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THE SIMULTANEOUS COMPILATION OF CURRENT PRICE AND DEFLATED INPUT-OUTPUT TABLES

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Summary

This paper discusses a number of aspects of the procedure according to which input-output tables are compiled in the Netherlands. A few years ago this method underwent an essential revision. The most significant improvement means that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other.

Data in current prices first used to be compiled and data in constant prices and changes in volume and prices used to be estimated only afterwards. With the new method the opportunity for the analysis of the interrelations between various kinds of data, and thus better estimates, is used.

In the present paper we have opted to explain the procedure involving volume and price information with the aid of the wide known scheme of make and use matrices.

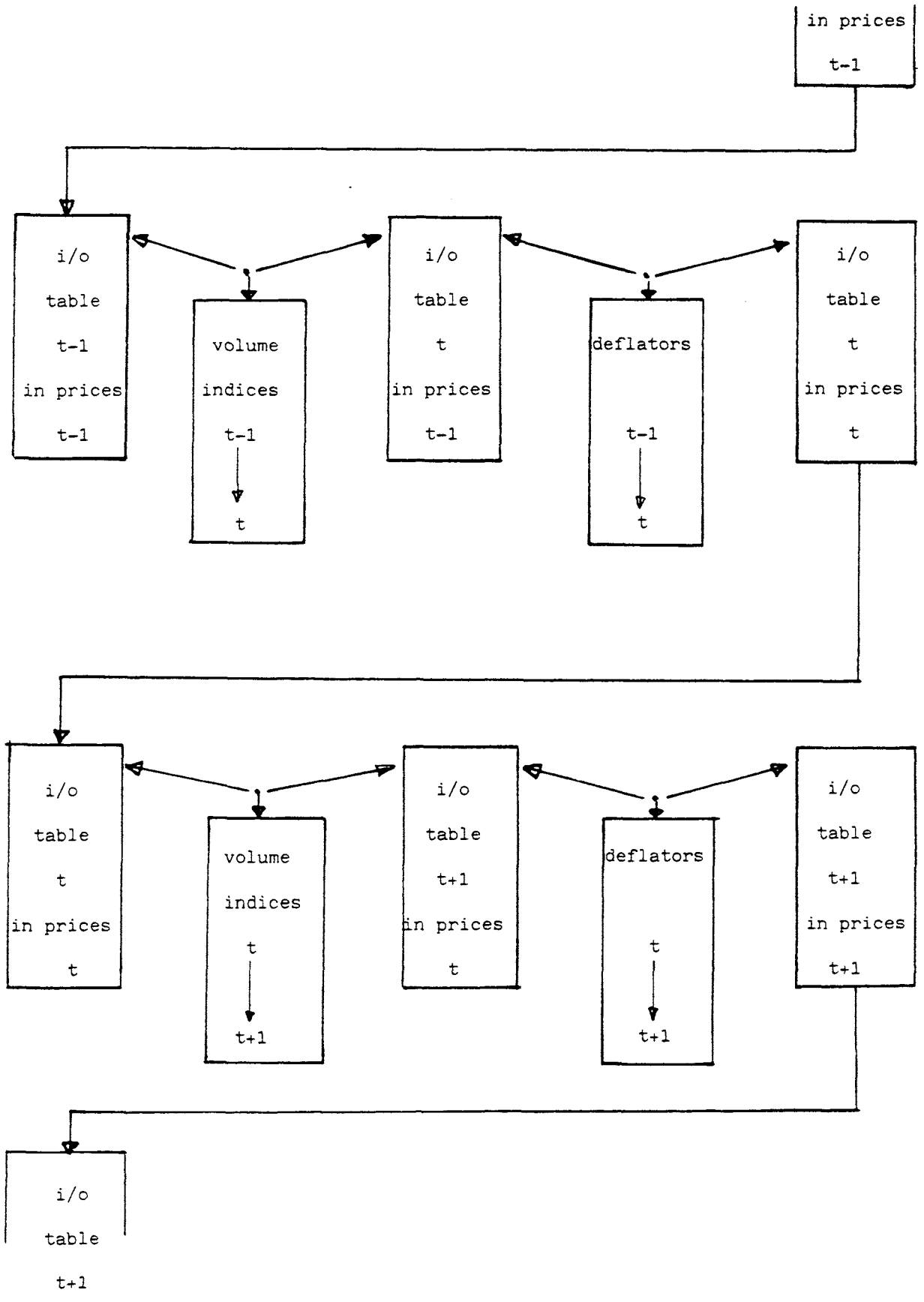
1. Introduction

This paper discusses a number of aspects of the procedure according to which input-output tables are compiled in the Netherlands. These tables are compiled annually and are fully integrated in the system of national accounts. A few years ago the method of compiling the input-output tables underwent an essential revision and, in our opinion, improvement. The most significant improvement now means that during the entire statistical process, from the processing and analysis of the basic data up to and including the phase of balancing the input-output tables, data in current prices and deflated data are obtained simultaneously and in consistency with each other. We believe that this is an innovation which may be of interest to other countries that currently compile input-output tables or wish to do so in the future, as many countries - just as the Netherlands used to do - first compile the data in current prices and calculate data in constant prices and changes in volume and prices only afterwards and often on a higher level of aggregation. This means that an important opportunity for the analysis of the interrelations between various kinds of data, and thus better estimates, is used to lesser extent or even not at all.

In cases where input-output tables are drawn up periodically the comparability in time of the estimates is an important requirement. For an extensive discussion on this matter, the reader is referred to Al and Broesterhuizen [1]. Plausibility checks of changes between two periods observed by statisticians can be carried out more easily and more meaningfully if the change in value is split into a volume change and a price change. In addition, with the informational aspect of economic statistics in mind, it is also important that there is complete consistency between deflated input-output tables and tables with volume and price indices. This can be achieved by compiling both current-price data and deflated data simultaneously. Scheme I shows part of the series of tables which then become available in the course of time.

In the Netherlands deflated data pertaining to a period t are always expressed in prices of the period t-1. In this way, the weighing schemes with the aid of which detail indices are weighed together to changes at a higher aggregation level, remain up-to-date. In this process the volume changes are

Scheme I


in prices
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weighed together with the aid of Laspeyres' formula and the price changes with the aid of Paasche's formula. The problems surrounding index figure formulas are not discussed in the present paper. The reader is referred to [3] and [4].

The Dutch input-output tables are currently still only limited in size. They consist of about 225 rows and 135 columns. The rows refer to industry groups or to commodity groups which add up to industry groups. The columns refer to industry groups and final expenditure categories. The published tables - industry group x industry group tables - are derived from these tables by means of aggregation. In the last few years there have been a number of developments in economic statistics which have led, or will lead to an improvement of the available basic data for the input-output table or to better conditions for the processing and analysis of the basic data. The following three aspects are concerned in this respect:

- the introduction of a standardized goods nomenclature in a large number of basic statistics, among others price statistics
- the start of annual statistics for the sectors of trade and services
- automation of the processing and analysis of the basic material and the balancing of the input-output table.

These developments make it more possible than it has been up to now to utilize volume data and price data in the analysis and processing of the basic data. In the near future the Netherlands will probably switch over to compiling separate make and use matrices, in accordance with the recommendations of the SNA with respect to the compilation of input-output information. Therefore in the present paper we have opted to explain the procedure involving volume and price information with the aid of this widely known scheme of make and use matrices.

The following sections contain a step-by-step discussion of the various stages within the statistical process. In doing this, the simultaneous compilation of data in current prices and deflated data is stressed. The paper concludes with a short look at the possibilities of applying the described system in various situations with respect to the basic statistical material available.

2. The statistical process in the Netherlands

2.1. Some general remarks

A number of phases can be distinguished in the compilation process of make and use matrices viz:

I the data collection phase
II the adjustment phase
III the processing phase
IV the balancing phase.

For the sake of simplicity the present paper gives the impression that these phases are passed through separately and consecutively. This is a simplification. It is actually more of an iterative process in which operations of a certain phase are followed by or carried out the same time as operations in other phases. For example, during the balancing phase the basic material may still have to undergo some corrections so that the adjustment and processing will have to be repeated.
In this section we shall look briefly into phases I and II. Attention will be given to the available basic information which is used in the compilation of the make matrix and the use matrix. Phases III and IV will be examined separately in the following sections.

2.2. The available basic information

The information used in compiling make and use matrices relates to a multitude of aspects of the economic process. There are data relating the production and input structure of industry groups, imports and exports of goods and services, household and government consumption, gross fixed capital formation and stocks. This is not the place to go into the sources in detail; an outline is given of the most important sources.

The most important group of statistics involving the compilation of information by sector of industry is that of the annual production statistics. These are compiled or are currently in the process of being developed for over 100 groups in manufacturing, 8 groups in construction and more than 50 groups in the services sector, including a large number in trade. Among other things, these statistics give detailed information on sales (split into domestic sales and exports), purchases and initial and final stocks of the manufactured and consumed goods. The data are usually specified by commodity, though on the user

side in particular unspecified or only roughly specified quantities do occur. In cases where sales or purchases are specified by commodity both values and volumes are given.

In many cases, particularly all the industry groups in manufacturing, the results of the production statistics relate to a proportion of all the enterprises of the industry group concerned. In these cases, the results relate to all enterprises with al least 10 employees. In the trade and services sector the results usually relate to all enterprises; here the results are obtained by crossing up the results of the sample survey.

For industry groups for which there are no available production statistics many various, and often external, sources are used. For agriculture, for example, there are ample functional statistics, i.e. statistics relating to markets for certain goods (not to producers). For large parts of the services sector, only very few data are available. Often there is only information on the number of persons practising a certain profession and wages and salaries.

With respect to foreign trade there are very detailed estimates of imported and exported goods and rougher estimates of imported and exported services. Data on consumption are based mainly on household budget surveys and turnovers in the retail trade. Fixed capital formation is observed partly bij means of direct surveys, but mainly by way of indirect measurement in the context of the commodity-flow method of the input-output table. Finally, price statistics provide very detailed information on the prices of goods: imported goods, exported goods, goods produced domestically and goods and services consumed by the public.

2.3. The adjustment phase

2.3.1. Continuity

In composing the national accounts not only the estimation of accurate levels has great priority, but also, or even rather, the estimation of accurate trends. Users of the national accounts and input-output tables require long time-series of data, in order to estimate econometric models, for example, or for comparisons in time. It has been explained elsewhere that the objectives of

accurate levels and accurate changes cannot be achieved at the same time (see for example Algera et. al [8] or Al and Broesterhuizen [1]). Adjustment of the basic material should be carried out in such a way that the data for the year under review can be compared to those of the preceding year (in other words: that the change which can be calculated from the consecutive levels does in fact reflect the actual development of the variables in question). The specific problems involved in these categories of adjustment have already been described in detail in the abovementioned papers.

2.3.2. Adjustment on the grounds of incomplete data

The basic statistics used are not always complete. We have already stated, for example, that production statistics for the manufacturing industry only refer to enterprises employing 10 or more persons. These results therefore have to be crossed up to include enterprises employing fewer than 10 people and own-account workers. For this group of enterprises, production, consumption and value added are estimated on the basis of the number of own-account workers and the totals of paid wages and salaries and figures relating to enterprises with more than 10 employees.

Another form of incompleteness may occur when the basic statistics are subject to systematic distortion. This could be the case for figures entirely based on tax statements of persons or enterprises. In these cases the basic data are grossed up by a certain percentage so that fraud is taken into account to a certain extent. This involves an explicit grossing up of the value added by nearly 1% of the gross domestic product (see also Broesterhuizen [10]).

2.3.3. Adjustment on the grounds of differences between company accounts and the national accounts

The great majority of statistics used in compiling the national accounts are based on statements by enterprises. The information these enterprises supply to the CBS is derived from their accounts. This means that there are inevitable differences between the information supplied and the information required in the context of the national accounts. Adjustments have to be made to translate figures for the financial year of the enterprise concerned into figures for the calendar year. The greatest differences, however, occur as a consequence of

differences in value assigment. In the framework of the national accounts, changes in stocks are valued in terms of actual prices. These changes cannot be expressed as the difference between the values stated by the enterprises of the initial and final stocks if the enterprise does not assign the real value to the stocks. The stated values of initial and final stocks then have to be corrected. These, very laborious corrections are, if possible, carried out for each commodity by making use of volume data if stated, prices of the commodity and knowledge of the valuation method applied in the industry group concerned.

3. The processing and analysis phase

Once the adjustments described in the last section have been carried out, we have an amount of basic information which covers the entire field concerned, is comparable to that of the previous year and, as far as definitions and registration is concerned, is in accordance with the guidelines of the national accounts.

In the processing phase an overview of means and expenditure is compiled for each industry group. To this end, specialists draw up estimates of volume and price changes in production, consumption and value added. In these processes, plausibility checks are carried out on the results in each stage. In some cases, in particular in agriculture and the food industry and some parts of the services sector, the available information is compiled by means of data on volumes and prices. The calculations, which are fairly laborious, have then been completed in a previous stage. However, in the majority of cases, and particularly in the manufacturing industry, the information currently available relates to production, consumption and value added in current prices and additional information is available on volumes and prices. In these cases there is a repetitive process of analysis and adjustment of the data in order to arrive at estimates in current prices and in prices of the previous year. The procedure is roughly as follows. The most detailed basic data relating to values in current prices and volumes are used to determine the production or intermediate consumption of a large number of commodity (groups) in current prices and in prices of the previous year. If no volume data are available, price developments based on price statistics are used. Plausibility checks on the values of production and intermediate consumption thus obtained take place at the commodity (group) level and by comparing the volume changes of production and intermediate consumption with each other and with other sources

(viz. short-term statistics, employment data etc.). If these volume changes turn out to be unplausible, the obtained data are subjected to further analysis. The sector specialist may come to the conclusion that a different deflator is required for a certain commodity group or that the original value amounts in current prices are incorrect. Adjustments are then made and new plausibility checks are carried out at the level of total production and intermediate consumption. This process is repeated until definity estimates are determined.

It can be stated that the simultaneous compilation of data in current prices and in prices of the previous year results in an improvement of both sorts of data compared with the compitaltion of figures in current prices followed by deflation after the make and use matrices in current prices have been finished.

This last conclusion becomes even more obvious when we take into account the role played by price information in determining trade and transport margins on consumed goods and in allocating unspecified or only roughly specified items to commodity groups. Examples of these items are "other raw materials", "other costs", "other metalware", " wood products" etc. Most of these cases used to be specified further on the basis of the allocation in the previous year, without specific price developments being taken into account. This can lead to serious distortions as became very evident at the time of sharply increasing energy prices in the seventies. For some time now a method of allocation has been applied which has been used in Denmark for a much longer period of time (see Thage [6]). In this method, the allocation is carried out on the basis of

(i) the allocation of the corresponding item in the previous year;
(ii) price changes of all the goods involved;
(iii) the value changes of the total item;
(iv) the assumption that all the components undergo the same volume change.

The form of the make and use matrices does not strictly require consumption to be broken down into producers' value and the trade and transport margins. However, for the actual balancing procedure (i.e. confronting demand and supply with goods and services) such a breakdown is necessary. Only few data are available in aid of making this breakdown, and it must therefore be carried out on the basis of assumptions. The method is completely identical to the allocation of the non-classified items as described above. When sharp price fluctuations are involved it seems especially more likely that the volume of

trade and transport margins is proportionate to the volume of consumption than that the nominal values of the margins are to the nominal values of consumption. If the first assumption serves as a starting point, then the price changes of the trade margins will have to be added separately.

The abovementioned allocation methods only give provisional results. Corrections can still be made during the balancing process. It should be clear that the above methods entail an improvement with respect to the situation where the only allocation was carried out on the basis of that of the previous year in current prices. In general, however, a word of relativity is not amiss with respect to such allocation processes, which are, it should be mentioned, necessary. As Thage (see Thage [6]) has already stated, the use of such classification routines in the make and use matrices may lead to a distortion in the direction of more constant structures. This conservatism, in the sense that the statistician will usually assume a gradual rather than an extreme structural change when faced with a lack of information, is justified because he must pursue minimalization of errors in his estimates. As he does not know in such cases which direction the effects will take, he opts for an average.

4. The basic scheme

The basic scheme (see Scheme II) is formed by a use matrix and a make matrix.
The contents of the use matrix:
The columns of the use matrix relate to industry groups, including any subsidiary activities, and categories of final expenditure (export, final consumption, gross fixed capital formation and changes in stock).
The rows of the use matrix relate to:

- The consumption of goods and services classified by standard commodity groups. Values are assigned according to purchasing value, including trade and transport margins and commodity taxes and subsidies.
- The commodity taxes and subsidies paid to the government by each industry group, classified by sort of tax.
- The non-commodity taxes and subsidies paid to the government by each industry group, classified by sort of tax.
- The compensation for the primary production factors for each industry group classified by category (wages and salaries, social insurance contributions paid by the employer, operating surplus).

The column totals of the use matrix give the gross output per industry group,

Scheme II

Use matrix

Make matrix

empty field

	input of industry groups	exports	private consumption	government consumption	gross fixed capital formation	increase in stocks	total
commodity groups	purchaser's value						
trade and transport margins							
commodity taxes and subsidies							
non-commodity taxes and subsidies							
compensation of employees							
gross operations surplus							
total							

	gross output of industry groups	imports	trade and transport margins	commodity taxes and subsidies	non-commodity taxes and subsidies	compensation of employees	gross operating surplus	total
approximate basic value								
			$-\Sigma$					

valued at producer prices, including the balance of product-linked taxes and subsidies and the totals per category of final expenditure respectively.
The contents of the make matrix:
The columns of the make matrix contain the production per commodity group for each industry group, valued of the approximate basic value. Subsequently, the produced trade and transport margins (this relates to subsidiary activities where industry groups outside trade are concerned). As a consequence of the fact that the input in the use matrix is valued at purchasing value including margins, the margins row is empty there and the total of the row is therefore 0. In the make matrix the row margins should also total 0. For this reason the margins are counter-entered by way of a diagonal booking and allocated to the commodity groups to which they relate in the column trade and transport margins. The commodity taxes, levies and subsidies entered as costs in the use matrix are included again in the make matrix, this time as a component of the production value of industry groups. In the corresponding columns, they are allocated to the commodities so that for each commodity group in the make matrix too the row total is the total purchasing value. For the sake of completeness the total non-commodity taxes, levies and subsidies and the components of value added are entered in a diagonal in the make matrix. Naturally there is a column with imports broken down by commodity group in addition to the domestic production of that commodity group. The column totals of the make matrix give the gross output per industry group valued at producer prices, total imports and the totals per primary cost category.

It is characteristic of the scheme that (ex post) the corresponding totals for each commodity group and each industry group in the use matrix and the make matrix are equal to each other.

The choice of the valuation in the use and make matrices takes place on the grounds of the following considerations:

- Valuations should link up as closely as possible with the basic information in more than one respect. On the one hand this applies for the money values of the flows, the other for the nature of the deflators to be used.
- The greatest possible uniformity of the valuations within the use matrix and make matrix respectively.
- From the perspective of the chosen valuation, as many other desired valuations as possible should be able to be derived as simpley as possible.

The precise extent of the use and make matrices is not known at present. We expect that the standardized commodity groups will number about 1,500 and

industry groups about 200. For ease of survey the number of final expenditure categories will remain limited. Detailed information on final expenditure (exports by group of countries, fixed capital formation by industry group, private consumption by trade channel, type of household or income group) will probably be elaborated upon in separate systems, which will naturally be related to the use matrix.

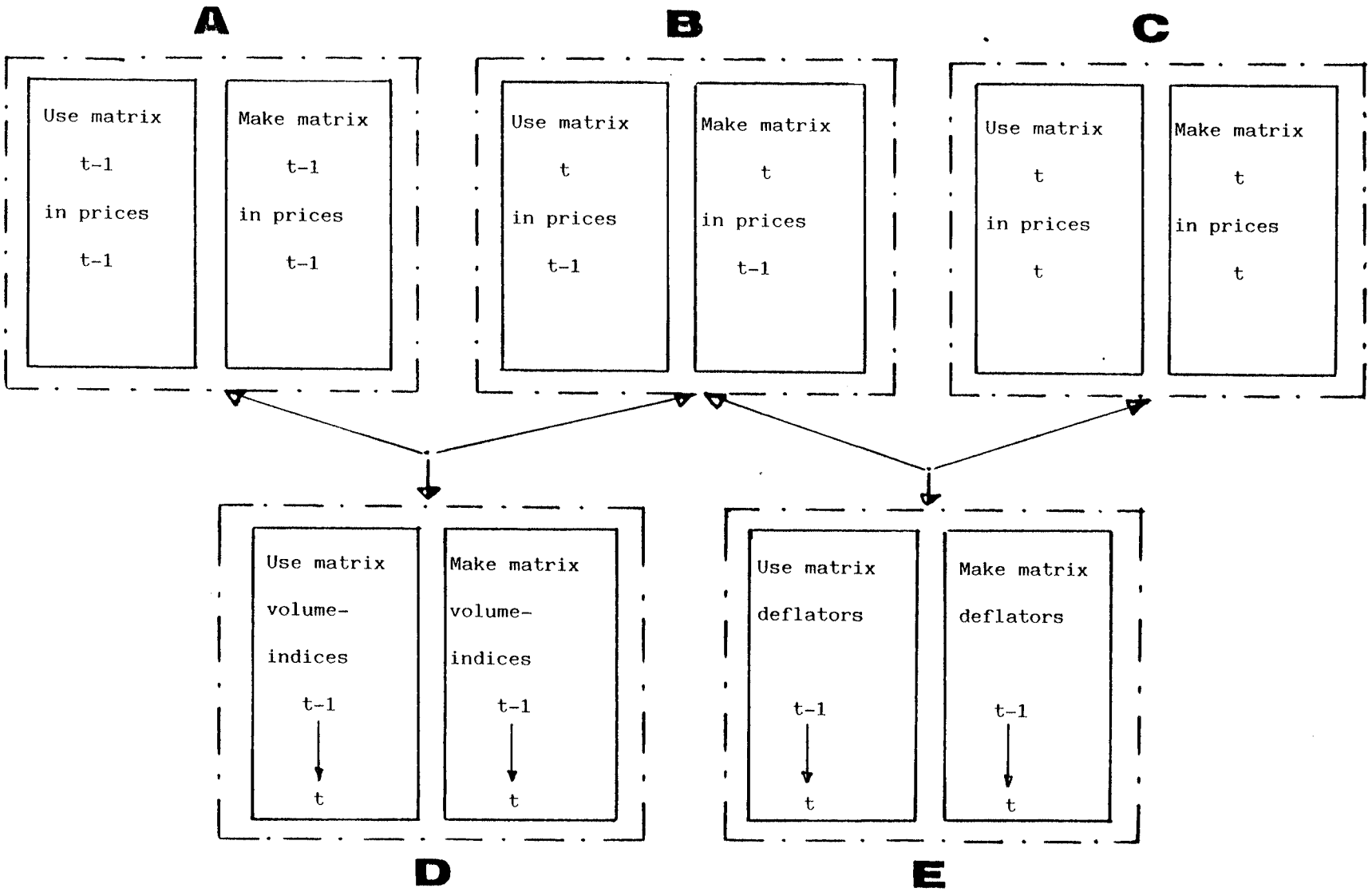
It is characteristic of the method of compiling input-output information described here that for each periode for which an input-output table is added to the existing series, simultaneous tables are compiled with deflated values, volume indices and deflators. This means that in each element of the make matrix and the use matrix five numbers play a part: the figures for t and t-1 expressed in current prices; the figure for t in prices t-1, the volume index and the deflator. Another way of putting it is that each time, five use matrices and five make matrices go to make up the system.

Scheme III gives an outline. In principle, Scheme III can be filled in in a number of different ways. It is necessary that data are present for three of the five table pairs. The "normal" situation is that A is known from the calculations of the preceding period and that B and C are derived from basic data which have been processed and checked in previous phases. The tables with the indices are then subsequently derived. In a situation with incomplete information, for example in the case of estimates for recent periods (in the Netherlands: the two most recent years under review), the data are usually based on indicators for volume changes and deflators. In this case A, D and E are entered and B and C are subsequently derived. The scheme can further be used for restoring continuity in the series of input-output tables following a general revision. Here the procedure is the other way round and C is the known quantity. E will usually be able to be maintained. If the revision also affects previously estimated volume indices, D should be adjusted subsequently; revised A and B can then be derived from C, E and D.

5. The balancing process

When the stages of the statistical process described in sections 2 to 4 have been completed the use matrix is filled completely and in the make matrix the columns referring to the production of industry groups and the imports of goods and services are filled. The trade and transport margins, commodity taxes and

Scheme III


A
Use matrix
t-1
in prices
t-1
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in prices
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C
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t
in prices
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in prices
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D
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volume-
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Make matrix
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subsidies for each industry group are then added to the make matrix. These data can be estimated with the aid of, for example, gross profit margins of commercial companies, turnovers of transport companies, tax rates, etc.

The balancing of the use matrix and the make matrix is, in the first instance, related to the data as they occur in scheme II. For various reasons - the transformation to various types of input-output tabels for example - it is necessary that the tables are balanced in each desired valuation. To this end each element in the use matrix has to be broken down into trade margin, transport margin, indirect taxes and subsidies and approximate basic value.

When the data on the margins and indirect taxes etc. have been entered in the make matrix, the scheme to be balanced is complete (see Scheme II an III). Ex post, the totals of the use matrix and make matrix should be equal, both in current prices and in prices of the previous year. Initially, these equalities will only exist in very few cases. Various methods are conceivable for eliminating the differences - depending on the situation from country to country (e.g. available manpower and time) and on the nature of he basic statistical material. For a discussion of the methods, such as those used in Denmark and Norway, the reader is referred to Thage [6] and Furunes and Røgeberg [9]. A number of characteristics of the balancing process to be applied in the Netherlands in the near future are given below. On the one hand the aim is the simultanious compilation of estimates in current prices and prices of the previous year; on the other, the balancing of commodity markets in two phases.

a. Simultaneous balancing of current price and deflated data.

Just as was the case in the preceding phases of the statistical process, the procedure in the balancing phase takes place as far as possible simultaneously for the data in current prices and the deflated data. Differences per commodity group are eliminated by adjusting elements in either the use matrix or the make matrix. If a figure in current prices is adjusted the consequences for the corresponding figures in prices of the previous year, volume index and the deflator respectively are examined. If a deflated figure is adjusted, a similar procedure takes place. This procedure offers the possibility of a check on the plausibility of an intended correction. Deflators which can be found in the various columns of the use matrix and the make matrix for one commodity

group constitute an important starting point for the analysis of the differences. These deflators were determined independently of each other in previous phases of the statistical process. Now they are compared and their consistency with each other is checked. These checks can point to where corrections should be carried out. Some differences can only be eliminated by means of corrections on important aggregates: the gross output or the total input of goods and services of an industry group. As a consequence of such corrections, the value added as determined in the stages preceding the balancing stage must also undergo correction. In this respect, the simultaneous correction of data in current prices and deflated data makes the analysis of the effect of such a correction on the change in operating surplus and on the volume change possible at the same time. It would often seem obvious to eliminate differences by corrections on consumption of households or fixed capital formation. The method described here presents the possibility of directly analyzing the consequences of such corrections on the volume of final expenditure. If, according to statistical experts, intended corrections on value added or expenditure in either current prices or volume turn out to lead to improbable results, alternative ways should be sought to eliminate a certain difference. It may be expected that the simultaneous balancing in current prices and in constant prices will result in a different allocation of corrections than the balancing in only current prices. This is due to the fact that in simultaneous balancing the consequences of an intended correction can be seen more clearly.

b. Balancing in two phases

The first phase consists of an analysis of the most important differences as far as size is concerned. The first phase may best be described as the search for inconsistencies in the figures collected and processed in the phases leading up to the balancing phase. Such inconsistencies may come about as a result of, for example, uncorrected errors in the observation of data, incomplete observation (e.g. of changes in stock), unvalid assumptions used in the allocation of non-specified items or in grossing up data for missing companies, and non-representivity of the deflators, all in previous phases of the process. In this phase, the elimination of differences takes place completely on the grounds of human judgement. In the process, both the use matrix and the make matrix are divided into blocks of inter-related commodity groups (e.g. metal products, foodstuffs, services). The idea behind this is

that the consequences of corrections due to elimination of differences will be noticeable mainly within one such block. This phase is continued, until, in the opinion of the statisticians, the remaining differences are so small that their elimination will have relatively insignificant consequences. For the elimination of the probably numerous small remaining differences a computer might be called upon to help. The fact that the matrices which are to be balanced are so large makes the automation of part of the procedure in the balancing phase an absolute necessity. In the Netherlands, we are currently experimenting with a method of elimination of differences in which each element of the make matrix and use matrix is assigned a confidence margin.

When the balancing phase has been completed, the user has at his disposal a system of tables containing consistent and detailed information on the levels, volume changes and price changes of goods and services transactions, in and between two periods respectively. In addition, this system comprises detailed information on the levels and trends in primary incomes and final expenditure in both nominal and real terms. All this is significant for various categories of users: policy makers, constructors of macro-models and models of components of the economy (industry groups, final expenditure categories), market researchers etc. Many users of national accounts data require long series of volume and price indices and level data. This requirement can be met by means of a series of tables as shown in scheme I.

Apart from this, users of input-output tables require information on the inter-industrial relations of groups of economic subjects and on the direct and indirect relations within the production structure of a certain country. To this end, they need input-output tables of the type industry x industry and homogeneous activity x homogeneous activity. This information does not occur as such in the make matrix and the use matrix since these are commodity x industry type tables. The required input-output tables can, however, be derived from the use matrix and the make matrix by way of transformation. The description of this transformation falls outside the scope of the present paper; the reader is referred to the literature concerned, for example [5].

6. Conclusion

The present paper describes how the quality of input-output information can be improved by making use of informaton relating to volume and price changes in

each stage of the statistical process. This is explained with the aid of a system of make and use matrices such as that the Netherlands is aiming to achieve in the near future, though it should be mentioned that the principle of applying price and volume data in the entire statistical process has already been applied for a number of years.

The system presented in the present paper for the compilation and presentation of input-output data can be applied in a wide variety of statistical environments. Some relevant aspects of the statistical environment are:

- the nature and specification of the available basic data;
- the quantity and quality of the available manpower;
- the time available.

In practice, statistical environments vary widely. On the one hand there are differences between different countries, while on the other, differences in completeness and degree of specification of data between recent years and years further back in time exist within the countries themselves.

Depending on the available basic information and manpower and computer capacity, the compilation of make and use matrices must to a greater or lesser extent always involve assumptions. These assumptions may relate, for example, to the allocation of non-specified items and to the relation between input and output. Making these assumptions will always lead to the information losing in depth since there is a tendency to take averages. In each statistical environment statisticians will have to determine how much loss in depth they still consider acceptable and how much becomes unacceptable. For provisional data more assumptions will be allowed than for definite data. The objective of the information to be obtained is also significant. If this objective is study of the input structure of industry classes or the composition of final expenditure, the assumptions may be relied on to a lesser extent than when estimates of the level, volume or price changes of goods and services transactions in the context of the national accounts are aimed at. The loss in depth as a consequence of the application of assumptions can be expected to be less if differences in price changes between various goods and services are taken into account. One condition for this is that there is sufficient relevant price information. The resulting distributions are, however, probably of a better quality than when the distributions are carried out on the basis of nominal value data only.

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