in column 12 are the sums of columns 8 to 11.

Table 2. Columns for horticulture in the user matrix 1981 (1000 Dkr.)

Year	Commodity no.	User id.	Branch no.	Automatic balancing, basic values: After vertical distribution	Automatic balancing, basic values: Total commodity difference	Automatic balancing, basic values: After horizontal distribution	Final figures: Basic values	Final figures: Whole sale trade margins	Final figures: Retail trade margins	Final figures: Commodity taxes, net (excl. VAT)	Final figures: Purchasers values (excl. VAT)
1	2	3	4	5	6	7	8	9	10	11	12
81	000001	2010	11103	37.140	7.727.724-DS	37.140	51.140	0	0	0	51.140
81	000002	2010	11103	15.863P	4.923.941-DS	15.863	15.863	0	0	0	15.863
81	000802	2010	11103	44.808	11.577-	42.875	42.875	0	0	-27.069	15.806
81	003621	2010	11103	20.000P	0	20.000	20.000	0	0	0	20.000
81	003840	2010	11103	26.010P	2	26.010	26.010	0	0	0	26.010
81	004000	2010	11103	53.619P	15.611.535-DS	53.619	53.619	0	0	0	53.619
81	005210	2010	11103	13.825	70.762-	12.586	12.586	0	0	0	12.586
81	006301	2010	11103	1.381P	2.959	1.381	1.381	0	0	1.296	2.677
81	006303	2010	11103	4.185P	0	4.185	4.185	0	0	0	4.185
81	007141	2010	11103	111.767	190.402-	108.596	108.596	0	0	0	108.596
81	009001	2010	11103	114.274	29.000.825-DS	114.274	158.176	0	0	14.350	172.526
81	060201	2010	11103	116.099	25.933-	113.737	133.737	19.995	0	0	153.732
81	120309	2010	11103	38.680	5.041	42.775	42.775	93.284	0	0	136.059
81	250501	2010	11103	2.766	6.404	3.041	3.041	993	0	0	4.034
81	251707	2010	11103	13.023	69.616	15.611	19.253	3.771	0	0	23.024
81	270101	2010	11103	16.272P	0	16.272	16.272	6.509	0	0	22.781
81	270305	2010	11103	33.824	4.897-	30.588	30.588	3.681	0	0	34.269
81	271006	2010	11103	10.122P	2	10.122	10.122	1.417	1.721	8.796	22.056
81	271008	2010	11103	1.621P	3	1.621	1.621	227	0	0	1.848
81	271016	2010	11103	8.155P	2	8.155	8.155	897	523	0	9.575
81	271018	2010	11103	68.638P	0	68.638	22.879	2.517	0	0	25.396
81	271022	2010	11103	328.600P	4	328.600	328.600	23.002	0	0	351.602
81	271024	2010	11103	867P	8.698	867	867	607	998	0	2.472
81	271101	2010	11103	10.454P	3-	10.454	1.241	2.010	602	0	3.853
81	271701	2010	11103	28.358P	0	28.358	28.358	0	0	0	28.358
81	310301	2010	11103	1.809	2.141-	1.713	1.713	669	0	0	2.382
81	310501	2010	11103	115.080	129.306-	105.620	105.620	22.279	0	0	127.899
81	321203	2010	11103	97	329	97	97	16	0	0	113
81	381103	2010	11103	565	3.865-	522	522	72	0	0	594
81	381105	2010	11103	255	2.837	286	286	70	0	0	356
81	381107	2010	11103	35.093	18.475-	33.370	43.370	7.097	0	0	50.467
81	390205	2010	11103	20.552	1.381.740-D	20.552	20.552	0	0	0	20.552
81	390737	2010	11103	32.680	185.493	39.412	44.412	10.757	0	0	55.169
81	401111	2010	11103	914P	7.835-	914	914	155	314	0	1.383
81	401119	2010	11103	770P	29.516-	770	770	0	0	0	770
81	442103	2010	11103	6.142	16.165-	5.528	5.528	0	0	0	5.528
81	480801	2010	11103	302	118-	297	297	0	0	0	297
81	481601	2010	11103	21.551	13.475-	21.262	21.262	3.587	0	0	24.849
81	620301	2010	11103	742	7.053	936	936	0	0	0	936
81	681601	2010	11103	13.653	2.558	15.661	15.661	3.422	0	0	19.083
81	691401	2010	11103	3.758	1.676-	3.364	3.364	364	0	0	3.728
		201		1.374.314		1.365.672	1.407.244	207.398	4.158	-2.627	1.616.173

P = predetermined, D = Difference not horizontally distributed, S = Supply not entered in the system

For comments : See text to table 1

new basic values, except for exports and stock changes where trade margins have been determined earlier, cf. above.

- A print-out showing the calculated input of commodities into each industry and category of final demand (the columns of the use matrix). As illustration the print-out for horticulture is shown in table 2. The three first rows have the following interpretation:

  (5) This is the column created in the first step of the RAS procedure. Its total is the initial estimate of intermediate consumption at basic value.

  (6) This column shows the total difference between supply and use for each commodity after the first step of the RAS procedure. So this difference is the one which is distributed in the second step of the RAS procedure. The figures in this column are not specific for horticulture but for the commodities and are just printed here for information.

  (7) This is the input column created in the second step of the RAS procedure, and the point of departure for the manual balancing. It is seen that the sum of this column differs from the initial estimate in the first column. In the following balancing process we must adjust the figures in this column in such a way that they together with the derived changes in trade margins permit us to hit the total at purchasers' values, but not necessarily the total at basic values that we started out with in column 5.

Apart from these two prints the "balancer" will also have at his disposal a detailed version of the master file system, which shows the connection between the national accounts commodity numbers and the most detailed commodity classification in foreign trade and industrial production statistics, and this print also gives the text belonging to each commodity. In the balancing process this is a tool for going back to the most detailed primary statistics if necessary. Also available is a collection of notes describing the special treatment which should be given to certain commodities or industries in the balancing, and containing a list of checks etc. which must be carried out. For the preceding year the final versions of the two prints mentioned above and some special work sheets from the balancing process will be available.

Then the rest is in the hands of the "balancer", who in this capacity is deemed omnipotent. He may of course discuss problems with his colleagues, but the final results of whatever considerations or investigations he makes are usually not written down, and what happens in the manual balancing process can usually not be reproduced by another person. This is where the art of national accounting takes over from the techniques of national accounting.

Usually the manual balancing work (which may very well be carried out by means of a computer terminal, cf. below) is shared between three or four persons (economists) in a way which experience has shown to be fruitful. The main idea is here to distinguish between different "complexes" in the economy, where the interaction within complexes is much more intense than between complexes. When one particular complex is allocated to one person in the balancing work this also minimises the extent to which the members of the balancing team have to interfere in each others' work. The most clearly separable complexes are:

- Agriculture, horticulture, fishing, the food and beverage industries, restaurants and the food and beverage groups of private consumption.
- The metal and machinery industries, construction, auto repair shops, fixed capital formation in machinery and transport equipment, the notional branch for repair goods and services, government purchases of military equipment, and private consumption of most durable goods.
- Forestry, mining of rocke, sand etc., industries producing wood products and non-metallic mineral products, construction, and some private consumption groups.
- Manufacture of textiles, clothing and footwear, and the corresponding groups of private consumption.
- Chemical industries, including plastic products and a number of groups of private consumption.
- Service industries, including producers of government services, the notional branch for services and private consumption of services.

The two last-mentioned complexes are characterized by having their output distributed to a large part of the economy, whereas their inputs mainly come from within the groups themselves. There is no complex for energy at this stage, as energy branches and energy commodities have already been finally balanced in the subsystem for energy.

Within each complex there has over time developed a knowledge about the most appropriate order to make changes. Generally speaking the most basic commodities and/or branches will usually be treated first, and commodities with few uses or branches with few dominant inputs will usually be treated early in the balancing process. Before making any changes, the person responsible for a certain complex will use some time to look through all the details of the area to get some ideas about what are the main balancing problems and perhaps also make some summary design for their solutions. Also at this stage it is important to find out whether there is an overall surplus or deficit within the complex, as this may imply either a more than average interaction with other complexes or already now acceptance of changes in one or more of the initial totals for user categories belonging to the complex. This overall check might also lead to detection of errors in the data input into the system on either the supply or user side or to the conclusion that some significant new developments have happened which must be further investigated before the ordinary balancing can begin.

In order to keep the manual balancing process under control, a commodity is never left unbalanced, i.e. if an industry or a category of final demand is given more of a commodity, it is at the same time decided which user or users it must be taken away from. During this redistribution of commodities it often happens that a user category gets its difference increased rather than decreased, but of course the general tendency is towards decrease of differences. When a difference has been brought down to a very small size, for example one per cent or less of total input into an industry, the residual is eliminated by (additional) changes in the inputs received from the notional branches for goods or services.

During the balancing process it may be decided that the initial estimate for an input total at purchasers' values is not valid, and a new one is explicitly fixed as the target. This happens primarily for service industries and for construction, but in practice never for manufacturing industries, where the totals are the results of statistically well founded calculations. For the categories of final demand (exclusive of exports and stock changes) the initial totals have a weaker status and are more often than not changed during the balancing. So the commodity flow method has a decisive influence not just on the commodity composition, but also on the total sizes of the final demand categories. By means of price indices the real developments in the groups of private consumption are kept under surveillance.

Although exports of goods and stock changes have already in principle been finally calculated by commodity, some changes are none the less possible in the manual balancing process. For exports it is possible to move the borderline between basic value and wholesale trade margin (but keeping the purchasers' value unchanged, as this is the figure for exports f.o.b. in the foreign trade statistics). This will change the amount at basic value available for domestic use. For stock changes it is felt permissible to make counterbalancing changes in commodities belonging to the same broad commodity group. For example, one kind of semi-manufactured metal product can be exchanged for another in the stock column, but it cannot be exchanged for coffee or clothes. Total stock changes are not affected by these manipulations, but they are affected by a special category of stock changes which comes into existence in the balancing process. These "technical" stock changes are used as the last resort to solve a balancing problem. Only few commodities enter these stocks every year, and it is strictly forbidden to use them as a general means of solving problems. They can for example be used to offset differences in the timing between registration in foreign trade statistics and either domestic sale or purchase. Commodities such as soyabeans, tobacco, ships and airplanes are frequently entered at these stocks. Taken over a number of years these stock changes must add up to approximately zero.

It is not easy to say how many elements are changed during the manual balancing process, but a qualified guess is that about ten per cent of the elements (not counting the zero elements) are changed. In years with either input censuses for manufacturing industries or household budget surveys the changes are of course much more comprehensive. In general more changes are made in large figures than in small ones, and many small commodities are not touched at all but are left at the values determined by the automatic calculations. But of course these figures have a statistical or other empirical basis in some earlier year, as elements different from zero cannot be created automatically by the RAS method if there is not a value there already.

As the heading of this section indicates we are at this stage in principle concerned with the balancing at basic values only, i.e. we aim at making such changes as will eliminate the deviation from the original estimate of the total basic value of each user category. From 1983 onwards some improvements were however introduced in the system which permit us to currently take into account the interconnection between changes in basic values and changes in trade margins. In the following the procedure used for the years 1966-82 will first be described, and afterwards the new procedure will be presented.

Even though the procedure used for the period 1966-82 was in principle concerned only with the basic values of the system, leaving the whole of the "second" trade margin balancing to be solved at a later stage, it was of course possible at any time to move the borderline between total basic value and total trade margins for a specific user category. If for example it was decided that an industry should receive as input a new commodity with a relatively high trade margin, it was usually at the same time decided to decrease the basic value total and increase the trade margin total (but leaving the total for purchasers' values unchanged). Also when commodities subject to commodity taxes were redistributed the commodity taxes were redistributed as well, thereby influencing the total for basic values. Such movements of the "borderline" were however only made on an ad hoc basis, and often not very systematically, and the overwhelming part of the changes in the balancing process were restricted to figures at basic values only.

From the year 1983 the "manual balancing" became further computerized in the sense, that each person engaged in the balancing had a computer terminal in front of him, by means of which he could communicate directly with the central commodity balance system, so that changes to the system should no longer take place by filling in punched card forms, as had earlier been the case. The basic print outs described in tables 1 and 2 were not changed, but the new terminal based procedure made it possible to build into the balancing work a number of facilities which it would earlier had been too cumbersome to handle, in spite of the fact that they had all the time been seen as very desirable.

The most important new facility is one which automatically changes trade margins in the same proportion as the corresponding basic value elements are changed. If a different change in the trade margin is desired, it is of course also possible to specify this. At a first glance this facility is just a way of keeping a closer check on the trade margins during the balancing process (a check which because of the work it involved was not possible in the earlier system). A closer look at the system unveils however, that a much more profound change has taken place, namely a shift from a balancing at basic values to a balancing at all value concepts simultaneously, where the total we are aiming at is the one at purchasers' values, and where the initial totals for basic values and trade margins have had their status reduced to just being necessary supporting variables at a certain stage of the calculation procedure. (For private consumption the change is less pronounced, as at least total retail margin by consumption group is usually predetermined from separate sources, cf. above).

It should be obvious that this new procedure in general improves the quality in the balancing work, in particular by avoiding the distortions which the earlier almost complete separation between basic value balancing and trade margin balancing introduced. It must however also be underlined, that the final balancing of the trade margins (cf. the next section) is not made superfluous by this new facility, as it does not secure that all the individual trade margins add up to the total output from the trade branches (wholesale trade and retail trade). But the final balancing of the margins becomes a lot easier to carry out.

Apart from the new facility for trade margins the terminal based system allows many checks to be carried out currently in the balancing process so that errors can immediately be corrected. Also a number of specific files which form part of the terminal based balancing system (such as the "correction file" for commodities and the "file for totals and differences") make it possible to follow exactly which changes have been made (and by whom), and what are their consequences for the differences we are trying to eliminate. So each person has in front of him a permanently updated status report. Into these files is also written any text which is necessary to explain the reasons for the change. So the terminal based system supplies us also with a complete documentation of the changes made by each individual balancer, which is a big step forward compared to the earlier documentation standard. The "correction files" including the relevant text for year t-1 are very helpful as background reference in the balancing work for year t, and substitute a rather complicated system of handwritten notes, the purposes of which were among other things to ensure that a commodity is not by sheer coincidence year after year changed in the same direction away from the statistical base in the census year.

When the persons involved in the balancing have finished their "complexes", the new values were in the pre-1983 system punched and entered into the system. Different controls were printed out (do all commodities in fact balance, and are all input totals and categories of final demand at the target levels?). Usually three or four correction rounds were necessary before all errors made during the manual balancing process had been eliminated. The terminal based system used 1983 onwards makes most of these checks superfluous as they are currently made by the system.

At this stage there will usually still be some branches (for example construction and producers of government services and the notional branches for goods and services) which are not completely balanced. The final operations necessary to arrive at the completely balanced system at basic values (which interacts with the final balancing of trade margins and VAT, cf. below) are now carried out by one or two persons who have the responsibility for solving all remaining problems and for the final outcome of the balancing work.

The manual balancing usually takes 4-5 weeks, and about 5 man-months go into the work. In years with industrial input censuses or household budget surveys the use of resources might be twice this amount.

6. Balancing the system at purchasers' values

We now have complete and balanced matrices for supply and use at basic values and a complete (use) matrix for commodity taxes, net, exclusive of VAT. To arrive at the system at purchasers' prices the final (use) matrices of wholesale and retail trade margins, respectively, must be constructed as well as the final row for the distribution of non-deductible VAT by user category.

6.a Calculation of the final trade margin matrices

First the method used in the final balancing of trade margins for the period 1966-82 are described and afterwards the modifications which follow from the introduction of the terminal based balancing system from 1983 onwards.

The method used for 1966-82

In chapter 3 the preliminary trade margin balancing was described. It resulted in two absolute figures for each user category, one for wholesale trade margins and one for retail trade margins, but no matrices of trade margins were created at that stage, and there might be differences between the supply and the calculated use of trade margins.

In the manual balancing process two kinds of decisions may have been made which explicitly influence trade margins. Firstly the borderline between total use at basic values and the total trade margins for a category of use may have been moved. Secondly the percentage trade margins for specific elements may have been changed (and if an element formerly zero at basic prices is given a value the trade margins must explicitly be decided). These changes are entered into the system in the same process as the corrections to the basic value matrix.

The first step is now to calculate complete matrices for wholesale and retail margins from the balanced basic value matrix by using the percentage trade margins from the preceding year, to the extent that they have not been replaced by new ones in the balancing, or absolute trade margins have been put into the system together with the predetermined values. The column totals of these trade margin matrices (second estimates) can now be compared with the initial estimates of the totals (as modified in the manual balancing).

There are now two balancing problems to solve. Firstly the new trade margin totals for a category of use may be different from the initial estimates (they usually are), and if they were kept at the new level the initial estimates of use by category at purchasers' prices could not be upheld. Secondly the sum total of the two kinds of trade margins so calculated will be different from the corresponding supplies (the output from wholesale and retail trade industries, respectively) to which they must eventually be adjusted.

To help solve these problems the accounts statistics for trade are again utilized. The gross margins by detailed subbranches in the statistics for retail trade are first reduced by retail margins on intermediate consumption and gross fixed capital formation, according to the preliminary trade margin balancing. The remaining margins are then transformed to private consumption groups by the same key as used earlier in connection with initial estimates of private consumption and stock changes in retail trade. These results are used in connection with similarly calculated figures for the preceding year to calculate a set of growth rates for retail margins by consumption group, and these growth rates are in turn multiplied by the final retail margins for the preceding year to obtain a new (third) estimate of retail margins by consumption groups in the current year. (This seemingly topsy-turvy way of calculation is necessary because the accounts statistics do not have total coverage, nor can they be transformed precisely into the classification of household consumption). It is not possible in the same way to make estimates of wholesale trade margins by consumption groups because the branch classification in these statistics is different, and a much larger share of these margins is derived from intermediate consumption, fixed capital formation and exports. Still for 16 consumption groups margin totals are estimated from the wholesale accounts statistics.

Still at the level of total trade margins by categories of use the following assumption are made:

- The second estimates of retail trade margins on intermediate consumption and fixed capital formation are final.

- The second estimate of wholesale trade margins on exports is final (here are no retail trade margins).
- The second estimate of both wholesale and retail trade margins on stock changes are final.
- The third estimate made for wholesale trade margins on 16 consumption groups is only changed in exceptional cases.
- The second estimate of wholesale trade margins on other consumption groups and fixed capital formation is usually accepted.
- The third estimate made for retail trade margins on all groups of private consumption of goods is usually preferred to the second estimate.

This leads to the following procedure for balancing trade margins at category level:

- Wholesale trade margins on intermediate consumption into all industries except construction are calculated as residuals, as all other values in the sequence from basic values to purchasers' values are given, and purchasers' values are final.
- The retail trade margins on all uses are summed up and compared with target total (output from retail trade). The difference, which usually does not exceed a few per cent of the total, is distributed proportionally on all groups of private consumption.
- The wholesale trade margins on all uses are summed up and compared with the target total (output from wholesale trade). Also in this case the difference is usually small. The wholesale branches trading in building materials and in fixed capital goods are studied before more or less arbitrarily eliminating this difference.

The result of this balancing is the final distribution by the two kinds of trade margins by category of use. In the same process the category totals at purchasers' prices exclusive of VAT for construction, private consumption and fixed capital formation in machinery and transport equipment are determined.

What is now missing is the calculation of two matrices of trade margins for which we have just determined the column totals. This is simply done by multiplying (for each column) the trade margin matrices of the second set of estimats by the ratios of the final column totals to those of the second estimate, still leaving predetermined margins unchanged. There are no further balancing problems involved here, as the row totals of the trade margin matrices have no counterparts on the supply side.

As illustration the balanced columns at all price levels are also shown in table 2.

The method used 1983 onwards

It follows from what is said about the new terminal based method in section 5 that the earlier method for calculations of final trade margins must be modified on the following points:

1. From the "basic value" balancing both wholesale and retail trade margins are already final (both as totals by category of use and by commodity) for all industries which are not left to play a role in the final balancing operations, such as construction and producers of governemnt services.

2. For private consumption the trade margin totals described above as the third estimate (all retail margins and 16 groups of wholesale margins) have been introduced already before the "basic value" balancing, and have as far as possible been kept unchanged (as totals by category of private consumption) in the balancing process, where on the other hand the trade margin rates by commodity have had the burden of adjustment.

3. The degrees of freedom in the final trade margin balancing are now fewer than before, but still we must make sure that the sum total of the two kinds of trade margins are equal to the known output totals from the wholesale and retail trade branches, respectively.

4. For wholesale trade margins the adjustment can take place in the construction industry, in producers of government services, the unrestricted categories of private consumption and in fixed capital formation. In the case of producers of government services purchasers' values are completely fixed, whereas they can be permitted to change for the other categories mentioned above.

5. For retail trade margins there is at this stage very little room for manoeuvre, but on the other hand the introduction of the "third estimate" already in the first trade margin balancing secures in connection with the balancing method that the difference to the output total will be quite small and can be eliminated by insignificant changes in the retail trade margins in private consumption.

6. As before we now have the final total wholesale and retail trade margin by user category. For those categories where changes have taken place compared to the results from the final "basic value" system, the differences must as earlier be distributed by commodity proportional to the existing trade margin elements, leaving out any predetermined margins.

6.b Final balancing of non-deductible VAT

As a result of Denmark's single-rate VAT system, a complete VAT matrix is not very interesting, and the estimate of non-deductible VAT is therefore confined to one row, showing a figure for each category of use. Non-deductible VAT levied on intermediate consumption and fixed capital formation is found only for a few industries such as dwellings, passenger transport, private medical services and producers of government services. If the balancing process has not given any obvious cause for change, the figures from the first VAT estimate are retained for these groups, and the final VAT balancing is consequently limited to the area of private consumption. Here it is ensured that the same VAT rate is applied to all fully taxed consumption groups and at the same time that non-deductible VAT on all categories of use adds up to the target figure in government finance statistics. The resulting average VAT rate on private consumption is always somewhat below the theoretical rate.

7. The system as a basis for national accounts and input-output tables

The balanced commodity flow system contains a supply matrix of dimension 2500 by 124 and four user matrices of dimension 2500 by 198 for basic values, wholesale trade margins, retail trade margins and commodity taxes, net, respectively. When these four matrices are added the user matrix at purchasers' values exclusive of VAT is obtained. When the column sums of this matrix are added to the row of non-deductible VAT by user category, each use (intermediate or final) is obtained at purchasers' prices.

In order to get the necessary basis for the ordinary national accounts tables and the input-output table we must further:

- Add the stock changes of finished products and work-in-progress in manufacturing industries to (1) sales by manufacturing industries, in order to move from the sales concept to the production concept at the output side, and to (2) stock changes at the user side - in the case of the national accounts tables just as one figure, and in the case of the input table distributed by branch. So the commodity decomposition of these stocks, cf. earlier, is only used as a technical remedy in their calculation at current and constant prices.
- Calculate other indirect taxes, net, (non-commodity indirect taxes or production taxes) by industry. Taxes on land and buildings, motor vehicle duties and deficits in government owned enterprises account for the dominant part of these taxes.
- Calculate compensation of employees by industry. This task is interrelated with the estimation of employment by industry, but will not be discussed here.
- Consumption of fixed capital by industry, which belongs naturally in this list, is not yet estimated in the Danish national accounts.

7.a National accounts tables

From this data base it is now possible to construct:

- The goods and services account
- The production account
- The generation of income account

for the whole economy, and in the case of the two last mentioned also for each industry. At industry level the output concept is basic value and value added is calculated at factor prices (although it might also be calculated at basic values as is actually done in the sector accounts). In the accounts for the whole economy all the standard value concepts are applied, as they can be constructed by aggregations in the data base. All the usual supporting tables showing private final consumption expenditures by purpose, gross fixed capital formation by type of goods etc. are also taken directly from the system.

7.b Input-output tables

As mentioned above the 2,500 national accounts commodities are not strictly comparable over time, so even though it is useful to work at this level in the balancing procedures and in the "current" calculations of constant price figures, a more aggregated level, containing about 1600 commodities, is used for (1) rebasing constant-price figures for earlier years, when the base year is changed (2) the commodity flow system in the preliminary national accounts and (3) the construction of the input-output tables.

The 1600 commodity level is obtained by aggregating all national accounts goods to the four-digit CCCN nomenclature (with a few exceptions) and keeping the services as they are. At this level there is theoretically complete comparability over time.

From the supply (make) matrix and the use (absorption) matrix at this level of aggregation the input-output table is automatically calculated, i.e. a 117 x 1600 make matrix is multiplied by a 1600 x 200 (approx.) absorption matrix to obtain an industry x industry input-output table on the assumption of an industry technology. This method follows the recommendations of the SNA, and as no aggregation of commodities to characteristic commodities is done prior to the matrix multiplication in order to avoid loss of information caused by this procedure, the choice of an industry technology is the only one possible.

The techniques used in the construction of Danish input-output tables from the two basic matrices are described in detail in chapter 3 of this publication.

Chapter 3

TECHNIQUES IN THE COMPILATION OF DANISH INPUT-OUTPUT TABLES AT CURRENT PRICES

1. Introduction

National Accounts work in Denmark has since its initiation in the 1930's been closely connected with the construction of input-output tables, and the commodity-flow method - or production statistical method - has been the core of the technique.

Input-output tables for Denmark have been published for the years 1930-39 (DSD 1948), 1946 (DSD 1951), 1947 and 1949 (DSD 1955), 1953 (DSD 1962) and 1966 (DS 1973) at still higher levels of detail and sophistication. A summary of the early Danish experiences is given in Bjerke, Milhøj and Nørregaard Rasmussen (1956). Since 1966 annual input-output tables have been worked out. At the moment the time series of tables cover the years 1966-83 on a comparable basis. Summary versions of these tables are now published in the annual publications on national accounts and on input-output tables and analyses.

Compared with the earlier tables the 1966 table represented a new generation of input-output tables, partly by its size (130 industries), and partly by being worked out according to precisely defined techniques, namely as an industry-industry table on the assumption of an industry technology in the terminology of new SNA (UN 1968). The 1966 table was completed in 1972 and published in 1973, and over the next 4-5 years comparable tables for 1967-75 were compiled. This "first version" of the tables for 1966-75 were available at both current prices and constant 1970-prices. For practical reasons they were however not published but made available in a data bank, and were used extensively for analytical purposes in the following years.

To supply some background information this paper gives a brief description of the commodity-flow system on which the input-output tables are based and of the techniques used for constructing the first version the tables for 1966-75. Its main contents are however a description of the more disaggregated techniques which is now used. It was introduced at the time the 1976-table was compiled, but all the tables for the period 1966-75 were also completely recalculated according to the new method.

The modified technique is still following the SNA recommended procedure, but it differs from the methods first used in the construction of the 1966-1975 tables especially concerning the degree of disaggregation of the two basic matrices (the make matrix and the absorption matrix), and the treatment of imports. The basic matrices are now rechtangular and contain about 1600 commodities. The treatment of imports, which is a very important question in input-output tables for countries with a high rate of foreign trade, has been modified to make the table more flexible for different analytical purposes. In this connection the question of distinguishing between competitive and non-competitive (complementary) imports which is particularly difficult to handle in time series of input-output tables has been solved by introducing more flexibility in the treatment of imports.

2. The commodity-flow system[1]

In Denmark there is, as proposed in the new SNA, a complete integration between national accounts and the detailed commodity and production accounts which form the basis for the input-output tables. The final yearly national accounts contain about 4000 commodity accounts (over time gradually declining to 2500, cf. below) and 121 production accounts inclusive of four artificial production accounts, three of which are redistribution accounts and one contains imputed bank service charges. On the supply side there are furthermore one account for imports c.i.f. and two for customs duties. There are 77 categories of final use, of which private consumption represents 66 categories. The complete system is thus made up of a 4000 x 124 matrix for supply and a 4000 x 198 matrix for use. In the latter matrix each element is further subdivided into element for basic value, wholesale trade margin, retail trade margin and commodity taxes, net. The total number of elements in the commodity-flow system is therefore about 3.5 million (inclusive of empty cells).

The calculation at constant prices takes place also at this level of detail, i.e. price indices for imports and for domestic production, respectively, are determined (mainly from wholesale price material) and the uses at constant prices are calculated roughly on the assumption that exports are made up of domestic output, and all other uses have identical import contents.

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1) A comprehensive description of the commodity flow system at current prices is given in chapter 2, and at constant prices in chapter 4, of this publication.

Most of the figures published for the final national accounts are obtained by aggregations in this data system, but of course figures on income distribution, other indirect taxes etc. must be calculated separately outside the system. After a long period of catching up, final figures are now ready 33 months after the year to which they refer, and the input-output table can be produced immediately after, as this is a purely technical matter which does not require any further estimation work on the data.

In principle the 4000 commodities are comparable over the whole period after 1966, but in practice it has over time been necessary to aggregate some (because of changes in the basic commodity nomenclatures) and to accept other kinds of discontinuities. As a consequence of this the total number of commodities decreased from about 4000 in 1966 to about 2500 in 1982. Nonetheless it has been found extremely useful to carry out the balancing in the commodity-flow system at this detailed level, where each commodity has an immediately clear meaning.

Of course the balancing of the commodity flows and production accounts is carried out by extensive use of computer based procedures, but eventually the last differences are eliminated by conjectural procedures. As the emphasis in this paper is on the subsequent production of the input-output table, these procedures will not be described here, but it is important to realize that it is in this balancing process that the material contents of the input-output table are established, i.e. the national accounts picture of the real world is determined here, whereas the following construction of the input-output table is basically a question of presenting these data in a more aggregated and operational form with a minimum loss of information.

As mentioned above, the most detailed commodities are not strictly comparable over time, so even though it is useful to work at this level in the initial balancing and calculation of constant-price figures, a higher level of aggregation has been found appropriate for the purpose of recalculating the figures to a new base year for constant prices. This level contains about 1600 commodities, of which 500 are services which are not aggregated, as there are no problems of temporal comparability. The goods are simply aggregated to the four-digit CCCN nomenclature (i.e. the former BTN-nomenclature), which is possible because the first four digits at the 4000-commodity level are identical with the code numbers of the CCCN headings. In this way complete intertemporal comparability is secured at the 1600-commodity level. These series are available on an annual basis since 1966 in current prices and in constant prices. (See annexes 1 and 2 for some modifications to this aggregation procedure).

3. The first version input-output tables 1966-75

The method applied in construction these tables is summarized below and fully explained in (DS 1973).

To each of the 4000 commodities an identification code for one of the 130 characteristic industries is attached. The characteristic industry is defined as the main producer of the commodity in 1966. Here as elsewhere in the paper the term "industries" also includes "other producers" in the SNA meaning of the term. This code was then applied as an aggregation criterion, and 130 commodity groups were thus obtained, and the make matrix as well as the intermediate consumption part of the absorption matrix became square matrices (see figure 1 for an illustration of make and absorption matrices). So the above-mentioned medium level of aggregation (1600 commodities) played no role at that time. Most commodities without Danish production (at the 4000-commodity level) were classified as non-competitive imports, and not given any code for characteristic industry. Imports of these commodities were in all subsequent calculations treated as a primary input.

By means of the well known SNA procedure an input-output table of the industry-industry type on the assumption of an industry technology was then calculated.[2] The final demands were also included in this

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2) An industry x industry table has industries, which are ideally made up of establishment kind units, in both rows and columns of the intermediate consumption part of the table, whereas a commodity x commodity table has rows and columns defined in terms of a commodity classification.

Both kinds of tables can be constructed from the make and absorption matrices using either the assumption of an industry technology or the assumption of a commodity technology. In the first case it is assumed that an industry has the same input structure whatever its product mix, whereas in the second case, it is assumed that a commodity has the same input structure in whichever industry it is produced.

It is not possible at this place to summarize the intense discussion the last 10-15 years on the pros and cons for these different kinds of tables, but this article can be seen as a strong case for choosing the Danish solution.

negative final demand. In this way a complete input-output table with imports treated according to method C in "Input-output Tables and Analysis" (UN 1973) was obtained.

This table was named the "exogenous" version, because competitive imports in models based on it would be an exogenous variable. As a quantity model this raised some problems, although in some applications as for example calculation of energy contents it proved useful. As a basis for price models it was in some cases easier to apply because of the limited number of exogenous prices it required.

In many uses, however, it was desirable to be able to calculate competitive imports as an endogenous variable, which required a separation of competitive imports from domestic production in each element of the matrices for intermediate consumption and final demands. This was done on the assumption that exports had no direct import contents, whereas all other uses of each characteristic commodity had the same proportion between imports and domestic production. Hereby imports were treated according to method D in (UN 1973).

Both sets of input-output tables (the "exogenous" and the "endogenous" version respectively) were placed in a data bank in connection with a special computer programme for IO-analysis (based on the PASSION programme developed at the Harvard Economic Research Project in the sixties). The complete set of matrices for one year was made up of 46 matrices, 23 for the current-price tables and 23 for the constant-price matrices. Apart from the column totals all matrices were stored in coefficient form only.

These tables were used for many kinds of analysis, often in connection with supporting data matrices, for example of energy use in physical terms and/or employment figures, which were fitted to the classifications of the input-output table.

When these tables became the "first version" only it was because they - under pressure of time and resources - had been produced using the 1966 procedure, although it was planned to work out a new procedure (cf. below) which could take full advanage of the detailed basic data source, and also because a change in the classification of branches was planned (from 1958 ISIC to 1968 ISIC). Furthermore the constant-price tables would be recalculated from 1970 to 1975 as base year, which - taking place only at the 1600-commodity aggregation - would invalidate the concept of characteristic industry earlier used.

It was an indispensible requirement to the new - and present - version tables that they should constitute an unbroken time series starting in 1966. The new branch classification was established by amalgating or resequencing the branches of the old one. As an exception from this general rule, two new branches were created by subdivision: "Extraction of coal, oil and gas" and "Domestic services" (DS 1981). In this process the total number of branches decreased from 130 to 117. All national accounts data from 1966 and onwards have been reclassified according to the new classification.

4. Basic features of the present techniques

Compared with the detailed data base in the commodity flow system it is obvious that the above-mentioned method for constructing input-output tables introduced unnecessary aggregation errors by taking the round-about route represented by the initial aggregation to characteristic commodities. The main idea in the new method is to avoid this error by constructing the input-output matrices and the import matrices directly from the 1600-commodity level matrices.

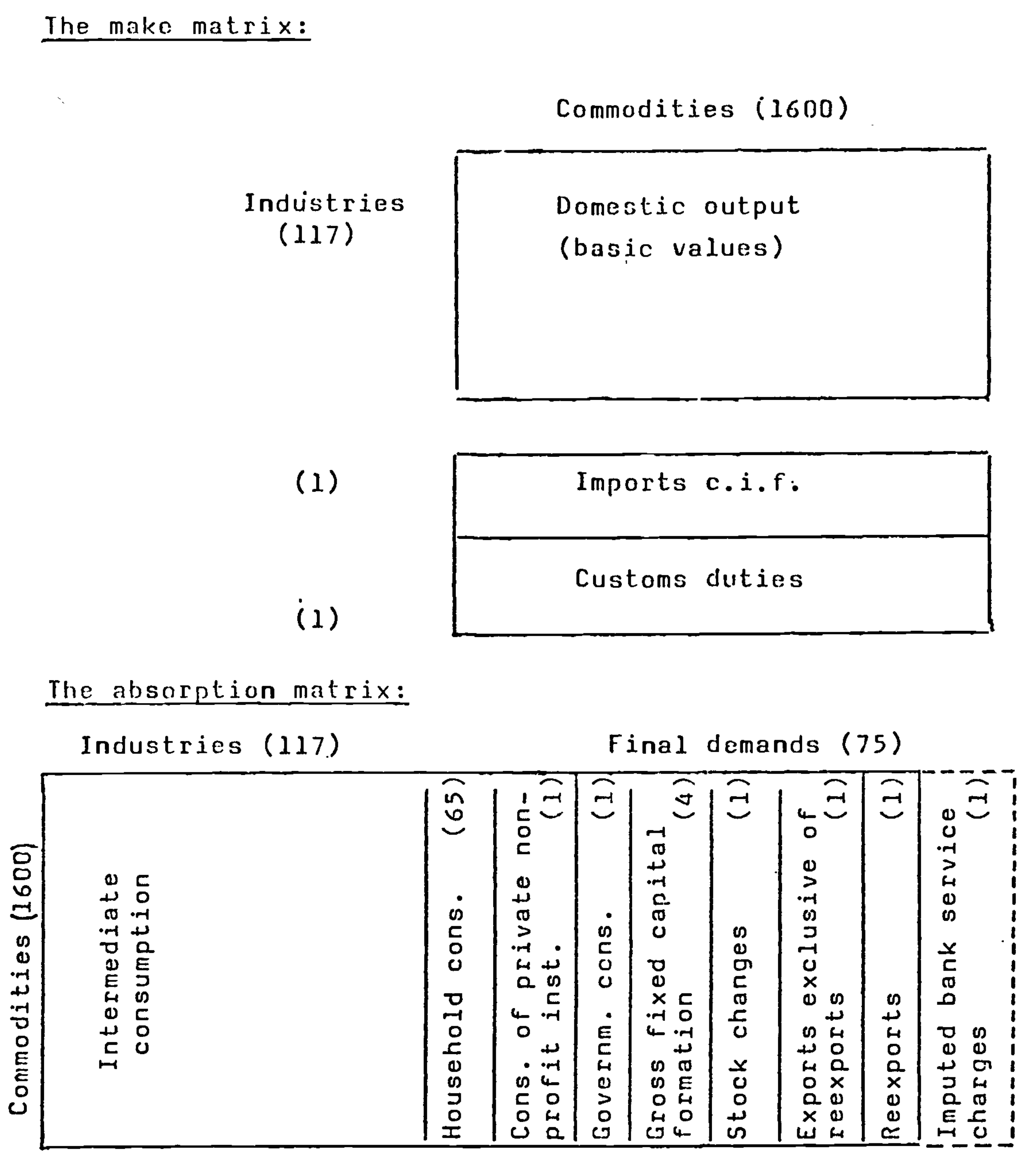
The two basic matrices are shown in figure 1 where numbers indicate matrix dimensions.

These matrices exist for each year in current and constant prices. To facilitate the calculation of the input-output table the matrices shown above have been slightly modified compared with the arrangement of the matrices in the basic commodity-flow system. This concerns the following four points.

1. Three artificial distribution sectors for "unspecified goods", "unspecified services" and "goods and services for repair and maintenance", each producing one commodity have been eliminated on the assumption that each sector receiving input of these commodities gets a basket of commodities equal to the input structure of the artificial sector in question.

2. Reexports have been deducted from the figures in the total export column. Ideally this can be done just using the reexport figures given

Figure 1. The make matrix and the absorption matrix.



in the foreign trade statistics. In practice the matter is a good deal more complicated, because registered reexports can exceed imports of the commodity. In such cases the direct import contents of domestic uses would be negative. In other cases it happens that the domestic output of a commodity is less than total exports - reexports. In the first case it is assumed that reexports are equal to imports, and in the second case that total exports - reexports are equal to domestic output (which defines the size of the reexports). Solutions to other complications which can emerge, have also been built into the computer programme handling this procedure.

In the constant-price figures total exports are divided into reexports and the rest, by deflating reexports by the prise index for imports, and calculating the constant-price value for the rest as a residual from the given constant-price value for total exports. (Cf. chapter 3 in the present publication).

3. In the national accounts imputed bank service charges are treated as intermediate consumption. Technically this is implemented by having an artificial sector with imputed bank service charges as input and output equal to zero, which implies a negative gross operating surplus equal to the input.

To keep this artificial sector in the input-output table would cause problems for two reasons. Firstly, the output is zero and therefore input-coefficients are not defined. Secondly, if the sector were aggregated with the financial sector, this amalgamated sector would have a dominant own-delivery, and the small proportion of bank services which are actually paid for would have an enormous multiplier effect, which could invalidate the results of model calculations.

Therefore it has been decided to move imputed bank service charges to the final demand section of the table. This will remind the user of its existence and the need to take it into consideration if the financial sector (and consequently other sectors) is to appear in a meaningful way in model calculations.

Finally it must be underlined that this treatment of imputed bank service charges implies that total GDP in the input-output table is calculated as the sum of value added in the individual branches less this element of final demands.

4. The five categories of stock changes (exclusive of work-in-progress and finished own products in manufacturing industries, which are not distributed by commodity) have been added together to one single column, as the subdivision applied in the commodity-flow system is mainly of technical character, and not useful in the context of input-output tables. For the samne reason the two categories of customs duties are added together

5. The treatment of imports

The distinction between competitive and non-competitive imports is not applied, but some special commodities which are not covered by the foreign trade statistics are singled out and treated as three categories of primary inputs. The commodity contents of these rows are:

1. Goods and services imported directly to off-shore activities in the Danish part of the North Sea. (In 1983 the coverage of the foreign trade statistics was extended also to such goods, so from this year the group contains services only).

2. Purchases abroad by resident households and expenses for business trips etc. and purchases in Denmark by non-resident households etc.

3. Expenses abroad for Danish ships.

In the preceding chapter it was explained how reexports were isolated, and this of course is the same as calculating the direct import contents of exports. To make a complete disaggregation of the absorption matrix into one showing uses of domestic output and one showing uses of imports, it is necessary to make an assumption as to how the remainder of imports (i.e. imports cif + customs duties - reexports) are distributed among the categories of use.

For lack of any specific information it is assumed (for each of the 1600 commodities) that the ratio of domestic output to imports is identical in all domestic uses. Changes in stocks of work-in-progress and finished own products are of course always domestic output, and are so treated in the input-output table.

It is important to note, that this assumption for imports is in the present system applied at the detailed commodity level, whereas in the earlier version it was applied at the level of 130 characteristic commodities, and therefore could lead to import figures in cells about which it was positively known that all input was of domestic origin (for instance agricultural input into dairies). This source of error is almost eliminated when imports are singled out at the detailed commodity level, and for model purposes it may often be more useful to assume identical import proportions in all domestic uses of an individual commodity than to use the actual more or less incidental or random figures for import contents - if we had knowledge about them, which we don't.

By the above-mentioned procedures the total absorption matrix has been subdivided into two matrices of equal dimensions - one for uses of domestic output, and one for uses of imports.

Three different aggregations of the resulting import matrix are carried out:

1. By means of the make matrix aggregation takes place to form industry groups (117) corresponding to the domestic industries. In principle the imported commodities are rearranged to suit a classification where each commodity is assumed to be supplied by industries in the same proportion as the domestic output of the commodity. (Technically the absorption matrix for imports is premultiplied by the make matrix in a coefficient form, the column totals being 1). As explained in the following section on the treatment of domestic output, a problem did arise in cases where no domestic output existed, as such commodities are not contained in the make matrix. The problem was solved by "assigning" a domestic industry to these commodities.

2. All commodities contained in the CCCN nomenclature (i.e. all goods) are aggregated over the first two digits of this nomenclature, which yields 99 rows (CCCN groups 01-99). All services are lumped together in one row (no. 100). The advantage of this classification is its direct comparability with current statistics, and the absence of any questions of interpretation.

3. A special aggregation for use in the macroeconometric model ADAM showing the ten divisions of SITC and an 11th group for services. This grouping was also worked out for exports. This aggregation is not in the ordinary input-output data bank.

6. The treatment of domestic output

The absorption matrix for domestic output (at the 1600-commodity level) is treated in a way parallel to the first kind of aggregation mentioned above for the import matrix, i.e. it is premultiplied by the make matrix in a coefficient form. The result is an industry x industry input-output table calculated on the assumption of an industry technology, which incidentally is the only possible technology assumption when the calculations are based on rectangular matrices. Also in this case a commodity x commodity table would not make any practical sense - but theoretically a 1600 x 1600 input-output table could be calculated.

It is worth noticing that the much discussed problems of which technology assumption to choose and whether to produce industry x industry or commodity x commodity tables are completely eliminated when maximum advantage is taken of a detailed data base in the construction of the table (cf. also UN 1973, p. 38).

As mentioned earlier there is no need for the concept of characteristic products in order to construct the input-output table by the new procedure. The make matrix does however automatically imply this concept if each commodity is defined as characteristic in the industry which is the main producer. Furthermore, for commodities which are not produced in Denmark (about 300 at the 1600-commodity level) it has been necessary to assign a characteristic sector in order to carry out the first aggregation of the import matrix. In this way the concept of a "characteristic sector" has been defined for all commodities for the year 1975.

7. Selected commodities

It is generally accepted, that the distinction between competitive and non-competitive (complementary) imports is important in input-output analysis. The distinction is set out in SNA (UN 1968) and discussed in more detail in (UN 1973). From the latter the following passage might be quoted:

> "The decision on classification (i.e. between competitive and complementary) may thus (because it depends on the level of disaggregation of commodities, p. 60), to a certain extent, be arbitrary in particular cases and may need revision over time if

domestic production ceases or commences. Finally, it should be noted that the classification will vary between economies and this may cause slight problems in international comparisons" (p. 61).

In the first version of the Danish input-output tables 1966-75 almost all commodities at the 4000-level disaggregation for which no Danish production took place in 1966 were classified as complementary. This meant that about 30 per cent of imports were so classified.

In the compilation of time series of input-output tables and the application of these in analysis, two problems showed up:

Firstly, for some product categories such as iron and steel work products which are partly produced in Denmark (but only by recycling waste) and partly imported, it was found that about half of the commodities were classified as complementary and the rest as competitive, even though this case might from a common sense point of view had been expected to show a clear-cut example of complementary imports, as no iron ore is produced in Denmark. In input-output analysis the capacity limit for Danish output could not be taken into consideration, whereas on the other hand it would not make sense to classify the actual Danish output as complementary. Similar cases arose for many other primary products such as agricultural products, and lately in the case of Denmark also for crude oil and natural gas. Clearly these problems have no simple solution as their character is marginal in a system which is based on average ratios throughout.

Secondly, over time the above-mentioned definition of complementary imports strictly applied would imply that commodities had to be reclassified yearly, which would impair the concept in applications where it would be useful to interpret it as covering homogenous commodity groups - this would be the case both for complementary imports and for the groups of imports classified as competitive to the output of a specific domestic industry. In other words: a yearly reclassification of the goods would be necessary to stick to the ideal definition, but on the other hand such a reclassification would make the data more or less meaningless as time series.

It is obvious that these problems can be solved in specific applications of the input-output tables, where they are used as a data base for more sophisticated econometric models, and where marginal effects etc. can be taken into consideration. To producers of input-output tables which are required to be comparable over many years and to be useful in many different applications (of which many might not be known at the time the table is produced), the problem is, however, a much more difficult one, as discussed in Thage (1973).

In the following the solution which was finally chosen to this problem, is set out. It is based on three basic principles:

1. Maximum flexibility. The former "exogenous" and "endogenous" versions can be obtained as special cases from a more general system.
2. The link to the detailed rectangular data matrices is utilized and thereby makes clear to users that the input-output data system can be applied in connection with much more detailed data which are also available in a standard form. (In fact to show that the commodity-flow data represent a system of consistent statistics which are comparable over time and available in connection with - but also without - the input-output tables).
3. To take into consideration that in many cases the user will be interested in analysing the effects on certain key commodities of a specific policy and also in knowing whether the changes are of domestic or foreign origin. In recent years analysis of energy and other raw material problems, pollution and technological development and in general analysis of the inflationary process are examples to be mentioned.

These considerations led us directly to the concept of <u>selected commodities</u>, which simply meant to select from the absorption matrix (in the 1600 x 192 version) a number of commodities which might reasonably be called key commodities in the Danish economy. These commodities are arranged in special matrices corresponding in format to the input-output matrices and placed together with these in the data bank. It is important to note that no aggregation of these commodities take place, so that the rows in the matrices for selected commodities consist of four-digit CCCN groups. This means that they have a clear definition for users and can easily be connected with other statistical information (for example statistics on production, foreign trade and prices).

A total of 99 commodities were selected. Of the total supply of these commodities, 67 per cent consisted of imports, and these imports made up 52 per cent of total imports of goods (in 1975).

For practical reasons it was a priori decided, that the number of selected commodities should not exceed 100. But for users with special wishes it is possible to select other goods from the absorption matrix by ad hoc procedures, as these matrices cannot be available in full in the input-output data bank. The commodities selected can broadly be said to consist of the following categories:

Agricultural products not produced in Denmark
Grain and other important feeding stuffs
Energy products
Fertilizers, basic plastics
Timber, pulp, paper
Wool, cotton, chemical fibres
Iron and steel (not fabricated)
Other metals (not fabricated)
Aircrafts and parts thereof, computers
Transistors, microchips
Tractors, motorcars and parts thereof.

In annex 3 a full list of selected commodities is given. Energy products are only divided into four commodities, but in connection with the input-output tables there are also special energy matrices for all years since 1966 which show 25 kinds of energy, both in value and physical quantity terms.

In annex 3 the set-up of the matrices in the input-output table data bank is shown for one single year. In fact there are to such sets for each year - one in current prises and one in constant prices. It can be seen that the input-output table has been divided into many submatrices to faciliate calculations. In the data bank there are also two inverse matrices (nos. 16 and 17) which are the inverse of matrix no. 1 and matrices 1+4, respectively. All matrices with the exception of nos. 13, 14 and 15 are given in a coefficient form, but can be converted to absolute figures by means of the absolute column totals given in the three mentioned matrices.

The coefficient matrices for selected commodities are shown as nos. 21-23. In this form they can only be applied to calculate the total contents of these commodities or to trace price effects on special assumptions. But by means of the supporting coefficient matrices nos. 24-26 they can be changed into forms which are compatible with matrices nos. 1-6 and thereby allowing a more generalized treatment of imports.

8. A generalized treatment of imports

As mentioned above, the matrices for selected commodities (nos. 21-23) have rows consisting of 4-digit CCN groups. By applying the same procedure as described earlier for dividing the absorption matrix into a matrix for domestic production and a matrix for imports, the matrices 21-23 can each be so divided. The necessary information for this operation is contained in matrix 25 (import ratio in domestic uses) and matrix 26 (import ratios in exports). The result of this procedure is illustrated in figure 2.

As described above, the breakdown of the original matrices for selected commodities takes place by applying the actual import ratios for the year in question given in the matrices 25 and 26. But it is of course also possible to choose different ratios for some or all commodities in individual calculations, the two extremes being (1) the import ratios for all commodities are one (2) the import ratios for all commodities are zero. This flexibility in splitting up the original matrices makes it possible to take into account marginal conditions and to use what external information the analyst might possess.

After the above procedure has been carried out, the two sets of matrices are still on a commodity basis. From the total make matrix is singled out a partial matrix which contains the information concerning the 99 selected commodities. (Matrix no. 24 of dimension 117 x 99). By means of this matrix it is now possible to transform the matrices 21a-23a and 21b-23b into a form having industry identifications in the rows, i.e. matrices with 117 rows which can be subtracted from or added to the two sets of matrices 1-3 and 4-6, respectively. To faciliate the following exposition, the relevant sets of matrices (with the symbols used hereafter) are set out in figure 3.

Figure 2. The breakdown of selected commodities into domestic output and imports.

Original matrices for selected commodities (cf. annex 1):

		(117)	(66)	(9)
Domestic output and imports	(99)	21	22	23

After breakdown into domestic output and imports:

Domestic output	(99)	21a	22a	23a
Imports	(99)	21b	22b	23b

Figure 3. Illustration of symbols used in the definition of "stripped" matrices.

Standard coefficient matrices (cf. annex 1):

		(117)	(66)	(9)
Total domestic output (uses) by industry	(117)	1 DA	2 DC	3 DD
Total imports (uses) classified by producing industry	(117)	4 MA	5 MC	6 MD

Coefficient matrices for selected commodities:

Domestic output of selected commodities by industry	(117)	SDA	SDC	SDD
Imports of selected commodities by industry	(117)	SMA	SMC	SMD

In the following each of the four sets of matrices is symbolized by a single variable name. D is the common name for the matrices DA, DC and DD. Similarly the names M, SD and SM will be used for the three other sets of matrices, and S is defined as SD + SM.

Initially we shall assume that the matrices SD and SM have been calculated by means of the actual import ratios and relevant make matrix elements for the year in question. It is then obvious that these matrices are completely contained in D and M, respectively, and can be subtracted from them without leaving negative elements in the resulting matrices.

The traditional input-output matrices D and M stripped of their contents of selected commodities will then be:

$$(1) \quad D - SD$$

$$(2) \quad M - SM$$

And what we have subtracted adds up to the total matrix for selected commodities (both domestic and imported):

$$(3) \quad S = SD + SM = SD^* + SM^*$$

The matrices in (3) can be either the actual matrices of the year (SD,SM) or some specially constructed matrices SD* and SM* which can be obtained from the original matrices for selected commodities (fig. 2) by applying other import ratios and possibly also a different partial make matrix. This allows the user to take into account any a priori information he might possess, and to make special assumptions regarding marginal changes.

Now we have the necessary instruments for illustrating the generalized treatment of imports by some standard cases. The basic idea is to add to the "stripped" matrices (1) and (2), matrices of selected commodities. The only requirement to the matrices added is that the column totals must be equal to the column totals of matrix S.

The standard cases are first shown using the actual S, SD and SM matrices of the year. Line (a) shows matrices for delivery from domestic industries, line (b) endogenous imports exclusive of imports of selected commodities and line (c) endogenous imports of selected commodities.

	"Stripped" matrices	Case 1	Case 2	Case 3
(a)	D - SD	+ S	+ SD	+ 0
(b)	M - SM	+ 0	+ 0	+ 0
(c)	0	+ 0	+ SM	+ S
Sum	D + M - S	S	S	S

To exemplify how the above set-up is to be read the complete "case 2" model will be:

(a) D - SD + SD = D

(b) M - SM + 0 = M - SM

(c) 0 + SM = SM

The three above cases for adding selected commodities to the "stripped" matrices have the following characteristics. In all cases it is assumed that endogenous imports of category (b), cf. above, are used according to the actual import ratios of the year. Through the three cases from 1 to 3 a still higher proportion of selected commodities are treated as endogenous imports.

In case 1 it is assumed that import ratios for all selected commodities are zero - or alternatively imports of these commodities can be determined exogenously.

In case 2 selected commodities are assumed to be domestically produced (or exogenous) and imported according to the average rates of the actual year. If SM is interpreted as complementary imports this case corresponds to the model which in the first version of the tables was named "endogenous".

In case 3 it is assumed that import ratios for all selected commodities are equal to one.

As matrices in line (b) and line (c) can be added, it is possible to form total import matrices, where imports of selected commodities are lumped together with other imports. It might be mentioned that in these cases it is possible to have import matrices in both line (b) and (c) classified according to 2-digit CCCN groups, or to keep matrices in line (c) at the 4-digit CCCN grouping of the original matrix for selected commodities.

If the lines (a) and (b) are added we get three new cases, where it is assumed that imports exclusive of what is specified as imports of selected commodities are zero - or alternatively determined exogenously. For imports of selected commodities the assumptions will be the same as in cases 1-3.

The three new cases are:

	"Stripped" matrices	Case 4	Case 5	Case 6
(a+b)	D + M - S	+ S	+ SD	+ 0
(c)	0	+ 0	+ SM	+ S
Sum	D + M - S	S	S	S

It is worth noticing that case 5 corresponds closely to the model which in connection with the first version of the tables was named the "exogenous", although "complementary imports" is now defined from a different point of view.

In the above six models the matrices SD and SM have been used to illustrate the standard cases which could be commented upon by reference to fairly simple model structures and to the treatment of imports earlier applied. It is, however, important to point out that the new system gives an infinity of model possibilities if the matrices SD and SM are replaced by SD* and SM*, which can be tailored to specific uses. In many instances the user will probably be interested in giving a special treatment to only one or a few of the selected commodities. In this connection it is important to remember that in the calculation of the "stripped" matrices it is always the actual S, SD and SM of the year in question which must be deducted.

Above the matrix for imports exclusive of imports of selected commodities (M - SM) has been considered in its entirety only. But of course it is possible to subdivide also in this matrix (or the matrix M) into submatrices by separating out entire rows and to treat these in a way parallel to the subdivided S-matrix.

A few examples may give an idea about the possibilities of analysis in models based on the above structure.

In an analysis of the marginal effects of an increase in output of animal products it would be appropriate to set the import ratios for the selected commodities grain and feeding stuff at one, as no additional supply of these commodities will be available from domestic sources. On the other hand, if the harvest has been unusually large in a single year and an input-output table for an earlier year is used as a basis for model calculations, these ratios could be decreased on the average.

Suppose that the capacity of steel mills or oil refineries has changed drastically. For almost any kind of analysis it will then be necessary to change the import ratios for a number of selected commodities.

These examples illustrate that the present input-output data structure among many other things makes it meaningful to draw a distinction between input-output models for average and marginal analysis, respectively, and generally speaking it will be possible to incorporate many kinds of a priori knowledge into the input-output model in a rather precise way. For more special applications it will be possible to go to almost any degree of detail by drawing on the data in the basic commodity flow system.

9. Concluding remarks

In the last decade there has been an enormous increase in the production of input-output tables and in their applications in still more fields of economic analysis. Apart from a general tendency to increase the size of the tables there has, however, not been much development in the techniques of producing the tables or in their general appearance, as this has been instituted by the recommendations given in the SNA.

The methods described in the present paper (and implemented for Denmark) can be seen as a step on the way to creating a more general concept of an input-output table which in close connection with the detailed data base of the national accounts can serve as a flexible instrument for structural economic analysis at all levels.

ANNEXES

Annex 1

A technical note on the 1600 commodity aggregation

As described above the main idea in the change in method from the preliminary input-output tables for 1966-75 to the final ones was to avoid the aggregation of the detailed commodity flows to characteristic sectors (giving square make and use matrices) by constructing the input-output table directly from the detailed (rectangular) matrices.

Because of problems of continuity these rectangular matrices are however not those containing the most detailed commodity flow system for each year, but an aggregation from about 4000 commodities (in 1966, but gradually declining to 2500 in 1982) to the stable 1600 commodity classification, where all goods are aggregated to the four digit CCCN classification, whereas services are left at their most detailed level.

The application of this particular level of aggregation gives raise to some theoretical and practical problems. Whereas it is always true that an industry by industry input-output table constructed on the assumption of an industry technology directly from rectangular make and use matrices containing the most detailed commodity flows available will be superior to the same kind of table constructed via the intermediate step of commodity aggregation to square make and use matrices, it is not a given matter that a similar kind of input-output table constructed from rectangular make and use matrices based on even a slight commodity aggregation, will have this property.

The criterion on "goodness" must be whether the resulting input-output table will contain some elements about which it can positively be known that they give a wrong description of the real world in the sense that they contradict information which can be obtained simply by inspecting the most detailed commodity flow system available.

The method based on aggregation to square make and use matrices does obviously not lead to input-output tables which will fulfil the above criterion, but on the other hand this method has a build in "safety net" which in general secures that real disasters do not occur. This safety net is made up by the assignment of a characteristic sector to each commodity. In other words the aggregation key is fitted to create as little turmoil as possible in the subsequent construction of the input-output table.

In the aggregation from the 4000 (or 2500) commodities to the 1600 groups we do however introduce an aggregation key (from the most detailed commodities to the four digit CCCN groups) which basically is irrelevant to the subsequent calculations - the exceptions being such cases where the added commodities happen to be mainly produced nn the same sector.

Even though the CCC Nomenclature is not very well designed for the purpose to which it is here put, as the commodities are essentially grouped according to the nature of the material of which they are made, so that in each section or shapter it often contains a product from its most crude to its most fabricated form, it is at the four digit level (the headings) fortunately most often the case that important individual commodities are produced in the same sector (this outcome is of course also a function of the given sector classification). It must also here be mentioned that many of the most detailed commodities are already at the four digit level (and more so as time passes on), and for these there are by definition no aggregation problems.

Now suppose that two commodities which are grouped together in a four-digit group have different producing sectors, different distribution on users, different import ratios and are both of a considerable size. In this case the resulting input-output table, and also its subdivision into a domestic matrix and an import matrix will be adversely affected in the sense that it will contain elements which are clearly contradicted by the information we have from the detailed commodity flows.

If raw milk delivered from farms were grouped together with milk delivered from dairies we would have an example of such a group. In the input-output table the average distribution to users of this group would be included in both the agricultural sector and in the dairy sector, making no sense in either case. The dairy sector would for example be seen to deliver about half of its output to itself, whereas farmers would have a big delivery of milk to final consumers.

In such cases it is obviously necessary to deviate from the principle of aggregating all goods to four-digit CCCN groups.

In order to detect cases where aggregation would cause unacceptable distortions, two "partial" input-output tables for 1977 were constructed for <u>each</u> of the 1600 4-digit groups (assuming for each partial table all other 4-digit commodities to be non existent). The first one (method A) was based on an initial aggregation of all detailed commodities belonging to the 4-digit group into one commodity group. This method implies, that the input-output table was constructed using a make and use matrix with one column and one row respectively and using one import ratio. The second one (method B) omitted the initial aggregation, so in this case the number of columns in the make matrix, the number of rows in the use matrix and the number of import ratios, respectively, were equal to the number of detailed commodities belonging to that particular 4-digit group. It followed from the methods used that the two resulting tables will have identical row sum vectors and identical column sum vectors, whereas the "interior" of the tables will be different.

It should come as no surprise that the total IO table based on the 1600 commodity classification could be obtained by adding up the 1600 Method A IO tables, and likewise that the total IO table based on the most detailed commodity level (3000 in 1977) could be obtained by adding up the 1600 Method B tables. Consequently the errors introduced into the total IO table by aggregating several detailed commodities into one 4-digit group could be calculated as the differences between the Method A and Method B table for that particular 4-digit group.

The two tables for each 4-digit group were compared cell by cell, and the differences calculated both as absolute values and as percentages of column sums in the total input-output table. In about 45 cases it was found that the aggregation to the four digit level gave raise to considerable errors either in the total table or in its subdivision into the domestic matrix and the import matrix. The latter kind of errors was seen as less serious than the former, which influences the technical properties of the input-output table. Finally about 15 four-digit groups were disaggregatd to two (often one specific detailed commodity and "the rest") or more subgroups, and this modification to the simple aggregation key has been applied for all years. This has of course required continuity for these more detailed commodities to be kept over time.

Another deviation from the strict aggregation principle happens in connection with the treatment of "scrap"commodities. This is explained in annex 2.

Annex 2

The treatment of scrap and waste materials

Scrap and waste materials can arise from two basically different sources. First it can arise as a result of demolishing existing capital goods, in which case it is supplied from a negative entry at fixed capital column. Second it can arise in the course of productive activity as a form of by-product, for example in cutting processes etc. in the mashinery industry.

Even at the most detailed commodity level scrap and waste from these two different sources are contained in the same commodity, which furthermore will often also contain some ordinary supply of this particular metal etc. But in most cases the dominant part of the supply will come from negative fixed capital formation.

If such a commodity, perhaps even after having being added together with other with other commodities in the same four-digit group, is subjected to the ordinary treatment in the process of constructing the input-output table, it is the distribution by domestic producer of supply of "production" waste products and any supply of ordinary output of the commodity group which determines how the original negative entry in the fixed capital formation cell is finally assigned to sectors. As such "production" waste products often originate from very many different sectors, each of these sectors will be given some part of the negative fixed capital formation in their row.

If these sectors have other (positive) deliveries to fixed capital formation, the figures in the cells may non the less be positive, so that users of the table might not see anything suspicious. There are however introduced some distortions in the table, as a number of sectors will have too small deliveries to fixed capital formation and too big deliveries to intermediate consumption - often to the branch itself. If some of these sectors do not have any ordinary deliveries to fixed capital formation, the negative entry will be visible in the input-output table in a cell where nobody would expect such a figure.

Where should we then expect to find this negative fixed capital formation in the input-output table? It is obviously not an output from any ordinary sector, and we do not wish to create an artificial sector solely in order to solve this problem. So we are left with two problems:

1. We must subdivide those of the most detailed commodities which contain scrap from demolished capital goods to isolate that part of the commodity which is supplied from negative fixed capital formation.

2. We must decide which sector is to be chosen as the characteristic producer of this kind of scrap materials.

As the most detailed commodities can by their vary nature not be subdivided by any automatic procedure, and the commodities containing negative fixed capital formation cells like all other commodities at the most detailed level lack continuity over time, it has been decided to use an artificial subdivision process. It is illustrated in figure 1.

In row (1) the original commodity balance is shown. It is seen that there are two domestic producers, each producing a relatively small share of the total amount available for use as intermediate consumption and for exports.

In row (2) it is shown how an artificial commodity is created by assigning a negative output to wholesale trade equal to the negative cell for fixed capital formation.

Table 1 Schematic illustration of the treatment of commodities containing scrap

			Supply			Uses		
			Domestic output					
			Industry no.	Value	Imports	Interme- diate con- sumption	Fixed capital formation	Exports
1	Original commodity at the most detailed level		38xx1 38xx2	7 3	100	250	-180	40
2	Subdi- vision	Artificial new com- modity Is kept separate in the construction of the IO-table	Wholesale	-180			-180	
3		Residual commodity (= 1-2) Is aggregated with any other commodity in the same four- digit group, except (2)	38xx1 38xx2 Wholesale	7 3 180	100	250	0	40

Finally row (3) is simply obtained by deducting row (2) from row (1). The "residual" commodity in row (3) is subsequently treated as an ordinary detailed commodity, i.e. it will be added together with any other commodity in the same four-digit group.

Schematically we have first delivered all scrap originating as negative fixed capital formation to wholesale trade as a reduction in the output (in order not to permit this playing around with scrap to influence the totals of the wholesale trade sector), and then in the next round the wholesale trade sector acts as the "producer" of the scrap, which has in this way been transformed from a negative use to a positive supply without affecting any of the totals of the system.

This treatment implies that the sum of all negative fixed capital formation elements in the input-output table will be placed in the wholesale trade row. As there are considerable wholesale trade margins on fixed capital formation of machinery etc., this negative entry will not be visible, but there will of course be a distortion in the wholesale trade row, as the deliveries to fixed capital formation will be to small and the deliveries to the sectors using scrap as inputs (and to exports) will correspondingly become to big. As the row for wholesale trade has rather high values in all cells the distortions will be relatively small. Also the too big deliveries to the scrap consuming sectors will not be without sense, as the biggest part of the value of scrap at purchasers' values actually do consist of wholesale trade margins. These last two arguments justifies that wholesale trade, and not for example steel or metal works, has been chosen as the characteristic producer of scrap from demolition materials.

Altogether eight such artificial scrap commodities have been defined. They are all iron or metal products, which are negative fixed capital formation in the category "Machinery and equipment". No negative fixed capital formation is defined in connection with the activity of demolition of buildings.

Annex 3

Contents of the data bank for input-output matrices

The organization of the input-output matrices for a single year is illustrated in the following diagram. It is seen that the input-output table has been broken down into many submatrices to facilitate the use. For each year two sets of matrices are placed in the data bank - one in current prices, and one in constant prices. At present (autumn 1986) the bank contains annual data for the period 1966-83.

The data bank is placed at the computer center of the University of Copenhagen in connection with a programme packet for input-output analysis which is a further development of the PASSION packet worked out at the Harvard Economic Research Project in the sixties. In this way the data can be made directly available also to users outside the statistical office. The programme packet and how to get access to the data files is described in Folke (1981).

All matrices with the exception of nos. 13, 14 and 15 are stored in a coefficient form only, but by means of the absolute column totals in these three matrices they can be transformed into absolute figures if needed.

The set of matrices 1, 3, 4, 6, 7, 9, 10 an 12 represents the traditional input-output table in a coefficient form. The matrices 2, 5, 8 and 11 give a detailed breakdown of the column for total private consumption contained in matrices 3, 6, 9 and 12.

The two last pages of the annex give a complete list of industries, groups of final demand and primary inputs used in the input-output tables. The matrices where 2-digit CCCN groups are used do not need any further explanation, whereas a list of the 99 4-digit CCCN groups of selected commodities is given on the last page of the annex.

In principle all matrices are given in approximate basic value, but in connection with indirect taxes, net, on uses, which are all contained in the matrices for primary inputs, a total in purchasers' values for each use is obtained. This implies that matrix 13 is in approximate basic values, while 14 and 15 are in purchasers' values.

Organisation of the input-output matrices in the data bank

	Dim.	Intermediate consumption	Private consumpt. (subgroups)	Final demands (main groups)
	Dim.:	117	66	9
Uses of domestic output classified by producing industry	117	1	2	3
Uses of imports classified in groups corresponding to the output structure of domestic industries	117	4	5	6
Uses of imports of special services etc.	3	7	8	9
Primary inputs	5	1o	11	12
Column totals (absolute)	1	13	14	15
Uses of imports classified by 2-digit CCCN groups (column totals equal to totals in matrices 4, 5 and 6)	1oo	18	19	2o
Selected commodities (domestic output and imports) classified by 4-digit CCCN groups	99	21	22	23

	Dim.		Dim.		Dim.	
	Dim.:	99		1		1
Transformation matrices to be used in connection with matrices for selected commodities: 24: Partial make matrix 25: Import ratios in domestic uses 26: Import ratios in exports	117	24	99	25	99	26

Matrices nos. 16 and 17 are not shown above. They are the inverses corresponding to matrices nos. 1 and 1+4, respectively.

Classification of industries (117) in the input-output table

1	11101 Agriculture	41	34210 Reproducing and composing services
2	11103 Horticulture	42	34221 Book printing
3	11109 Fur farming, etc.	43	34222 Offset printing
4	11200 Agricultural services	44	34223 Other printing
5	12000 Forestry and logging	45	34230 Bookbinding
6	13000 Fishing	46	34240 Newspaper printing and publishing
7	20099 Extraction of coal, oil and gas	47	34291 Book and art publishing
8	29000 Other mining	48	34292 Magazine publishing
9	31113 Slaughtering etc. of pigs and cattle	49	34293 Other publishing
10	31117 Poultry killing, dressing, packing	50	35110 Manuf. of basic industrial chemicals
11	31121 Dairies	51	35120 Manuf. of fertilizers and pesticides
12	31123 Processed cheese, condensed milk	52	35130 Manuf. of basic plastic materials
13	31124 Ice cream manufacturing	53	35210 Manuf. of paints and varnishes
14	31130 Processing of fruit and vegetables	54	35220 Manufacture of drugs and medicines
15	31140 Processing of fish	55	35230 Manufacture of soap and cosmetics
16	31151 Oil mills	56	35290 Manuf. of chemical products n.e.c.
17	31152 Margarine manufacturing	57	35300 Petroleum refineries
18	31153 Fish meal manufacturing	58	35400 Manuf. of asphalt and roofing mater.
19	31160 Grain mill products	59	35510 Tyre and tube industries
20	31171 Bread factories	60	35590 Manuf. of rubber products n.e.c.
21	31173 Cake factories	61	35600 Manuf. of plastic products n.e.c.
22	31174 Bakeries	62	36100 Manuf. of earthenware and pottery
23	31180 Sugar factories and refineries	63	36200 Manuf. of glass and glass products
24	31190 Chocolate and sugar confectionery	64	36910 Manuf. of structural clay products
25	31210 Manufacture of food products n.e.c.	65	36920 Manuf. of cement, lime and plaster
26	31229 Manuf. of prepared animal feeds	66	36993 Concrete products and stone cutting
27	31310 Distilling and blending spirits	67	36998 Non-metallic mineral products n.e.c.
28	31338 Breweries	68	37101 Iron and steel works
29	31400 Tobacco manufactures	69	37102 Iron and steel casting
30	32118 Spinning, weaving etc. textiles	70	37201 Non-ferrous metal works
31	32120 Manuf. of made-up textile goods	71	37202 Non-ferrous metal casting
32	32130 Knitting mills	72	38121 Manufacture of metal furniture
33	32158 Cordage, rope and twine industries	73	38138 Manuf. of structural metal products
34	32200 Manufacture of wearing apparel	74	38191 Manuf. of metal cans and containers
35	32300 Manufacture of leather products	75	38198 Manuf. of other fabr. metal products
36	32400 Manufacture of footwear	76	38220 Manuf. of agricultural machinery
37	33100 Manuf. of wood products,excl.furnit.	77	38238 Manufacture of industrial machinery
38	33200 Manuf. of wooden furnitute, etc.	78	38280 Repair of machinery
39	34110 Manuf. of pulp, paper, paperboard	79	38293 Manufacture of household machinery
40	34128 Manuf. of paper containers,wallpaper	80	38298 Manuf. of refrigerators, accessories

Classification of industries (continued)

81	38320 Manuf. of telecommunication equip.	100	71138 Other land transport
82	38330 Manuf. of electrical home appliances	101	71210 Ocean and coastal water transport
83	38392 Manuf. of accumulators and batteries	102	71230 Supporting services to water trsp.
84	38398 Manuf. of other electrical supplies	103	71300 Air transport
85	38410 Ship building and repairing	104	71509 Services allied to transport, etc.
86	38438 Railroad and automobile equipment	105	72000 Communication
87	38498 Manufacture of cycles, mopeds, etc.	106	81000 Financial institutions
88	38500 Professional and measuring equipm.	107	82000 Insurance
89	39010 Manufacture of jewellery, etc.	108	83110 Dwellings
90	39098 Manuf. of toys, sporting goods, etc.	109	83509 Business services
91	41010 Electric light and power	110	93109 Education, market services
92	41020 Gas manufacture and distribution	111	93300 Health, market services
93	41030 Steam and hot water supply	112	94000 Recreational and cultural services
94	42000 Water works and supply	113	95130 Repair of motor vehicles
95	50000 Construction	114	95299 Household services
96	61000 Wholesale trade	115	95400 Domestic services
97	62000 Retail trade	116	97099 Private non-profit institutions
98	63000 Restaurants and hotels	117	98099 Producers of government services
99	71118 Railway and bus transport, etc.		

Classification of private consumption expenditures

1	001	Bread and cereals	16	120	Non-alcoholic beverages
2	002	Meat	17	131	Beer
3	003	Fish	18	132	Wine and spirits
4	004	Eggs	19	140	Tobacco
5	005	Milk, cream, yoghurt, etc.	20	210	Clothing
6	006	Cheese	21	220	Footwear
7	007	Butter	22	311	Gross rents
8	008	Margarine and lard	23	312	Water charges
9	009	Fruits and vegetables	24	321	Electricity
10	010	Potatoes, etc.	25	322	Gas
11	011	Sugar	26	323	Liquid fuels
12	012	Coffee, tea, cocoa	27	324	Other fuels
13	013	Ice cream	28	410	Furniture, fixtures, carpets, etc.
14	014	Chocolate and sugar confectionary	29	420	Household textiles, furnishings etc.
15	015	Other foods	30	431	Major household appliances

Classification of private consumption exprenditures (continued)

31	432	Repairs to major househ. appliances	50	714	Maintenance of recreational goods
32	440	Glassware, tableware,househ.utensils	51	720	Entertainment, cultural services,etc
33	451	Non-durable household goods	52	730	Books, newspapers and magazines
34	452	Household services	53	740	Education
35	460	Domestic services	54	750	Day-care institutions for children
36	510	Medical and pharmaceutical products	55	811	Barbers, beauty shops, etc.
37	520	Therapeutic appliances and equipm.	56	812	Goods for personal care
38	530	Physicians, dentists, etc.	57	821	Jewellery, watches, rings, etc.
39	540	Hospital care and the like	58	822	Other personal goods
40	550	Accident and health insurance	59	823	Writing and draving equipment
41	610	Personal transport equipment	60	831	Expenditure in restaurants
42	621	Maintenance of transport equipment	61	832	Expenditure for hotels and lodging
43	622	Gasoline and oils for trsp. equipm.	62	850	Financiel services, n.e.c.
44	623	Other expenditure on trsp. equipm.	63	860	Services, n.e.c.
45	630	Purchased transport			Consumption in the domestic market
46	640	Communication	64	994	-Purchases in DK by non-res. househ.
47	711	Wireless and tv sets, gramophones	65	995	Purchases abroad by res. households
48	712	Photo and musical equipment, boats			Consumption by resident households
49	713	Other recreational goods	66		Cons. by private non-profit inst.

Classifications of final demands and primary inputs

	MAIN GROUPS OF FINAL DEMAND		SPECIAL CATEGORIES OF IMPORTS
1	Private consumption	1	Direct imports to continental shelf
2	Government consumption	2	Tourist transactions
3	GFCF, machinery etc.	3	Expenditures by Danish ships abroad
4	GFCF, transport equipment		**PRIMARY INPUTS**
5	GFCF, construction	1	Commodity taxes net (excl. of VAT)
6	Agricultural breeding stock	2	VAT on uses (net system)
7	Increase in stocks	3	Other indirect taxes net
8	Exports of goods and services	4	Compensation of employees
9	Imputed bank service charges	5	Gross operating surplus

Selected commodities (row no. in matrices 21-23)

No.	CCCN		No.	CCCN	
1	0801	Tropical fruits	51	5501	Cotton, not carded or combed
2	0901	Coffee	52	5505	Cotton yarn, not for retail sale
3	1001	Wheat	53	5506	Cotton yarn, for retail sale
4	1002	Rye	54	5509	Other woven fabrics of cotton
5	1003	Barley	55	5601	Man-m. fibres, not prep. f. spinn.
6	1004	Oats	56	5605	Yarn of man-m. fibres, not ret. s.
7	1005	Maize	57	5606	Yarn of man-m. fibres, retail sale
8	1201	Oil seeds and oleaginous fruits	58	5607	Woven fabrics of man-m. fibres
9	1507	Fixed vegetable oils	59	5804	Woven pile and chenille fabrics
10	1512	Animal or vegetable oils and fats	60	7105	Silver, unwrought or semi-manuf.
11	2205	Wine	61	7107	Gold, unwrought or semi-manuf.
12	2209	Spirituous beverages	62	7301	Pig iron, cast i. and spiegeleisen
13	2304	Oil-cake	63	7302	Ferro-alloys
14	2307	Preparations used in animal feeding	64	7303	Waste + scrap metal of iron/steel
15	2401	Unmanuf. tobacco or tobacco refuse	65	7307	Blooms, billets etc. of iron/steel
16	2510	Natural calcium phosphates	66	7308	Iron or steel coils for re-rolling
17	2701	Coal	67	7310	Bars and rods of iron or steel
18	2709	Crude oil	68	7312	Rolled hoop and strip of i./steel
19	2710	Refined oil products	69	7313	Rolled i./steel plates and sheets
20	2711	Gaseous hydrocarbons	70	7314	Iron or steel wire, not insulated
21	2816	Ammonia	71	7315	Ollay steel
22	2840	Phosphites and phosphates	72	7316	Track construction mat. of i./steel
23	3102	Nitrogenous fertilizers	73	7317	Tubes and pipes of cast iron
24	3103	Phosphatic fertilizers	74	7318	Tubes and pipes etc. of i./steel
25	3104	Potassic fertilizers	75	7319	High-press. hydro-el.steel conduits
26	3105	Mixed fertilizers	76	7320	Tube and pipe fittings of i./steel
27	3814	Additives for mineral oils	77	7401	Copper, unwrought or waste/scrap
28	3901	Condensation products	78	7403	Copper bars, rods, wire, etc.
29	3902	Poly- and copolymerisation products	79	7404	Copper plates, sheets and strips
30	4001	Natural rubber	80	7405	Copper foil (0.15 mm)
31	4002	Synthetic rubber	81	7407	Copper tubes and pipes, and blanks
32	4011	Rubber tyres and cases	82	7408	Tube and pipe fittings of copper
33	4403	Wood in the rough	83	7601	Aluminium. unwrought or waste/scrap
34	4404	Wood roughly squared	84	7602	Wrought alu. bars, rods, wire, etc.
35	4405	Wood sawn lengthwise	85	7603	Wrought alu. plates, sheets, etc.
36	4413	Wood, planed etc.	86	7604	Aluminium foil (0.20 mm)
37	4414	Wood, veneer and plywood sheets	87	7606	Aluminium tubes, pipes, blanks
38	4418	Reconstructed wood in sheets etc.	88	8408	Engines for aircrafts
39	4701	Pulp	89	8453	Data processing machines
40	4801	Paper and paperboard	90	8455	Parts, access. for office machines
41	4807	Paper and paperboard, impregnated	91	8508	Starting equipment for motors
42	5101	Yarn of man-made continuous fibres	92	8509	El. equipment for motor vehicles
43	5104	Woven fabrics of man-made c. fibres	93	8521	Transistors and el. microcircuits
44	5301	Wool, unmanufactured	94	8701	Tractors
45	5305	Wool or other animal hair, manuf.	95	8702	Motor vehicles
46	5306	Corded woollen yarn, not ret. sale	96	8706	Parts and access. for m. vehicles
47	5307	Combed w. yarn, not retail sale	97	8709	Motorcycles, auto-cycles, etc.
48	5310	Wool or other anim. hair, ret. sale	98	8802	Aircrafts
49	5311	Woven fabrics of w. or anim. hair	99	8803	Parts for aircrafts
50	5405	Woven fabrics of flax or ramie			

Chapter 4

Calculation of commodity flows and input-output tables at constant prices

1. Introduction

The main emphasis in this chapter will be on describing the system approach to deflation based on a detailed commodity flow system and the properties which this implies for the derived input-output tables at constant prices. Most of the technical and practical problems involved in the actual deflation work are therefore disregarded and readers are referred to the standard texts in the SNA, UN (1968), the more detailed "Manual on National Accounts at Constant Prices", UN (1979) and the ESA, Eurostat (1979). Danish readers are further referred to the chapters on national accounts at constant prices in Danmarks Statistik (1985b) and (1986a) respectively. For the same reason index formulas and mathematical derivations are completely avoided.

In Denmark there is a long tradition for compilation of input-output tables. Tables for the years 1930-39, 1946, 1947 and 1949 were published during the years 1946-55 cf. Bjerke et al. (1955), and this "early period" of input-output work in Denmark was concluded in 1962, when the table for 1953 appeared. Of these tables only one, the 1947-table, was calculated also at constant prices, namely 1949 prices, and the early analytical input-output work in Denmark was based on the two comparable tables for 1947 and 1949. All these tables were compiled by the Danish Statistical Office as part of the official national accounts statistics, and it is interesting to note that input-output tables - and more fundamentally: commodity flow method - have been a central feature of national accounts work in Denmark right from the beginning.

The "present period" of national accounts in Denmark starts with the year 1966. From that year onwards the system and methods are based on the recommendations of the 1968-revision of the SNA. Annual input-output tables are compiled at both current and constant prices, and there is complete integration between the contents of the national accounts tables and the input-output tables. In fact both are obtained from the more basic commodity flow system which contains about 2500 commodities and is balanced at this detailed level at both current and constant prices.

The annual input-output tables are only produced in connection with the final national accounts, and they now appear 2 1/2 - 3 years after the reference year. The size of the tables can be indicated by mentioning that the number of industries is 117, that there are 9 main groups of final demand, of which again private consumption is broken down into 66 functional groups, and each of the 3 main groups of fixed capital formation are broken down by approximately 40 purchasing industries. So the total number of final demand categories exeeds 200. Methodologically the tables are industry-by-industry tables on the assumption of an industry technology.

Whereas the national accounts figures at constant prices are published at their most detailed level only very aggregated versions of the input-output tables are published in the annual publication on national accounts, cf. Danmarks Statistik (1986a), and users are therefore required to obtain the tables either on magnetic tape or by direct access to the computer where the data are stored. However, to show the analytical possibilities there is also annually published a set of detailed input-output impact multipliers, cf. Danmarks Statistik (1986b).

The following exposition will fall into three parts. Firstly the deflation procedure used in the detailed commodity flow system will be set out, as this is where all the characteristics of the constant-price figures are determined. Secondly it is described what happens to the deflated figures in the transformation process from the commodity balance system to the input-output table and what implications this holds for the analytical uses. Finally the method used in connection with change of base year for constant-price calculations is explained. Annex 1 contains some empirical illustrations, and the results of two more aggregated rebasing methods are analyzed.

2. Deflation in the detailed commodity flow system

The balancing and structure of the detailed commodity flow system which forms the core of the functional part of the Danish national accounts, has been described in detail in chapter 2 of this publication. The contents of the present section is therefore confined to showing the basic methods by which the balanced current-price system together with price information is transformed into a constant-price system. The exposition will draw heavily on the simplified illustration in figure 1. It is seen that this is a special version of table 2.1 in the SNA, leaving out the transactions which are not connected to the functional part of the system.

Both in the SNA (chapter IV) and in UN (1979) it is recommended that deflation take place within such a system, as the problem of compiling a consistent set of accounts at constant prices reduces to the problem of systematically revaluing all entries at the prices of some base year while preserving the balances between the row and column totals for individual commodities and industries. At the same time this method, which for industries implies double deflation, has the further advantage of being rather easy to explain to the users of the data as compared to for example different methods of single deflation and subsequent more or less arbitrary balancing between the output side and the final demand side at an aggregated level.

Intuitively the idea of revaluing all entries at their base year price is easy to grasp, and when we work at a detailed commodity level this leads automatically to implicit price indexes of the Paasche type and quantity indexes of the Laspeyres type. The well known formulas and properties of these indexes will not be discussed here and reference to them only made when special needs arise.

The process of deflation must be thought of as an application of a model by means of which we produce an outcome which has no counterpart in the real world. It makes therefore no sense to ask the question whether a constant-price figure is "true" or not, as there is nothing to test it against. The most we can do is therefore to make sure that some basic principles of logic and consistency are observed. Examples are that the supply of a commodity must equal its use also at constant prices and that the prices used in the deflation must refer to the same value concept as the figure to be deflated (i.e. basic values, producers' values or purchasers' values).

In the Danish system the deflation is fundamentally carried out at the level of basic values. Only after the commodities have been balanced at constant prices at this value level are trade margins and commodity taxes, net, added by applying the base year margin or tax rates to the deflated basic values. This makes it possible to calculate the constant-price purchasers' values, and at this level a number of checks are carried out, primarily by comparing the resulting implicit price indexes with prices from the consumer price index and unit values derived from foreign trade statistics. But for reasons to be explained below, the level of purchasers' values is never used as the point of departure in the deflation process.

If each element in a commodity balance were deflated by independently chosen deflators it would only be by sheer coincidence that the deflated commodity would still balance. As we request this bookkeeping identity to be fulfilled also at constant prices, we must introduce special constraints on the deflators, a requirement which in practice usually is satisfied by calculating one of the deflators as a residual. An important characteristic of a deflation system is therefore the way this residual is chosen.

An analogous problem exists for each industry, where the bookkeeping identity requires that total output must equal total input. As this balance contains some elements which by their very nature cannot be separated into quantity and price elements, such as operating surplus, the choice is made easier. As furthermore compensation of employees also in the functional part of the national accounts is considered an income flow rather than a cost element which can be broken down into physical employment and a wage rate (the exception being that compensation of employees in non-market service branches is deflated separately), this leads to the conclusion that the deflator for value added is most appropriately chosen as the residual or derived deflator for an industry, and this is also done in the Danish system for the element "gross value added at factor cost". (This term indicates that non-commodity indirect taxes, net, are deflated independently in the Danish system). This way of deriving the deflator for value added is the very essense of the "double deflation" method. It must, however, be pointed out that in a "system deflation" the constraints put on the commodity deflators (cf. above) at the same time create an interdependence between the derived deflators for value added of industries. Therefore the result for each industry would probably have been different had the industry been "double deflated" in isolation from the system.

In the following we shall go through the individual steps of the deflation procedure based on the illustration in figure 1.

Figure 1 The Danisk deflation procedure illustrated in the SNA accounting framework

				Commodities			Industries		Final demands		Total
					Energy products	Trade	Market	Non market	Domestic	Exports	
				2.500			117		76	1	
Commodities	Basic values (excl. trade)		2.500				—D—			P	(S_1)
		Energy products					P				S_2
	Wholesale trade margins		2.500				R				
	Retail trade margins		2.500				R				
Industries	Market		117	P	PD	D					S_3
	Non-market								—D—		(S_4)
Imports, c.i.f.			1	P							S_5
Customs duties			1	R							
Commodity taxes, net, on uses (excl. of VAT)			2.500				R				
VAT on uses			1				R				
Other indirect taxes, net			1				R				
Compensation of employees			1				D	P			
Gross operating surplus			1								
Total				S_1	(S_2)		(S_3)	S_4	S_6		

Explanation of symbols used:
P Deflation by price indexes
D Deflators derived from bookkeeping identities
PD Original P-deflation followed by D-adjustment

R Base year rates for trade margins or net indirect taxes applied
S_i Constant price values obtained as sums of deflated figures
(S_i) S_i transferred to serve as a bookkeeping restriction for deriving D

The matrices which are marked with a letter are those for which constant-price values are calculated. The letters do not denote matrices, but are symbols indicating the method used to deflate each individual matrix. The methods are:

P Deflation by price indexes

D Deflators are derived by utilizing bookkeeping identities

R Constant-price values are calculated by using base year rates for trade margins or indirect taxes, net

S Constant-price values are calculated as sums of other deflated figures.

A parenthesis around an S indicates that these constant price values have been calculated somewhere else in the system and then transferred to this new position in order to fulfil their function as part of a bookkeeping identity in the further calculations. In any row or column having an (S) as sum there will therefore also be found a D symbol. An S without parenthesis, but with the same subscript, shows where this constant-price value is actually calculated in the system. It is at once seen that P-deflated matrices only appear in the basic value part of the system and in the special case of value added in non-market services. These matrices are the only areas where information external to the system plays a role in the deflation. All the rest is determined by derived price indexes, base year rates, and summing up in the system.

For an individual commodity balance (column = supply and row = use) the system shows two alternative ways of obtaining the corresponding constant-price balance.

Firstly (and this is the predominant method used for almost all commodities other than energy products) the supply which can come from either domestic industries or imports is deflated by means of price indexes, and customs duties, which form part of imports at basic values, are obtained at constant prices by using the base year rates. This allows us to calculate the total supply, S_1, which is deemed also to be the constant-price value of total use and subsequently transferred to the place of the row sum. In the row, exports are deflated independently (cf. below) and the price index to be applied for all domestic uses is then derived (or rather: the total domestic use at constant prices is calculated as a residual which is distributed on individual uses proportionally to the current-price values). This method implies that for each individual commodity balance all domestic uses will have identical price developments at basic values.

Secondly the procedure can be to deflate each individual use separately, and decide that the sum of the uses at constant prices, S_2, should be transferred to the supply side, and, again imposing the bookkeeping restriction, determine the supply at constant prices as the derived item. In the Danish system this procedure is used for energy products for which a very detailed subsystem is worked out in connection with the national accounts. As this subsystem also contains physical units (tons etc.) and the calculation method implies different implicit prices for different uses, it is natural to demand that for each individual element the constant price calculation should result in a constant-price development identical to the development in physical quantity. The cost of obtaining this result at the user side is however usually that it cannot at the same time be obtained at the supply side. This is because changes in the distribution between different users who in the base year paid different prices will be sufficient to change total uses at constant prices even though the total physical quantity is unchanged. This socalled "shift effect" is well known in the literature on deflation, and the usual justification for placing the burden of adjustment on the supply side is that we are really concerned not just with one commodity, but with as many commodities as there are users paying different prices. The total at the supply side is therefore a weighted average of all these different commodities and should therefore not be compared to one single physical quantity. Be this argument as convincing as it may from a theoretical point of view, the users of national accounts are still left confused if for example they know that output of electric power measured in GWH has increased by 10 per cent and they find the constant-price value of the output of electricity generating plants to have decreased by 5 per cent. Such cases have actually occurred in the Danish national accounts, and we have chosen to accept such results. In Norway, which has been a pioneering country on the subject of shift effects, it has been chosen to leave such commodities unbalanced in the constant-price calculations and add up the value of all shift effects to one overall correction item which is shown separately on the supply side, cf. Fløttum (1981). It is characteristic that shift effects are usually identified for rather homogeneous commodities which can also be measured in physical quantities. It is however a general problem, as price discrimination is perhaps more the rule than the exception. Fortunately, in most cases we do not have enough information to identify the problem.

The industry accounts in figure 1 show how output at constant prices from each industry is obtained as the sum, S_3, of the constant values of the commodities produced. The next step is to transfer S_3 to the column sum (S_3), which by using the bookkeeping identity makes it possible to derive value added at constant prices ("double deflation"). For producers of non-market services this calculation sequence is inverted, all inputs being priced separately and the output price index derived. In order not to overburden figure 1 this last case is somewhat summarily illustrated, routing the non-commodities directly from the producers to the final demand categories.

From figure 1 it is seen that also all constant-price values obtained by using base year rates (with the exception of customs duties), are calculated from the user side. This means that there is no independent estimate at constant prices for the supply of trade margins (= output in wholesale and retail trade) and for indirect taxes. The matrices for wholesale margins, retail margins and commodity taxes, net, (exclusive of VAT) have the same dimension as the matrix for uses at basic values, and for each individual element the rates relative to the basic values in the base year are applied to the basic values at constant prices in the current year. In practice it is sometimes decided to change some of the rates for real or technical reasons.

As there is a single-rate VAT system in Denmark, VAT on uses is usually not broken down by commodity (the exception being construction) and each element in the row is calculated at constant prices on the assumption that the rate of the value exclusive of VAT is the same as in the base year.

In the SNA it is assumed that "other indirect taxes, net" should not be deflated separately but be included in the concept of value added at constant prices, which would concequently in the case of the system in figure 1 become gross value added at basic values. In Denmark there is, however, a long tradition for calculating value added at factor cost also at constant prices, and other indirect taxes, net, are therefore deflated separately either by using the base year rate relative to total input at purchasers' prices for each industry or special base year taxes per motor vehicle etc. Constant-price figures for value added at factor cost by industry are also calculated in some other countries, for example the United Kingdom and Canada.

Untill now the description has been kept in rather general terms. It might, however, be appropriate also to give a brief outline of the price information actually used in the deflation.

About 3000 series of price indexes go into the deflation procedure. Almost all are individual index series from the most detailed primary information used in compiling the official price indexes published by Danmarks Statistik. This means that the weighting schemes applied in official price indexes play no role in the deflation system.

Most of the indexes are those collected for the socalled wholesale price index, which is usually an index for the prices charged the first time a commodity is sold. These indexes correspond to the basic value concept. Indexes based on prices (exclusive of indirect taxes) collected for the consumer price index are also used. As these prices include trade margins, they do not correspond to the basic value concept, but as this type of index is almost exclusively used for services, this problem is not a serious one. For agricultural products special detailed prices are available. As most of the output from construction is calculated at current prices by multiplying physical output measures by prices, the necessary price indexes are readily available. The biggest deficiency in the price material is in the area of services mainly used by business, such as the services of auditors and lawyers, advertising, engineering services and many other business services. Here it has been necessary to resort to constructing price indexes specifically for use in the national accounts. These indexes are based on many different kinds of indicators which are in some cases rather farfetched in relation to the values for which they are used as deflators. For non-market services, where the output at constant prices is defined as being equal to the constant-price value of the cost incurred in their production, it is necessary to deflate the factor costs directly. For this purpose a weighted wage index for government employees has been constructed.

At the supply side the price indexes to be used as deflators for domestic output and imports c.i.f. at the commodity balance level are calculated as Paasche price indexes from still more disaggregated levels which are essentially the most detailed industrial production statistics (about 7500 commodities) and the most detailed level in the foreign trade statistics (about 8500 commodities). The keys connecting the price indexes and the commodities at this very detailed level have to be updated annually to take into account changes in the commodity classifications. Even though one price index is in many cases used as deflator for several commodities at this very detailed level the advantage is that the resulting currently-weighted price index to be used at the commodity balance level is to be preferred to an unweighted average of the price indexes for commodities falling within a given commodity balance. The weighting of the individual price indexes with deflated current-year values makes the maximum use of whatever information we have below commodity balance level, and this gives the price indexes of the system as much "Paasche property" as possible, and thereby makes the constant price figures as much Laspeyres-type indicators as possible. This system implies that if the domestic supply at the commodity balance level originates in several industries there will be as many different output price indexes as there are different output proportions at the detailed commodity level. It must be stressed that these very detailed commodity levels for domestic output and imports are only used to support the calculations of the price matrix for domestic output and the price vector for imports, respectively, at commodity balance level. So this level of detail does not belong to the system at large.

At the supply side price indexes are given separately for domestic output and imports (this distinction being made in the wholesale price index). There is therefore no reason to use unit values for imports as deflators in the system.

At the user side the situation is more complicated. As price indexes at the level of purchasers' values are not used in the system there is almost by definition no price information which is directly applicable. An easy solution would be to assume an identical price index for all uses. This would, however, imply that the direct import contents in exports were of the same relative size as for domestic uses, and even though there are some reexports such an assumption would obviously be wrong. Instead we have gone to the other extreme and chosen to deflate all exports at the commodity balance level by the average deflators for domestic output, arguing that practically all exports originate in domestic industries and that the available price statistics do not allow any distinction to be made between selling prices to the domestic market and to exports. (The problems to be solved in cases where exports exceed domestic output will not be discussed here). The alternative of using unit values from the foreign trade statistics as deflators for exports has been rejected, partly for theoretical reasons, as unit values are not really price indexes, and partly for practical reasons, as the unit values in many cases show very peculiar developments at the commodity balance level. Such developments would then either have to be arbitrarily adjusted, or the unlikely developments would also be reflected in the derived price indexes for domestic uses. Because of the big export share for most commodities a possible check on the validity of the method chosen is that the derived price index for domestic uses of a commodity should have a reasonable development - which is generally the case. In the constant price calculation of Canadian input-output tables the same basic assumption is applied in the deflation of exports, cf. Statistics Canada (1981).

Until now the deflation procedure has been described as a completely automatic process where the inputs are the system at current prices, price indexes, base year rates for margins and indirect taxes and some keys connecting commodities and price indexes, and the outputs are the constant-price figures. Although this is basically true, checks and controls are of course carried out after each step of the calculation. If these checks reveal unlikely developments in constant-price figures or implicit price indexes it is most often the price indexes which are reconsidered, but also the current price figures will in some cases be changed, as the deflation in this respect serves as a final and rather efficient check for the current-price calculations. At more aggregated levels the implicit price indexes from the constant-price calculations are compared to unit value indexes for foreign trade for imports and exports and to consumer price indexes for private consumption. As this last index is a Laspeyres price index, and the unit values (cf. above) are not really price indexes, rather big deviations from the implicit Paasche price indexes are tolerated.

3. Construction of the input-output table at constant prices

When the commodity balance system shown in figure 1 has been balanced at both current and constant prices, we have the basis from which the input-output table is automatically constructed, so that between the commodity balance system and the input-output table no further primary information is introduced (apart from the separation of reexports, cf. below), and no further balancing work is to be done.

Two input-output tables, at current and constant prices, respectively, are calculated by identical methods from the commodity balance system. So the input-output table at constant prices is not calculated from the current-price input-output table, but they both emerge from the deeper level of disaggregation. The implicit prices which it is possible to calculate ex post by dividing the constant-price table into the current-price table have consequently played no role in the construction of the input-output table at constant prices.

The methods used in the construction of Danish input-output tables from the commodity balances are described in detail in chapter 3 of this publication and only a short summary necessary for the understanding of the following will be given here. The general principles for compilation of input-output tables according to the SNA framework are found in UN (1973).

Because of changes in the basic commodity classifications, commodity balances are not completely comparable over time (in fact we started with 4000 balances in 1966 and were down to about 2500 balances in 1982). Therefore the detailed balances are at this stage aggregated into about 1600 groups, which for goods correspond to the four-digit CCCN-headings (with about 30 more disaggregated groups as exceptions). Services are not aggregated as their classification system has been constant over time. At this level of 1600 groups we claim complete comparability over time.

Also at this level of aggregation, exports in the current-price system are subdivided into reexports and exports of domestic output, by means of the foreign trade statistics. This subdivision is needed for the following calculations. In the constant price system a similar subdivision is made by deflating reexports by import prices and calculating a derived price index for other exports. This ensures that total exports at constant prices of each commodity at the 1600 group level are not changed by the subdivision.

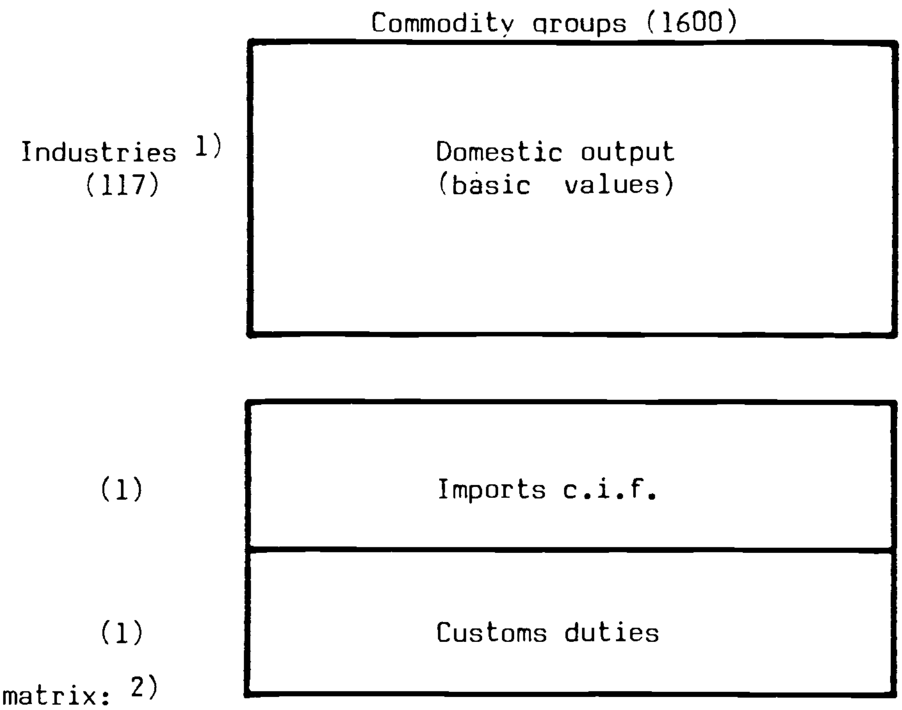
As shown in figure 2, we now have a make matrix of the dimension 117 x 1600 and an absorption matrix of the dimension 1600 x 192, disregarding the investment matrices, as they are calculated separately.

The next step is the breakdown of the absorption matrix into a matrix for domestic output and a matrix for imports. It is immediately clear that reexports belong in the import matrix only, and that other exports and stock changes of work-in-progress and own finished products belong in the matrix for domestic output only. The splitting of all other elements in the absorption matrix must for lack of specific information be based on assumptions, and the most simple one, namely that the ratio of domestic output to imports is identical in all these uses (for each of the 1600 commodities) is chosen. This procedure ensures that all elements in the import matrix at constant prices are the results of deflation with import prices only, and consequently that only domestic output prices have played a role in the constant-price matrix for domestic output. As in the main deflation system, cf. chapter 2, all exports have been deflated with domestic output prices, but later, at the 1600 commodity group level, are broken down into reexports and other exports by a special procedure, cf. above, there is, however, a slight lack of symmetry between the two matrices. This is best illustrated in the case of a commodity which has passed through the whole calculation sequence from the detailed commodity balances to the input-output table without being subjected to any aggregation or transformation. In the import matrix it will have a uniform price index along the row, whereas in the domestic output matrix the derived price index for exports, which will usually deviate from the average output price, will cause the implicit price index for domestic uses to show a compensating deviation. The obvious solution to this problem is of course to deflate reexports with import prices already at the most detailed level. In spite of some practical problems such a change in the system is at the moment being considered.

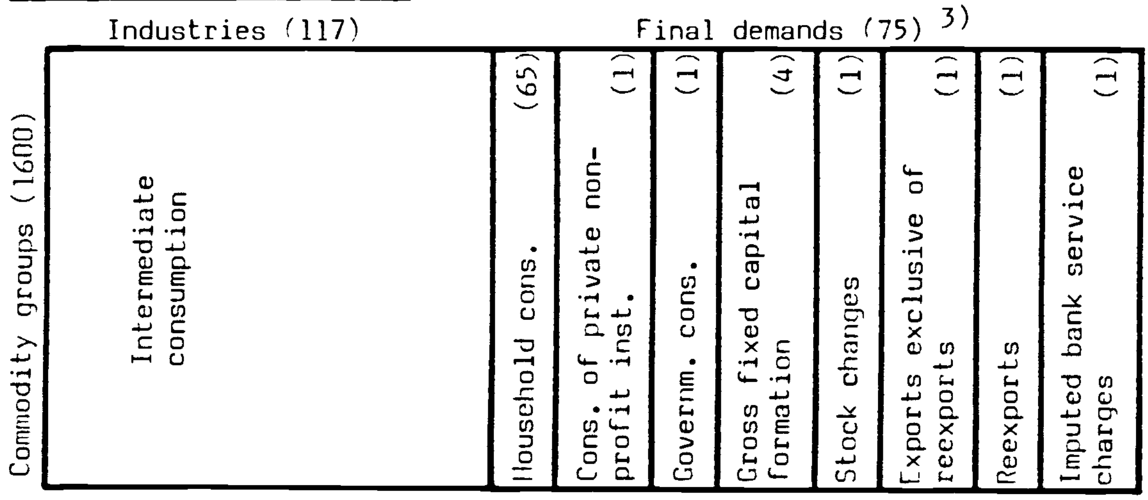
The final step is to premultiply the subdivided absorption matrix by the make matrix to obtain input-output tables with separate import matrices at both current and constant prices. By multiplying these

Figure 2. The make and absorption matrices used in the compilation of Danish input-output tables.

The make matrix:



The absorption matrix: 2)



Notes:

1. Here as elsewhere in the paper the term "industries" also includes "other producers" in the SNA meaning of the term.

2. Cf. figure 1 the absorption matrix is in the actual calculation composed of four submatrices: (a) basic values exclusive of trade, (b) wholesale margins, (c) retail margins, and (d) net commodity texas.

3. The connection between the 77 categories of final demand in figure 1 and the 75 categories above is that 5 categories of stock changes have been aggregated into one, whereas on the other hand the new categories reexports and imported bank service charges have appeared. The subdivision of fixed capital formation by owner branch has been disregarded in both figures.

detailed rectangular matrices directly we avoid the aggregation errors inherent in an aggregation to the level of characteristic commodities (square matrices) before the multiplication.

In the terminology of the SNA the resulting table is an industry-by-industry table on the assumption of an industry technology, although it should be mentioned that all "industries" outside manufacturing are really activity defined. The import matrix need not have the same classification in the front column as the "domestic part" of the input-output table, as the premultiplication with the make matrix is only necessary if the import matrix must have a form which makes it additive to the domestic matrix, a procedure which is useful in many kinds of analysis.

Now the question is which kind of implicit price indexes does this set of input-output tables contain, and what are the implications for the different uses to which the tables can be put?

From the basic commodity balances to the rows of the input-output table we have passed through first a simple aggregation procedure and secondly a combined aggregation and transformation procedure. The implicit price indexes for the balances at the three different levels have the following characteristics:

(1) At the commodity balance level (2500 commodities) each source of supply, i.e. different domestic industries and imports, will usually have different prices (because of the weighting of price indexes at an even more detailed level), and at the user side we will usually have two different prices, one for exports and one for domestic uses. So even at this level there is no uniform price index in a row, although all elements for domestic uses will show identical price movements for commodities other than energy products.

(2) After the aggregation to the 1600 grouping all implicit price indexes in a balance will usually be different, and after the separation of reexports we will also have two different export prices in each row.

(3) The premultiplication at the 1600 group level of the absorption matrix by the make matrix means first a splitting of the commodity groups (according to the market shares of industries given in the make matrix) and next an aggregation of these subdivided commodity groups with the producing industries as keys, resulting in 117 rows, where all implicit price indexes in a row must be expected to be different,

as we have now not only further aggregated commodities with different implicit price indexes, but also by the transformation procedure added parts of commodities which may in commodity classification terms be rather far apart. This is illustrated in table 1.

On this background it is obvious that simplistic theoretical statements such as the one that each row in an input-output table is assumed to consist of a homogeneous kind of output and therefore also to have identical implicit price indexes in all elements, are far removed from practical empirical work in this area. And it must be underlined that this would also have been the case if the input-output table had alternatively been constructed as a commodity-by-commodity table on the assumption of a commodity technology. The conclusion of this is for compilers of input-output tables rather trivial, namely that no input-output table will ever fulfil the assumptions which are usually underlying its use in input-output analysis. An interesting view on this problem is found in Olsen (1985), where the question of how to construct and use input-output tables is seen as being part of a more general aggregation problem rather than a choice between alternative technology assumptions.

This point can be elaborated a little more by making a few comments on an article by Rae, Chakraborty and Small (1984), to which reference has also been made in two recent papers by Viet (1985) and UN (1986), respectively. By a numerical example the authors illustrate the consequences of a change in a base year price of one commodity for an industry-by-industry table calculated on the assumption of an industry technology. Not surprisingly this price change will influence many (in the example: all) elements in the input-output table, which makes the authors conclude that this method of constructing input-output tables has been proved methodologically unsound and should therefore be rejected. This argument is hard to accept, as the question of whether an industry technology is valid or not is an empirical one and can therefore not be excluded from theoretical considerations alone, and similarly the question of whether the table should be given in industry-by-industry or commodity-by-commodity form is a practical one, depending on the needs of the users. It must also be underlined that if in order to avoid some aggregation errors the table is constructed directly from rectangular make and absorption matrices, an industry-by-industry table on the assumption of an industry technology is the only possibility. So the conclusions of the article seem to rest firstly on a too simplistic view of the relation between commodities and industries, the example having the number of commodities equal to the number of industries thereby leaving out the commodity aggregation problem, which is where the inhomogeneity unavoidably enters, and secondly on the assumption that implicit industry output prices should be uniform over the row, which seems to be mixing up table and model considerations.

The above remarks should also draw the attention to the very important difference between an input-output table and an input-output model. The table taken by itself cannot be theoretically wrong, nor are the usual input-output model assumptions of constant coefficients, prices based on the full cost principle etc. part of the input-output table. Such assumptions can, however, be tested against the input-output data, especially if there exist time series of input-output tables at both current and constant prices.

In cases where input-output tables are used as a basis for price models it is usually assumed that developments in industry output prices are determined exclusively by the cost structure of each industry (the special problem of price indexes for value added in price models is left out here). It is consequently assumed that the price index is the same for all elements in a row, i.e. that there exists an uniform industry output price index which is valid for all users of output from that particular industry. A look at the time series of implicit price index matrices derived from the input-output tables immediately convinces us that this is not so. Still this does not indicate, however, that something is wrong with the input-output table, but only that we have made simplifying assumptions in the model which may or may not prove to be acceptable.

If time series of input-output tables were long enough we could in principle estimate special relations for the prices of each individual cell. Simple input-output price models should therefore not be expected to reproduce the actual implicit matrices of price indexes outside the base year, but they may none the less serve rather well in predicting price indexes for more aggregated variables such as total input price for an industry or prices for individual categories of final demand. The functioning of the input-output price model in the Danish econometric model ADAM has been used to analyse the above problem in detail, cf. Danmarks Statistik (1985a).

Price models based on industry-by-industry tables on the assumption of an industry technology exhibit one feature of seeming inconsistency, as prices are properties (also in the construction of the input-output table) connected to commodities, whereas in the price model they appear as basically connected to industries even though individual industries have different commodity compositions in different uses of their output and over time. This implies that a commodity (say at the level of 1600 commodity groups) in a price model implicitly will be given several different price developments, depending on the number of industries producing it. This formal problem is avoided in a model based on a commodity table on the assumption of a commodity technology, which will, however, cause other problems both in the construction of the table (cf. above) and in model applications, as primary inputs are connected to industries rather than to commodities. In practice the problems inherent in the industry by industry price model are usually disregarded, as compared to many other simplifications they are only of minor importance. Also it is still possible to keep a separate import matrix in commodity terms even though the table for domestic output is in industry terms.

The problems outlined in the two above paragraphs would have been nonexistent if we had chosen a much simpler deflation scheme, where the constant-price calculation had been carried out directly at the input-output table level, each row being deflated by one single price index constructed in some more or less obscure way outside the system. Apart from the problems involved in defining the price indexes, this crude method is hardly to be recommended, as it imposes the assumptions of a simple input-output price model directly into the data structure. The distortions caused by such a simplified deflation method are illustrated empirically in annex 1.

4. Changes of base year

Internationally it is recommended to change the base year every five years because base year prices gradually become less and less representative of the current flows. Basically there are two ways of carrying out the change in practice. The first method is to calculate a new set of constant price figures which completely replace the previous ones and give an unbroken time series which extends on either side of the new base year. The second method is to use the new base year prices only for calculating constant-price figures from this year onwards, leaving comparisons back in time to be done by chain indexes - an approach which gives rise to the well known additivity problem, cf. for example UN (1979).

These two methods must however be supplemented by a third dimension, namely the level of detail at which the calculations take place. If the second method is applied at detailed commodity level, it comes very close to the first one and permits the additivity condition to be fulfilled by calculating all aggregates as sums in the rebased system. This is the essence of the procedure used in the rebasing of the Danish constant-price figures.

The present system of national accounts in Denmark had originally 1970 as the base year and has been rebased twice. First the base year was changed to 1975 in 1980 and next the base year 1980 was introduced in 1985. In both instances the rebasing was carried out both for the national accounts figures and the input-output tables for all years back to 1966, resulting in new sets of consistent national accounts tables and input-output tables at constant prices.

As the original deflation took place in a detailed commodity flow system as described in chapter 2 above, it might seem a natural thing just to repeat the whole procedure substituting new base price indexes and trade margins and indirect tax rates for the old ones. For several reasons such a procedure can however not be carried out automatically. Firstly, the number of commodities at the most detailed commodity balance level decreases over time because of aggregations necessitated by changes in the basic commodity nomenclatures (cf. above), which means that the commodities which "disappeared" before 1980 do not have any price indexes in the new base year. Secondly problems of the same kind will show up for the new base year rates for trade margins and indirect taxes, and thirdly all the specific changes made in the earlier constant-price figures in the checking phase will have to be redone in the course of the new deflation, but probably now affecting some other elements.

For these reasons the rebasing from 1970 prices to 1975 prices was done at the 1600 commodity aggregation (which also forms the basis for the construction of the input-output tables, cf. above). At this level of aggregation most of the problems mentioned above will not show up. The fact that this first rebasing was carried out at this level of aggregation is a further and rather decisive argument for carrying out the rebasing to 1980 prices at the same level, as the constant price system at 1975 prices does not exist at the more detailed level for the years 1966-74.

The following explanation of the method used in the rebasing concerns the change from 1975 prices to 1980 prices, but it is also valid for the first rebasing with the exception that the second rebasing implicitly contains two chainings and the first just one.

For each element of output by industry, imports and exports at the 1600 commodity level a conversion factor is calculated as value in 1980 at 1980 prices divided by value in 1980 at 1975 prices. These conversion factors are then multiplied by the corresponding elements for each of the years 1966-79. The growth rates of these elements at 1980 prices will therefore be identical to those at 1975-prices. This of course just illustrates the simple fact that growth rates are not changed at the chaining level. The domestic use at 1980 prices for each commodity balance is then calculated as the residual which makes use equal supply. The residual is distributed on uses in the same proportions as the values at 1975 prices, and the growth rates at constant prices for these elements will usually be changed by this procedure.

Trade margins at 1980 prices are not calculated simply by applying the 1980 rates to the 1980-price basic values as this would overrule the variation over time in the constant-price trade margin rates, which for different reasons have been introduced in the original constant-price calculations at 1975 prices. Instead conversion factors are calculated for trade margin elements in 1980 in the same way as for basic values, and these factors are in turn multiplied by the absolute margin elements at 1975 prices for the earlier years.

For all categories of indirect taxes the rates in 1980 are used to calculate the 1980 values for the earlier years.

In the same way as explained for the original deflation system illustrated in figure 1 it is now possible to calculate all other values and aggregates at constant 1980 prices. These will usually show growth rates which differ from the growth rates at 1975 prices and the expectation is to find lower growth rates at 1980 prices, at least for the period 1975-80, cf. annex 1.

The rebasing method implies a chaining of some elements at the 1600 commodity level, whereas all other rebased elements (and of course all aggregates) are derived. Furthermore commodities within each of the 1600 groups are still weighted by 1970 prices for the period 1966-74 and with 1975 prices for the period 1975-79. But as the relative price changes within groups are usually smaller than between groups, the result of the rebasing is believed to come very close to what would have been obtained by rebasing at the most detailed commodity balance level.

Although the rebasing is carried out rather mechanically, it is necessary for example to decide which 1980 prices to use for elements which do have values in some earlier years but not in 1980, and generally to make checks and controls in almost the same way as in the original deflations, as unexpected results always turn up as consequences of the many interactions in the system. It is also possible in this process to correct errors which have earlier been made to the extent that they only concern the deflation system, as current price figures may not be changed in the rebasing process unless this coincides with revision at current prices, which was not the case for the rebasing to 1980 prices.

After the commodity balances at the 1600 group level have been rebased to 1980 prices, the constant price input-output tables are compiled again in exactly the same way as described in section 3.

Annex 1

Some empirical illustrations

The data base of the functional part of the Danish national accounts system now contains the following sets of annual data which are mutually consistent and comparable over time for the years 1966-83:

1. The commodity balance system at the 1600 commodity group level at current prices and at constant 1980 prices.
2. Input-output tables at the 117 industry level at both current and constant 1980 prices. Of the 9 main categories of final demand private consumption is broken down in a consumption matrix showing 66 functional categories, and each of the 3 main categories of gross fixed capital formation is broken down in investment matrices according to about 40 owner branches.

and for the years 1966-80 there are furthermore:

3. The commodity balance system at the 1600 commodity level at constant 1975 prices.
4. Input-output tables as mentioned in (2) at constant 1975 prices, with the exception that the investment matrices are not found at 1975 prices as their compilation was only finished after the rebasing to 1980 prices in the national accounts had taken place.

As current-price figures were left completely unchanged in the process of rebasing to 1980 prices, all differences between the data sets at 1975 prices and at 1980 prices, respectively, are exclusively caused by the rebasing techniques used. This makes it possible to investigate in detail the consequences for volume and price measures of the rebasing. (A similar investigation was not possible at the time of rebasing to 1975 prices, as a main revision of current price estimates and industrial classifications took place at the same time).

In section 3 it was explained how the sequence of aggregation and transformation which takes place between the constant-price figures at the 2500 commodity balance level and the rows in the constant-price input-output table causes the implicit price indexes in different uses to become more and more different, which is just mirroring the fact that more and more inhomogeneity in rows is created during this process.

Within the scope of this paper it is not possible to empirically illustrate these different steps or even to show the implicit price indexes in the input-output table at the 117 industry level, but in table 1 these indexes are shown for the standard 27 industry group aggregation. Even though this aggregation adds further inhomogeneity to the rows the table is rather illustrative. Amongst others the following observations, which are also valid at the 117 industry level, can be made:

1. Implicit price indexes do to a considerable extent vary along rows. Exceptions are cases where commodities at the detailed level and as industry outputs are identical, such as for example repair and maintenance of buildings (all intermediate consumption of output from the construction industry, which is activity defined).

2. Implicit price indexes for corresponding elements of the domestic output matrix and the import matrix are usually different.

3. Whereas the average price indexes for corresponding rows of the domestic output and the import matrix (in the column "Total") do not show much correlation, the patterns of variation along the corresponding rows have many similarities. This is obviously because in each use the commodity structure of imports is more similar to the structure of domestic inputs than are the averages which are further blurred by the aggregation along rows.

As described in chapter 4 the rebasing to 1980 prices took place at the 1600 commodity group level. It might be of interest to compare the results of this method to the results of alternative more aggregated rebasing methods. Two such methods have been tested, they are:

1. "The element factor method", where an implicit price index matrix is calculated directly at the input-output table level by dividing each element of the 1980 input-output table at current prices by the corresponding elements at 1975 prices. The price indexes for all aggregates and for value added are disregarded. This price index matrix can in turn be used to recalculate the input-output table at 1975 prices for any other year to form a table at 1980 prices by a term-by-term multiplication and subsequent calculation of all aggregates and value added as sums and differences, respectively.

2. "The row factor method", where an implicit price index vector for each row sum is calculated following the same procedure as above. The index for value added is disregarded. By multiplying an input-output table at 1975 prices rowwise by this price vector and subsequently calculating the missing aggregates and value added as sums and differences, a table at 1980 prices is obtained. (As input-output tables at 1975 prices for other years than 1975 have different price indexes along a row, their recalculation to 1980 prices by the row factor method will not remove this variation).

Both methods are used at the 117 industry level of the input-output table with a separate import matrix and private consumption broken down into 66 groups, i.e. the most detailed input-output table available at 1975 prices.

The input-output tables for 1966 (at 1975 prices) and 1975, respectively, are rebased to 1980 prices by both method (1) and method (2). The implicit volume and price developments in the resulting tables can be compared to those implicit in the three tables at (A) 1975 prices and (B) 1980 prices, according to the detailed rebasing method actually applied. The comparisons are made for the main aggregates in table 2 and for private consumption subdivided into functional groups (aggregations of the 66 functional categories) in table 3. In both tables growth rates are shown for the two subperiods 1966-75 and 1975-80 and for the whole period 1966-80.

When national accounts figures are rebased the a priori expectation is that growth rates of volume indicators will decrease (because of substitution away from commodities which have increased relatively in price), at least for the period between the old and the new base year. By comparing columns (A) and (B) for the period 1975-80 in tables 2 and 3 this expectation is seen to be fulfilled, but also for the subperiod 1966-75 this change can be found, although less pronounced.

For the results of method (C) we can, by inspection of tables 2 and 3, in particular for the subperiod 1975-80, arrive at the conclusion that the growth rates generally lie somewhere between those of (A) and (B), and usually closest to the first ones. This is what we would expect, as the more aggregated rebasing method is less "Paasche type" than (B), and this for some aggregates to such an extent that the results come close to those we would have obtained if we had chained directly at the level of the main aggregates. (As government consumption is represented by just one figure also at the most detailed commodity level, the rebasing does not affect its growth rate. The same is the case with gross rents and purchases abroad by resident households in table 3).

It is difficult to have any a priori expectation to the results of method (D), as the averaging of the price developments in the rows which it implies can influence the results in two ways compared to method (C). Firstly the rebasing takes place at a higher level of aggregation which should give us growth rates even closer to those of (A). As, however, the chaining takes place by row, it is output by industry which keeps its growth rate (not shown in our tables), and not the final demand categories which are column sums - or value added which is determined as a residual also in this method. Secondly the averaging of the price developments in the rows will influence value added and the final demand categories in an unpredictable way as it depends on the degree of price index variation actually found in the row. A further reason for the unpredictability is that at this level of aggregation the differences between price developments in intermediate consumption, exports and domestic final demands will often be considerable (as can be seen in table 1, though at a higher level of aggregation than used in the calculations).

An inspection of the results of method (D) in tables 2 and 3 gives as expected no basis for general conclusions. Surprisingly the growth rates of the aggregates in table 2 are in many cases rather close to those of (B), but it must be deemed a sheer coincidence that the growth rate for private consumption works out at exactly the same growth rate as method (B) for the whole period 1966-80, as is confirmed by inspection of the results of the two methods for subgroups of private consumption in table 3, where for some subgroups method (D) gives results which are clearly unacceptable by any standards.

The observation that method (D) gives unsatisfactory results at the detailed level compared to the outcome of more sophisticated deflation methods is in agrement with the findings made by Richter (1985) in a similar experiment with Austrian input-output tables.

Although a lot more can be said about the comparative achivements of the different deflation methods the above should be sufficient to illustrate the importance of building up the constant price calculations from the most detailed level possible while keeping the whole procedure within a consistent system approach. When this is done the otherwise tremendous work of recalculating current-price input-output tables into constant-price tables is reduced to being just one of many possible applications of the basic data set.

Table 1. Implicit price indices of the aggregated danish 1975 input-output table at 1980 prices

			Intermediate consumption							
			11000	12000	13000	20000	31000	32000	33000	34000
		DANISH GOODS AND SERVICES								
1	11000	Agriculture, horticulture, etc.	64.98	61.57	61.73	62.79	71.22	57.08	65.04	65.77
2	12000	Forestry and logging	-	-	-	-	75.00	73.22	72.96	72.82
3	13000	Fishing	53.52	-	53.52	-	54.07	-	-	-
4	20000	Mining and quarrying	65.17	75.00	62.50	61.24	73.04	76.97	66.15	69.61
5	31000	Manuf. of food, beverages, tobacco ...	67.26	70.19	68.51	83.19	74.11	59.74	82.67	79.80
6	32000	Textile, clothing, leather industry ..	95.21	70.44	84.53	66.85	70.67	64.83	61.97	70.99
7	33000	Manuf. of wood products,incl. furnit.	66.92	62.50	67.06	64.25	67.23	56.89	64.53	82.63
8	34000	Manuf. of paper,printing,publishing ..	67.72	65.61	64.44	70.31	75.74	72.06	73.14	67.23
9	35000	Chemical and petroleum industries	62.80	53.41	44.25	45.76	59.76	62.69	64.58	64.49
10	36000	Non-metallic mineral products	69.74	62.18	62.40	66.42	71.72	68.15	56.18	55.31
11	37000	Basic metal industries	77.42	77.78	72.14	78.48	80.30	62.59	57.53	77.79
12	38000	Manuf. of fabricated metal products ..	65.99	66.60	63.68	67.75	69.16	68.45	72.33	68.38
13	39000	Other manufacturing industries	63.76	63.33	65.85	65.31	64.30	62.52	63.93	80.68
14	40000	Electricity, gas and water	58.09	59.75	-	63.22	66.85	63.79	54.54	59.77
15	50000	Construction	66.34	66.34	66.34	66.32	66.34	66.34	66.34	66.34
16	60099	Wholesale and retail trade	75.46	75.13	99.44	86.81	62.96	51.08	67.74	76.23
17	63000	Restaurants and hotels	63.24	63.26	63.24	63.24	63.24	63.24	63.24	63.24
18	71000	Transport and storage	61.27	60.95	66.71	60.89	63.27	61.99	63.52	62.55
19	72000	Communication	80.93	80.91	80.94	80.93	80.93	80.93	80.93	80.93
20	80099	Financing and insurance	64.75	65.10	64.97	64.56	64.54	65.00	64.84	64.95
21	83110	Dwellings	-	-	-	-	-	-	-	-
22	83509	Business services	67.81	66.61	86.61	66.61	66.61	66.61	66.39	66.14
23	93009	Market services of education,health ..	72.92	57.45	57.83	57.27	57.57	57.58	57.55	57.58
24	94000	Recreational and cultural services ...	58.79	60.00	59.09	58.62	58.84	58.84	58.74	61.51
25	95009	Household services, incl. auto repair	65.03	64.14	63.28	63.19	63.64	62.25	62.32	64.08
26	95399	Other producers, excl. government	-	-	-	-	-	-	-	-
27	98099	Producers of government services	68.58	68.58	68.58	68.59	68.58	68.59	68.58	68.58
		IMPORTS INCL. CUSTOMS DUTIES								
28	11000	Agriculture, horticulture, etc.	64.00	63.78	63.64	66.67	78.02	57.62	63.64	63.92
29	12000	Forestry and logging	-	-	-	-	41.29	64.45	62.73	64.25
30	13000	Fishing	55.92	-	55.90	-	55.87	-	-	-
31	20000	Mining and quarrying	65.91	-	-	55.09	69.87	71.28	43.07	48.31
32	31000	Manuf. of food, beverages, tobacco ...	65.84	73.33	68.85	83.61	72.15	56.46	89.13	82.36
33	32000	Textile, clothing, leather industry ..	80.39	74.16	91.85	70.83	75.57	69.10	61.82	57.21
34	33000	Manuf. of wood products,incl. furnit.	70.93	66.67	72.79	80.00	70.91	57.17	58.08	75.95
35	34000	Manuf. of paper,printing,publishing ..	70.08	69.00	67.35	77.75	78.14	75.91	78.03	78.71
36	35000	Chemical and petroleum industries	64.24	46.22	39.04	44.22	58.31	66.17	65.50	63.05
37	36000	Non-metallic mineral products	65.15	58.97	59.49	59.11	70.48	62.60	56.40	53.76
38	37000	Basic metal industries	70.21	69.23	70.14	71.15	70.56	61.43	61.93	76.73
39	38000	Manuf. of fabricated metal products ..	70.15	70.56	67.83	70.98	69.71	71.15	68.04	62.48
40	39000	Other manufacturing industries	69.47	68.18	70.81	69.31	69.26	61.30	63.03	73.91
41	40000	Electricity, gas and water	57.75	66.67	-	63.35	78.41	64.11	52.67	61.74
42	50000	Construction	-	-	-	-	-	-	-	-
43	60099	Wholesale and retail trade	-	-	-	-	-	-	60.00	62.93
44	63000	Restaurants and hotels	-	-	-	-	-	-	-	-
45	71000	Transport and storage	-	-	-	-	-	-	-	-
46	72000	Communication	-	-	-	-	-	-	-	-
47	80099	Financing and insurance	-	-	-	-	-	-	-	-
48	83110	Dwellings	-	-	-	-	-	-	-	-
49	83509	Business services	-	-	-	-	-	-	-	-
50	93009	Market services of education,health ..	-	-	-	-	-	-	-	-
51	94000	Recreational and cultural services ...	64.41	62.50	64.29	66.67	64.29	63.87	64.35	63.14
52	95009	Household services, incl. auto repair	-	-	-	-	-	-	-	-
53	95399	Other producers, excl. government	-	-	-	-	-	-	-	-
54	98099	Producers of government services	-	-	-	-	-	-	-	-
55		Other imports	59.90	60.00	59.89	62.42	59.90	59.90	59.89	59.90
56		Sum (1-55)	66.45	65.22	58.12	60.48	70.27	65.34	64.28	69.54
57		Purchases in Denmark by non-resid. household	-	-	-	-	-	-	-	-
58		Net taxes on commodities	56.05	42.49	40.42	39.54	-118.75	41.04	44.37	42.28
59		Value added tax	52.56	52.73	52.50	52.48	52.56	52.57	52.59	52.62
60		Uses at market prices (56-59)	66.94	64.61	57.95	60.25	69.38	65.17	64.16	69.25
61		Other indirect taxes, net	267.12	25.28	41.93	-835.81	13.72	-61.31	936.59	-175.79
62		Gross domestic product at factor cost	69.00	57.21	53.71	61.72	75.39	75.02	71.29	65.41
63		Gross output at basic values (60-62)	69.35	66.18	55.70	59.02	70.69	68.87	66.87	67.56

Table 1 continued

	Intermediate consumption (continued)												
	35000	36000	37000	38000	39000	40000	50000	80099	63000	71000	72000	80099	83110
1	85.47	81.58	81.95	81.54	81.88	81.48	87.55	81.54	87.53	61.52	61.53	81.54	81.58
2	-	78.85	-	73.28	71.43	-	72.87	-	-	-	-	-	-
3	102.87	-	-	100.00	-	-	-	-	53.50	-	-	-	-
4	48.99	64.81	70.87	83.93	79.78	63.78	72.03	63.55	71.13	83.36	63.46	62.50	-
5	71.21	79.33	73.51	73.83	72.85	89.47	71.11	89.48	71.09	69.54	89.51	89.47	89.49
6	73.25	69.32	87.36	70.10	67.24	68.08	87.84	82.36	84.85	71.33	70.42	71.95	72.27
7	83.87	68.52	82.11	63.22	53.45	82.37	87.49	84.43	82.01	60.93	82.43	62.89	83.33
8	73.20	73.49	89.78	70.59	76.87	85.57	83.94	70.55	68.55	85.64	85.82	65.78	85.83
9	58.06	54.09	55.46	63.12	81.20	44.32	83.21	54.12	52.55	39.23	48.49	52.20	49.14
10	68.81	68.42	53.44	60.20	82.38	82.11	65.90	72.07	81.74	61.85	62.12	80.95	51.81
11	63.59	89.02	58.27	71.12	58.20	79.23	72.20	80.20	77.01	78.87	79.11	78.35	75.00
12	68.43	89.03	68.55	88.97	85.54	87.75	89.01	88.31	87.79	88.00	87.77	87.88	88.89
13	67.87	64.35	84.05	64.23	58.20	64.54	72.30	63.14	64.13	62.16	63.07	61.35	60.85
14	58.03	58.17	58.56	81.99	75.89	82.98	58.78	59.72	58.62	84.67	58.40	58.35	58.29
15	88.34	68.34	88.34	88.34	88.34	88.34	88.34	88.34	68.34	66.34	88.34	88.34	68.34
16	89.99	68.71	58.71	74.07	41.95	100.87	72.86	72.88	70.50	72.71	78.75	85.36	88.74
17	63.24	83.24	83.23	83.24	63.24	63.24	63.24	83.24	83.24	83.24	63.24	63.24	63.24
18	63.29	61.42	83.51	62.32	81.57	87.09	61.24	82.81	62.79	64.18	72.52	62.79	62.79
19	80.93	80.93	80.93	80.93	80.93	80.93	80.93	80.93	80.93	80.93	80.93	80.93	80.93
20	64.88	84.88	65.06	64.82	84.88	64.94	63.27	63.88	64.97	63.45	63.68	64.93	65.67
21	-	-	-	-	-	-	-	-	-	-	-	-	-
22	66.61	68.81	68.61	66.61	66.61	66.61	65.10	66.53	66.61	68.61	68.60	86.61	68.81
23	57.60	57.61	57.50	57.58	57.93	57.85	57.57	57.58	57.83	57.57	57.62	57.59	57.85
24	58.84	58.85	58.73	58.80	59.21	58.93	58.83	58.81	91.25	58.81	58.92	58.80	58.87
25	61.89	81.99	82.29	62.37	62.58	87.15	65.19	84.87	81.63	85.30	64.51	61.00	72.00
26	-	-	-	-	-	-	-	-	-	-	-	-	-
27	68.58	68.58	68.59	88.58	68.59	88.59	68.58	88.58	88.58	68.58	88.58	68.58	88.58
28	58.82	84.13	62.50	41.47	111.45	63.64	83.55	63.87	49.38	83.88	63.75	83.49	63.75
29	41.30	77.78	-	59.31	100.00	-	84.15	-	-	-	-	-	-
30	80.11	-	-	57.14	127.27	-	-	-	55.08	-	-	-	-
31	39.72	55.53	61.29	54.78	36.53	75.32	85.35	-	65.91	-	-	-	-
32	75.88	82.25	68.68	67.79	85.25	74.16	78.21	74.12	71.17	74.16	74.15	74.11	74.03
33	73.77	74.80	71.28	74.29	69.43	72.55	78.08	75.28	72.51	75.17	74.53	75.50	75.73
34	65.08	58.48	81.32	59.93	55.37	88.00	58.84	63.53	88.07	85.41	89.54	77.44	100.00
35	78.25	78.77	70.69	73.52	78.43	68.58	70.50	72.99	71.95	69.09	88.98	89.14	69.17
36	81.19	54.88	53.09	65.41	63.72	44.18	59.02	49.05	41.88	38.57	43.12	44.88	43.09
37	64.31	59.77	83.69	54.81	63.55	59.21	58.45	89.52	59.58	59.07	59.18	58.75	54.84
38	81.88	58.95	67.96	67.63	31.26	70.28	71.72	78.46	69.49	89.88	70.03	69.34	86.87
39	70.45	70.53	68.59	68.98	68.10	70.87	71.53	69.20	69.83	71.58	70.53	69.24	66.41
40	72.11	46.92	68.21	52.42	58.80	68.58	69.54	69.58	86.78	69.10	88.93	69.25	69.28
41	58.98	79.27	42.24	89.09	73.39	63.02	83.04	84.20	64.20	89.31	64.31	64.18	84.45
42	-	-	-	-	-	-	-	-	-	-	-	-	-
43	55.58	59.55	56.48	64.28	57.80	-	95.72	-	-	-	-	-	-
44	-	-	-	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-	-	-	-
51	64.38	64.39	65.00	84.17	82.50	64.29	84.16	64.24	64.38	64.32	63.64	64.18	64.04
52	-	-	-	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	-	-	-	-
55	59.90	59.90	59.94	59.90	59.93	59.90	59.90	59.90	59.90	53.23	59.90	59.90	59.90
56	50.70	62.92	60.88	87.92	55.93	54.19	66.34	64.67	67.82	57.95	68.15	66.45	66.92
57	-	-	-	-	-	-	-	-	-	-	-	-	-
58	38.80	32.42	48.96	43.41	41.28	2.10	48.51	40.95	65.42	44.85	42.83	38.89	34.77
59	52.58	52.55	52.53	52.58	52.58	52.57	52.89	52.72	52.49	33.09	32.88	34.89	39.00
60	50.86	82.70	60.68	67.71	55.81	51.08	88.18	83.46	67.35	57.31	63.10	59.55	60.83
61	-176.56	83.95	81.28	140.48	54.72	82.99	27.96	67.88	71.96	58.49	21.04	102.81	87.98
62	71.28	69.07	98.97	87.79	59.37	91.28	88.20	77.60	56.97	87.92	93.54	66.11	57.77
63	55.32	85.87	69.87	87.79	57.57	85.55	87.02	73.83	83.08	63.00	80.93	84.73	59.11

continued

Table 1 continued.

		Intermediate consumption (continued)							
		83509	93009	94000	95009	95399	98099	Imputed bank service charges	Total
	DANISH GOODS AND SERVICES								
1	11000 Agriculture, horticulture, etc.	61.53	81.64	62.94	81.51	61.67	65.27	-	70.21
2	12000 Forestry and logging	-	-	-	-	-	48.46	-	72.59
3	13000 Fishing	-	-	-	-	-	53.49	-	54.36
4	20000 Mining and quarrying	57.14	82.50	85.38	62.50	100.00	70.43	-	58.06
5	31000 Manuf. of food, beverages, tobacco ...	69.48	71.35	69.39	69.30	69.49	70.96	-	72.07
6	32000 Textile, clothing, leather industry ..	72.27	71.91	71.09	62.03	72.28	69.77	-	66.66
7	33000 Manuf. of wood products,incl. furnit.	65.52	62.50	62.46	59.69	64.52	62.27	-	66.06
8	34000 Manuf. of paper,printing,publishing ..	65.52	85.82	85.35	71.60	65.63	85.48	-	68.15
9	35000 Chemical and petroleum industries	53.42	50.13	53.75	84.08	83.59	61.44	-	56.75
10	36000 Non-metallic mineral products	56.19	61.39	82.14	57.26	58.00	81.37	-	65.99
11	37000 Basic metal industries	73.58	78.87	79.13	55.55	75.00	85.52	-	69.45
12	38000 Manuf. of fabricated metal products ..	87.22	63.43	68.80	88.30	68.07	65.72	-	67.66
13	39000 Other manufacturing industries	62.88	61.57	82.99	65.77	60.95	66.58	-	65.78
14	40000 Electricity, gas and water	58.40	58.58	56.42	58.83	57.92	59.07	-	59.88
15	50000 Construction	88.34	88.34	66.34	66.34	88.35	68.20	-	86.31
16	60099 Wholesale and retail trade	88.72	69.80	87.64	66.65	85.68	90.82	-	71.81
17	63000 Restaurants and hotels	63.24	63.24	63.24	63.24	63.24	63.17	-	63.22
18	71000 Transport and storage	68.24	62.79	81.75	61.56	62.79	85.91	-	63.51
19	72000 Communication	80.93	80.93	80.93	80.93	80.93	80.94	-	80.93
20	80099 Financing and insurance	64.88	64.12	64.80	63.49	84.87	64.85	64.91	64.84
21	83110 Dwellings	-	-	-	-	-	59.11	-	59.11
22	83509 Business services	86.55	88.81	66.27	66.61	68.61	66.77	-	68.28
23	93009 Market services of education,health ..	57.59	72.67	57.56	57.55	57.55	76.14	-	75.51
24	94000 Recreational and cultural services ...	62.42	58.51	82.29	58.88	58.90	89.80	-	65.22
25	95009 Household services, incl. auto repair	62.70	81.64	62.18	65.03	60.35	63.14	-	64.90
26	95399 Other producers, excl. government	-	-	-	-	-	-	-	-
27	98099 Producers of government services	68.58	68.59	68.58	68.58	88.59	68.58	-	68.58
	IMPORTS INCL. CUSTOMS DUTIES								
28	11000 Agriculture, horticulture, etc.	63.55	62.98	65.18	63.68	62.50	55.80	-	69.95
29	12000 Forestry and logging	-	-	-	-	-	45.83	-	58.87
30	13000 Fishing	-	-	-	-	-	54.94	-	56.01
31	20000 Mining and quarrying	-	-	-	-	-	65.88	-	42.74
32	31000 Manuf. of food, beverages, tobacco ...	74.13	77.18	74.22	72.87	74.38	69.77	-	69.08
33	32000 Textile, clothing, leather industry ..	75.67	75.46	82.58	63.48	75.71	73.29	-	69.42
34	33000 Manuf. of wood products,incl. furnit.	90.00	74.19	69.23	71.20	88.89	73.22	-	57.97
35	34000 Manuf. of paper,printing,publishing ..	60.84	69.12	69.00	72.60	69.16	71.69	-	75.79
36	35000 Chemical and petroleum industries	45.93	45.35	46.60	54.25	55.40	54.46	-	55.14
37	38000 Non-metallic mineral products	57.14	59.20	59.20	55.97	58.76	62.17	-	59.47
38	37000 Basic metal industries	64.62	31.99	70.06	58.25	66.87	65.92	-	65.69
39	38000 Manuf. of fabricated metal products ..	64.43	68.06	70.56	67.57	67.92	67.87	-	69.31
40	39000 Other manufacturing industries	68.36	69.27	65.13	68.39	69.03	73.44	-	66.07
41	40000 Electricity, gas and water	64.11	84.10	64.22	64.08	64.10	64.15	-	58.78
42	50000 Construction	-	-	-	-	-	-	-	-
43	80099 Wholesale and retail trade	-	-	-	-	-	-	-	58.74
44	63000 Restaurants and hotels	-	-	-	-	-	-	-	-
45	71000 Transport and storage	-	-	-	-	-	-	-	-
46	72000 Communication	-	-	-	-	-	-	-	-
47	80099 Financing and insurance	-	-	-	-	-	-	-	-
48	83110 Dwellings	-	-	-	-	-	-	-	-
49	83509 Business services	-	-	-	-	-	-	-	-
50	93009 Market services of education,health ..	-	-	-	-	-	-	-	-
51	94000 Recreational and cultural services ...	64.19	64.41	59.77	64.32	65.22	62.10	-	60.34
52	95009 Household services, incl. auto repair	-	-	-	-	-	-	-	-
53	95399 Other producers, excl. government	-	-	-	-	-	-	-	-
54	98099 Producers of government services	-	-	-	-	-	-	-	-
55	Other imports	59.90	59.88	59.89	59.90	59.90	59.90	-	54.42
56	Sum (1-55)	86.10	83.18	64.20	65.68	86.81	68.32	64.91	64.97
57	Purchases in Denmark by non-resid. household	-	-	-	-	-	-	-	-
58	Net taxes on commodities	37.44	40.95	17.42	51.10	49.84	24.30	-	30.18
59	Value added tax	312.87	30.38	52.54	52.57	89.92	38.69	-	39.39
60	Uses at market prices (56-59)	66.47	57.21	62.40	85.25	68.58	63.24	64.91	63.83
61	Other indirect taxes, net	34.17	-477.43	33.52	130.81	1137.27	50.69	-	194.07
62	Gross domestic product at factor cost	66.79	77.02	67.75	64.42	57.94	68.76	64.91	69.30

Table 1 continued

	Final demands: Private consumption	Final demands: Government consumption	Gross fixed capital formation: Machinery and equipm.	Gross fixed capital formation: Transport equipm.	Gross fixed capital formation: Construction	Gross fixed capital formation: Breeding stock	Changes in stocks	Exports	Total	Total
1	68.48	-	-	-	-	73.26	71.84	84.45	64.05	69.35
2	45.06	-	-	-	-	-	50.13	58.71	53.86	88.18
3	53.49	-	-	-	-	-	17.15	57.57	57.08	55.70
4	66.59	-	66.95	-	-	-	76.72	64.47	64.23	59.02
5	71.36	-	67.28	-	-	-	28.95	89.20	70.19	70.69
6	88.90	-	71.31	-	-	-	88.18	70.21	69.52	88.87
7	84.88	-	88.46	72.86	-	-	57.47	88.53	67.53	68.87
8	65.30	-	63.85	-	-	-	78.17	71.54	66.05	67.58
9	47.33	-	64.53	45.83	-	-	58.31	58.99	54.13	55.32
10	64.38	-	88.42	-	-	-	65.58	64.45	64.22	65.67
11	64.08	-	65.40	-	-	-	78.79	71.00	70.49	69.87
12	88.87	-	70.50	50.43	-	-	70.05	88.14	67.85	67.79
13	43.14	-	67.01	-	-	-	52.74	83.97	56.44	57.57
14	70.48	-	-	-	-	-	132.19	66.33	70.31	65.55
15	-	-	-	-	67.25	-	-	-	67.25	67.02
18	74.86	-	71.74	72.33	-	187.53	151.80	75.88	74.68	73.83
17	63.04	-	-	-	-	-	-	-	63.04	83.08
18	67.08	-	-	-	-	-	-	60.99	62.57	63.00
19	80.93	-	-	-	-	-	-	-	80.93	80.93
20	64.17	-	-	-	-	-	-	65.70	64.18	64.73
21	59.11	-	-	-	-	-	-	-	59.11	59.11
22	68.69	-	65.88	-	89.91	-	-	84.72	68.52	66.57
23	69.39	-	-	-	-	-	-	-	89.39	73.15
24	72.89	-	-	-	-	-	83.38	59.18	72.41	71.20
25	64.45	-	-	-	-	-	58.16	-	64.45	64.86
28	58.70	-	-	-	-	-	-	-	58.70	58.70
27	86.50	66.87	-	-	-	-	-	68.58	66.86	86.88
28	49.97	-	-	-	-	83.50	60.58	48.88	50.43	59.39
29	24.88	-	-	-	-	-	49.97	55.53	50.13	56.67
30	54.94	-	-	-	-	-	62.22	55.82	55.22	55.87
31	54.78	-	-	-	-	-	60.68	53.20	59.84	43.29
32	70.50	-	-	-	-	-	87.93	70.22	70.52	69.57
33	72.83	-	80.70	-	-	-	71.18	70.29	72.73	71.04
34	89.08	-	85.28	76.98	-	-	81.31	61.01	86.98	59.63
35	70.25	-	53.36	-	-	-	79.36	87.37	65.02	74.82
36	41.12	-	66.09	76.72	-	-	47.43	89.50	44.79	51.95
37	64.27	-	85.88	-	-	-	64.89	61.23	83.88	60.32
38	51.49	-	65.86	-	-	-	37.10	59.51	81.65	85.48
39	74.52	-	71.73	64.33	-	-	54.53	70.60	70.23	89.84
40	85.85	-	82.41	-	-	-	71.95	51.20	65.24	65.46
41	83.80	-	-	-	-	-	123.38	67.24	88.25	67.27
42	-	-	-	-	-	-	-	-	-	-
43	60.35	-	-	-	-	-	113.74	60.08	61.14	59.45
44	-	-	-	-	-	-	-	-	-	-
45	-	-	-	-	-	-	-	-	-	-
46	-	-	-	-	-	-	-	-	-	-
47	-	-	-	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-	-	-	-
50	-	-	-	-	-	-	-	-	-	-
51	80.51	-	-	-	-	-	59.46	81.32	80.84	80.40
52	-	-	-	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-	-	-	-
54	-	-	-	-	-	-	-	-	-	-
55	59.90	-	62.19	-	-	-	-	-	59.96	57.27
58	65.25	86.87	70.58	62.41	87.30	73.12	102.32	86.27	66.15	65.68
57	83.63	-	-	-	-	-	-	63.83	-	-
58	55.74	-	119.38	35.86	17.82	-	-21072.22	51.49	53.84	49.38
59	41.81	-	68.27	35.48	48.12	-	-	-	43.11	42.43
60	61.61	88.87	70.81	80.78	84.08	73.12	118.28	86.48	84.15	84.03

Table 2. Percentage growth of main components of danish gross domestic product at constant prices

	1980 mill. kr.	1966-1975 A	1966-1975 B	1966-1975 C	1966-1975 D	1975-1980 A	1975-1980 B	1975-1980 C	1975-1980 D	1966-1980 A	1966-1980 B	1966-1980 C	1966-1980 D
1 Private consumption	208814	23.8	22.9	21.0	23.6	9.2	7.3	9.1	6.7	35.2	31.9	32.0	31.9
2 Government consumption ..	99734	57.5	57.5	57.5	57.5	25.4	25.4	25.4	25.5	97.5	97.5	97.5	97.6
3 Gross capital formation .	69187	9.5	8.6	8.8	9.3	1.7	-0.6	2.5	-0.4	11.3	8.0	11.4	8.9
4 Domestic final uses (1+2+3)	377735	27.0	26.0	25.0	26.6	11.6	9.9	11.6	9.6	41.7	38.4	39.5	38.7
5 Exports	122256	54.9	55.5	55.6	56.9	27.9	24.9	25.4	26.2	98.1	94.3	95.1	98.0
6 Final uses of goods and services (4+5)	499991	32.4	31.5	30.8	32.2	15.3	13.2	14.7	13.2	52.8	48.9	50.0	49.7
7 Imports	126205	43.9	41.0	40.8	41.2	18.0	13.3	15.6	15.9	69.9	59.7	62.7	63.7
8 Gross domestic product at market prices (6-7)	373786	29.2	28.6	27.7	29.5	14.5	13.2	14.4	12.4	48.0	45.5	46.1	45.5
9 Indirect taxes, net	57797	25.6	25.2	20.0	23.9	1.0	-0.2	3.3	-0.4	26.8	25.0	24.0	23.5
10 Gross domestic product at factor prices (8-9)	315989	29.8	29.3	29.5	30.7	16.5	16.0	16.7	15.1	51.2	50.1	51.0	50.4

NOTE : Columns marked A are at 1975 prices
Columns marked B are at 1980 prices calculated by commodity balance factors
Columns marked C are at 1980 prices calculated by IO element factors
Columns marked D are at 1980 prices calculated by IO row factors

Table 3. Percentage growth of components of danish private consumption at constant prices

	1980	1966-1975				1975-1980				1966-1980			
	mill. kr.	A	B	C	D	A	B	C	D	A	B	C	D
Food	35894	3.1	1.8	1.8	2.6	9.7	9.4	7.4	8.2	13.1	11.4	9.4	11.1
Beverages	9215	72.0	71.6	71.0	72.1	9.6	5.2	9.3	-13.7	88.5	80.5	86.9	48.5
Tobacco	7130	-1.5	3.7	-1.5	-1.5	-6.8	-0.2	-6.8	-16.3	-8.3	3.5	-8.1	-17.5
Clothing and footwear	12236	5.3	3.5	4.4	4.5	10.7	9.9	10.1	7.4	16.6	13.8	14.9	12.3
Fuel and power	24419	39.9	41.7	32.7	39.3	4.6	0.9	10.0	15.9	46.4	43.0	46.0	61.5
Other non-durable goods	24966	27.3	22.9	25.4	25.5	7.3	5.4	5.6	4.0	36.6	29.5	32.4	30.6
Total of non-durable goods .	113860	17.5	18.0	16.0	17.9	7.3	5.7	7.0	4.6	26.1	24.7	24.1	23.4
Furniture, fixtures, carpets	5916	35.9	33.5	35.3	35.8	-5.3	-6.6	-5.3	-4.8	28.7	24.7	28.0	29.3
Personal transport equipment	6234	18.8	14.2	17.6	17.7	-29.9	-29.6	-29.6	-37.5	-16.7	-19.6	-17.2	-26.5
Other durable goods	6253	75.8	48.2	60.3	68.7	0.6	-9.9	-4.4	-14.1	76.8	33.6	53.2	45.0
Total of durable goods	18403	38.6	28.8	33.4	35.1	-12.8	-16.8	-15.0	-21.6	20.8	7.1	13.4	5.9
Gross rents	38956	65.6	65.6	65.6	65.6	15.0	15.0	15.0	15.2	90.4	90.4	90.4	90.7
Transport and communication	8598	17.6	17.9	16.0	17.1	37.7	28.5	36.8	29.2	61.9	51.5	58.7	51.2
Hotels and restaurants	9738	20.3	20.4	20.2	20.2	3.0	2.8	2.9	4.7	23.9	23.8	23.7	25.9
Other services	19224	1.9	-1.4	-10.4	-0.6	17.4	14.0	21.3	18.5	19.6	12.5	8.7	17.9
Purchases in Denmark by non-resident households	-8367	63.3	62.4	63.3	63.3	1.6	2.2	1.6	-3.8	65.9	66.0	65.9	57.1
Purchases abroad by resident households	8402	61.2	61.2	61.2	61.2	37.5	37.5	37.5	37.5	121.5	121.5	121.5	121.5
Total of services excl. gross rents	37595	6.7	5.3	-0.8	5.0	26.2	21.5	27.5	27.0	34.7	27.9	26.5	33.3
Total of services	76551	30.4	30.0	26.3	30.4	20.5	18.0	20.8	20.7	57.1	53.6	52.6	57.4
Total of private consumption	208814	23.8	22.9	21.0	23.6	9.2	7.3	9.1	6.7	35.2	31.9	32.0	31.9

NOTE : Columns marked A are at 1975 prices
Columns marked B are at 1980 prices calculated by commodity balance factors
Columns marked C are at 1980 prices calculated by IO element factors
Columns marked D are at 1980 prices calculated by IO row factors

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