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INTEGRATION OF INPUT-OUTPUT TABLES AND SECTOR ACCOUNTS; A POSSIBLE SOLUTION*)

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Abstract

In this paper, the establishment-enterprise or company problem is tackled by taking the institutional sectors to which the establishments belong into account during the construction of input-output tables. The extra burden on the construction of input-output tables resulting from this approach is examined for the Dutch situation.
An adapted sectoring of institutional units is proposed for the construction of input-output tables.
The proposed approach contains perspectives on further specification of the institutional sectors, households and non-financial enterprises and quasi-corporate enterprises.

Contents

1. Introduction

At the Netherlands Central Bureau of Statistics, work is in progress on the construction of a complete set of accounts (abbr. SA) for institutional sectors (IS) in the economy. An important objective whilst developing this system is to maintain and intensify the link with the hard core of the Dutch National accounts, namely the input-output tables (abbr. I-O).
This implies an approach in which far as possible the production account of IS is linked - or more strongly - integrated with the I-O tables. An attempt is made to break down the institutional sectors (specifically the sectors non-financial and quasi-corporate enterprises and households), by categorising the institutional units in each sector according to their main economic activity (ISIC 1 digit for instance).

This approach requires a statistically feasible solution for the establishment-enterprise problem. Although the proposed solution is based on the possibilities of the Dutch statistical system, the general idea may be applicable in other countries. Section 2 of this paper gives a short description of the Dutch statistical system. The proposed solution for the establishment-enterprise problem is examined in section 3. A further elaboration of the approach is given in section 4, ending in a possible breakdown of IS into a one-digit activity classification by main economic activity - center of gravity (c.g.) - of institutional units. The additional burdens in constructing the I-O tables are discussed in section 5.
Section 6 contains some conclusions.

2. The Dutch statistical system

In the Dutch statistical system according to the SNA (1968), two types of statistical units are used for national accounts:

- The establishment (EST) (SNA 1968 par. 5.15)
- The enterprise (ENT) (SNA 1968 par. 5.41)

The information EST provides with regard to the production process, together with additional information (e.g. foreign-trade statistics), is integrated into a condensed and consistent system. Since 1948, the integration framework is constituted by an input-output table with the format activity by commodity. The input table includes data on value added components; therefore a production account by activities may be derived from the input-output table. (Cf. for information on the compilation of I-O tables in the Netherlands: P.G. Al, 1985.)

The input-output table forms the corner-stone of the national accounts. In the past, information on ENT was scarce and the switch from activities to institutional sectors was therefore problematic. The sectors and accounts were hybrids of an institutional and activity approach. Value added estimated in the framework of the I-O table formed the starting point of the SA. There was little feed-back from SA to I-O.

Recently, a considerable amount of information on ENT has become available, covering large parts of the sectors financial enterprises and non-financial and quasi corporate enterprises with a centre of gravity (c.g.) activity classification of the ENT, and Government.

This opens up the possibility of a more thorough analysis of the Dutch economy within the framework of a set of institutional sector accounts.

The aspired institutional sectors and accounts are presented in scheme 1.

Scheme 1. Sectors and accounts in the new system of accounts

Accounts	Institutional sectors						
	Non-financial corporate and quasi-corporate enterprises	government	financial institutions	households p.n.p's serving households	of which unincorporated enterprises	other-household	Rest of the world
Production	x	x	x	x	x	x	x
Distribution of income	x	x	x	(x)	x		x
Use of income		x		(x)	x		x
Capital transactions	x	x	x	(x)	x		x
Financial transactions	x	x	x		x		x

x : denotes the occurrence in the sector of the mentioned accounts.
(x): feasibility under examination.

The classification of the statistical units into institutional sectors, as presented in scheme 1, strongly resembles the international guidelines as stipulated by the SNA and ESA (1968; 1979). In brief, the sectors can be described as follows.

- Non-financial corporate and quasi-corporate enterprises (to be referred to as non-financial enterprises).
  This sector comprises all units which produce goods and non-financial market services, and which operate independently of their owners. In addition, enterprises which do not have the legal corporate structure but in every sense behave as a corporation (quasi-corporate enterprises) are also included in this sector. The prime resources are the revenues from the sale of goods and services on the market.

- Financial institutions
  This sector represents all corporate and non-corporate statistical units whose main economic activities lie in the field of finance (banks and credit institutions) or insurance (insurance enterprises).

- Government
  Included in this sector are all government agencies which do not primarily produce for the market. In general, these agencies produce public non-market services. Taxation (direct and indirect) is the prime source of resources. Private non-profit institutions serving the government, defined as receiving more than 50% of their resources from the government, are also considered to be units of this sector. In principle, it is possible to form a separate sub-sector of these p.n.p.'s.

- Sub-sector private non-profit institutions serving households.
  In general, the units classified in this sector produce non-market services for (certain groups of) households, and are financed for more than 50% by households (current transfers).

- Sub-sector unincorporated enterprises
  This sector comprises all enterprises of which the owners and operators are, legally and in actual fact, one and the same (group of) person(s). The largest group of units in this sector consists of the units known as sole proprietorship.

- Other households
  This is the residual of the household sector, and contains households in their role as consumers, savers, receivers of wages, etc.

The compilation of a complete set of accounts for each individual sub-sector of the household sector poses practical as well as - up to now - theoretical difficulties, which in all likelihood will not be overcome in the near future. The present statistical possibilities are illustrated in scheme 1. Only a production account can be constructed accurately for the p.n.p.'s. Furthermore, information is available on the production account for the other two sub-sectors, but the rest of the real accounts can only be given in combined form.

The available information on the financial transactions permits no sub-sectoring at all within the sector of households.

- Rest of the world
  This sector comprises all non-residents, in their relationships with Dutch residents.

A clear relation between I-O table and SA is desirable for purposes of statistical analysis, economic analysis and presentation of the national accounts. A strong relation will be achieved when, in the new situation, the production account of the SA can also be derived from the I-O table.
Such a relationship allows a well-defined interaction between statistical analysts in estimating the data for the I-O table and SA.
The possibilities for statistical and economic analysis are particularly intensified by a further breakdown of institutional sectors into e.g. a c.g. one digit ISIC classification. The proposed approach is outlined in the next section.

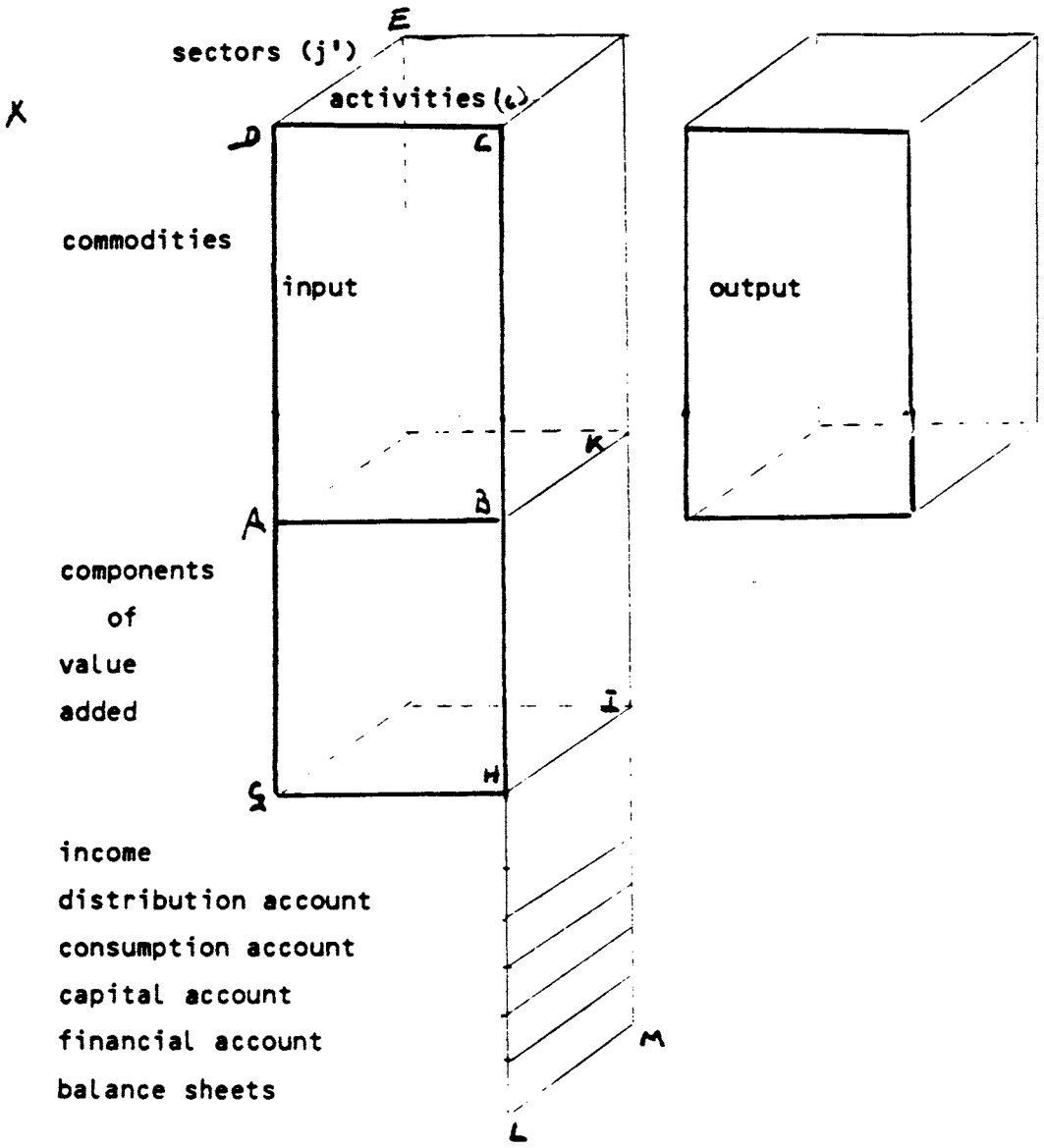
3. The link between input-output tables and sector accounts

The crux of the linkage problem between I-O table and SA lies in the disparity of the units and classifications which underlie the analysis of the I-O table and SA respectively. On the question of the disparity of units, a mode of thought leading to a possible solution is indicated by Postner (1985). He points to statistically relevant developments in management and accounting in the large compound enterprises. In these enterprises, it is becoming normal practice to distinguish separate divisions, which bear a close resemblance to the industries or groups of industries as defined by the SNA. On the division level, both information on production and data concerning income distribution and financing are sufficiently available.

This approach might be fruitful in the long run. It would be necessary to harmonise (inter-)national recommendations on business reporting etc. in order to obtain divisions which are statistically relevant with respect to definition and detail. But even then, a complete solution would not yet have been found. The classification problems of the private unincorporated enterprises remain. Moreover, Postner's proposed approach should not be allowed to lead to a situation in which the production process information concerns less homegeneous units than the EST. This would imply a serious handicap in constructing I-O tables. Nevertheless, this option deserves to be studied.

The situation at present and in the near future, however, will be dominated by the use of different statistical units in many countries, among which the Netherlands.
That is why in the Netherlands, the feasibility of constructing a connection between information from ENT and EST belonging to ENT is being studied. This connection should be retained when compiling the I-O tables. This implies differentiating the activities (i) as distinguished in the I-O tables by groups of ENT belonging to IS, as illustrated in scheme 2.

Scheme 2 Detailing activities by institutional sectors in the input-output table



Normally, the input and output table contains the dimensions activities (i) and commodities (plane ABCD in scheme 2). It is proposed to differentiate the activities by groups of ENT, denoted sectors J', to which the EST in each activity belong (DE in scheme 2). When in the input and output table the value added components are registered (plane ABHG), additional information is generated on sectoral value added components (plane BHIK).

The linkage between the activity and institutional sector analysis is expanded from the value added components (B-H) in the old situation to BHIK in the new one.
Finally, plane HLMI in scheme 2 constitutes (further) analysis on the income distribution etc. by institutional sectors according to SA.
The advantages of the proposed procedure are manifested especially in the field of:

- improvement of estimates by intensifying the interaction of the institutional sector analysis (LMKB in scheme 1) and the activity approach. This improvement is the consequence of the possibility of a more direct confrontation of the estimates in the I-O and SA analysis on a more detailed level.
  Desired adjustments - e.g. in the framework of the activity analysis (i) - can be verified with regard to the possibilities in the context of the SA and vice versa.
- clearer presentation of the link between I-O tables and SA.

A disadvantage of the approach is the additional burden on the statistical analysis of the production process in the framework of the I-O table. Consequently, the sectoring applied in the I-O table (j') should be chosen in such a way, that an optimal ratio results between further taxation of the I-O analysis imposed by detailing economic activities (i) to (j') on the one hand and additional information gains on the other.
This dilemma is further analysed in the next sections. The information gains are dealt with first of all.

4. Further elaboration on the link between the input-output table and the sector accounts; the information gains

4.1 The institutional sectors and their mutual relationship.

The approach enunciated in section 3 led to the conclusion that an optimum has to be found between additionally burdening the analysis of economic activities by further detailing to (j') on the one hand, and the information gains on the other.
In this weighing proces, the (j') classification depends on the institutional structure of the economy, data availability and the technical possibilities of constructing the I-O tables. In the Netherlands, the feasibility of the following classification of (j') is being investigated:

- General government excl. non-profit institutions serving government
- Financial institutions (ENT > EST)
- Unincorporated enterprises (ENT=EST)
- Compound non-financial enterprises (ENT > EST)
- Other non-compound enterprises (ENT=EST)

By so choosing the sectors (j'), the possibilities of a further breakdown of the IS are taken into account.
For the sector (j') "General government excluding non-profit institutions serving government", separate information is available on an institutional level (ENT) as well as on economic activities (EST).
The ENT's in this sector are all classified as general government. Further breakdown of this sector (j') into institutional sub-sectors takes place within the accounting framework of the SA, and plays no role in the relation between I-O and SA.

For the sector (j') "financial institutions", more or less the same is valid. Separate information on an institutional level is available together with a break-down into economic activities based on information from the EST belonging to the ENT.
Little information is available on the sector (j') "unincorporated enterprises". This holds for both EST and ENT, since EST=ENT in this sector. From a statistical-analytical point of view, it is very important to confront estimates for this sector derived from I-O tables with SA, as they contain different bodies of information, resulting in divergent estimates on e.g. value added for this sector.

The sector (j') "compound non-financial enterprises and quasi-corporate enterprises" is formed from ENT, composed of two or more EST's, therefore ENT > EST here.
Isolating the compound non-financial enterprises is important for three reasons:
- According to the definition, a compound enterprise comprises two or more EST's. Experience shows that the gathering of information from several EST's belonging to one ENT is often afflicted with observational defects (what is observed or accounted for where?). In the framework of the process of constructing statistics, this group requires special attention.

- The compound enterprises consist to a large extent of holdings, concerns, multinationals etc., in short, more often than not they are big businesses most likely showing unique, characteristic behaviour in the fields of income distribution and finance.
- The proposed split-up leads to the realisation of a closer link between economic activity and institutional sector analysis (cf. section 4.2).

In the Dutch statistical system, separate statistical information can be made available for this sector, for the ENT and the EST belonging to these ENTs. From a statistical point of view, this is a difficult operation because of the dynamics within this sector. Consolidations, deconsolidations etc. take place from year to year, So that the compound enterprise structure has to be analysed every year.

The last sector (j') is called "Other non-compound enterprises". All enterprises not mentioned in the other sectors (j') belong to this sector. Characteristic for this sector is that in all cases ENT=EST, which implies that the economic activity classification (i) may be used as an economic activity classification of the ENT within this institutional sector.
The detailed information for this sector (j') in the input-output tables allows the transformation from the sector classification (j') used in making the input-output tables to the sector classification used in the SA (j).

The relation between (j) and (j') is depicted in scheme 3.

Scheme 3 Relationship between the institutional sectors (j) in the set of accounts and the sectors (j') in the input-output table

	Classification of sectors (j) in set of accounts				
Classification of sectors (j') in Input-output table	Government and p.n.p. serving government	Financial institutions	Non-financial corporate and quasi-incorporate enterprises	Households, unincorporated enterprises	of which pnp's serving households
Government, excluding p.n.p.'s serving government	X				
Financial Institutions		X			
Unincorporated enterprises				X	
Non-financial compound enterprises			X		
Other non-compound enterprises	X (pnp's serving government)		X (non-financial non-compound enterprises)		X

As may be seen in scheme 3, an ad-hoc detailing of the (j') "other non-compound enterprises" has to be carried out only for "non-profit institutions serving government", "non-profit institutions serving households" and "non-compound non-financial enterprises". This detailing is accomplished by making autonomous estimates for (j) "non-profit institutions serving government" and "non-profit institutions serving households", based on economic activity information (i). The non-compound non-financial enterprises are determined as a residual of this particular group.

4.2 Breakdown of institutional sectors into economic activities

For purposes of statistical and economic analysis, a further breakdown of the institutional sectors is desired. The chosen institutional sectors (j') offer a first disaggregation of the sector non-financial and quasi-corporate enterprises into compound and non-compound enterprises. A second possibility partly brought about in the sector breakdown (j') is a further split of institutional sectors into economic activities (k).
This concerns a c.g. classification by main economic activity of ENT within each sector.

For the sector Government, no classification in (k) is opted for, although a set of accounts broken down by (k) is possible for non-profit institutions serving government. The sector "Financial institutions" - given the production-account information for this sector from the I-O tables - may be divided into the activities (k) banking and insurance. This institutional breakdown is based on a coarse institutional data set for this sector.

The sector "Non-financial corporations and quasi-corporate enterprises" consists of two sub-sectors (cf. scheme 3): the compound enterprises and the non-compound enterprises.
For the compound enterprises, a production account may be derived from the I-O tables.
Based on the ENT data set for compound enterprises, a further breakdown of this sub-sector by (k) is possible. The CBS carries out separate surveys aimed at the big ENTs.

This data set contains synoptic information on production and intermediate consumption. Detailed information is available on value added and its distribution, together with information on the financial transactions and balance sheets.
Therefore, for all accounts except the production account, a breakdown by (k) is possible. Options for a further classification by (k) of the production account should be studied carefully.
The problem is reversed in the case of the sub-sector non-compound enterprises. A detailed breakdown is possible for the production accounts for ENT=EST, but information on income distribution, capital accumulation and financial transactions is scarce.
This information gap might theoretically be bridged by enlarging the questionnaire for these enterprises.

The production account of the institutional sector households may be divided into the subsectors (cf. scheme 3):
- private non-profit institutions serving households
- unincorporated enterprises and
- other households.

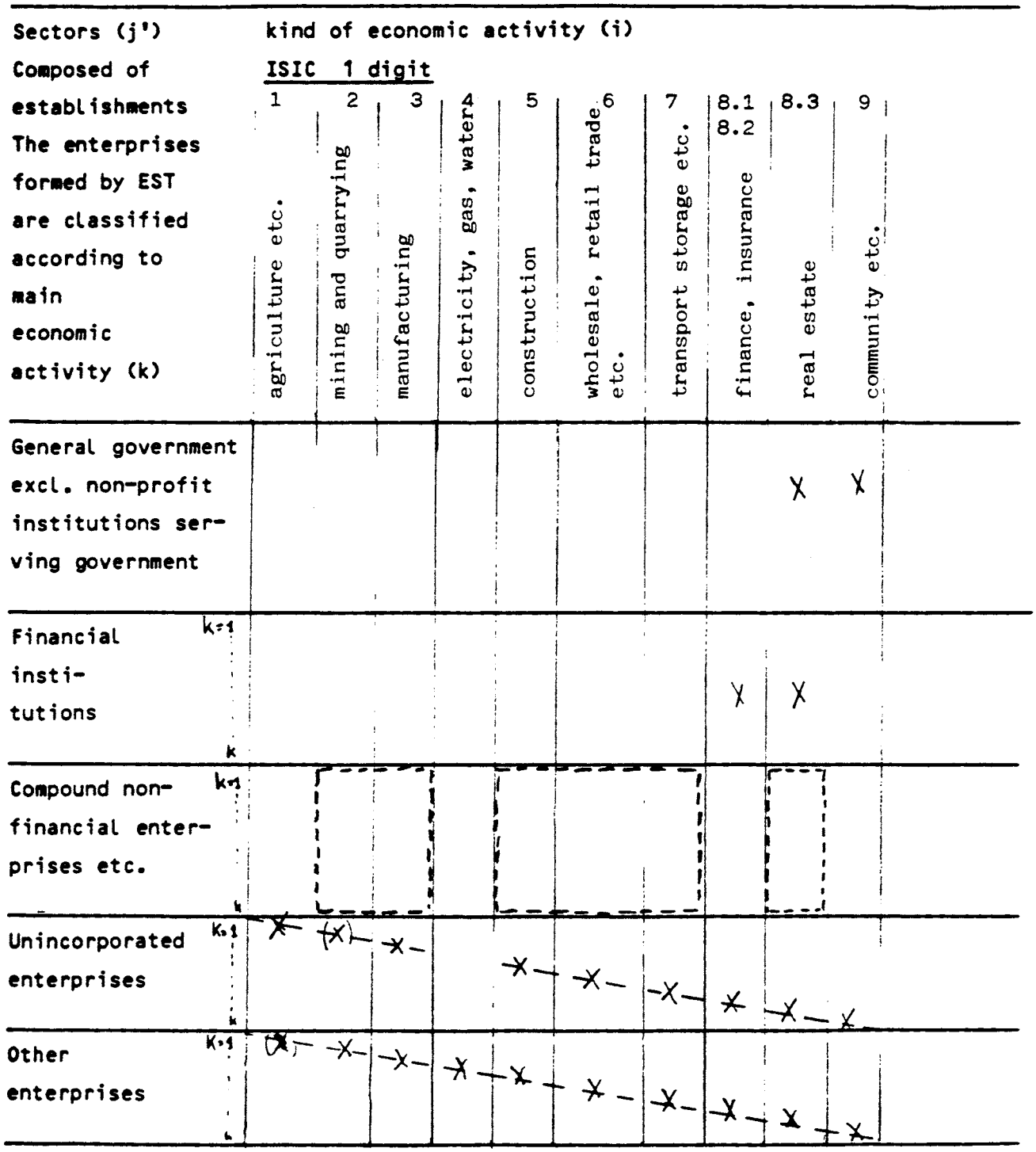
The production account of the sub-sectors p.n.p., households and the unincorporated enterprises may be split into economic activities in conformity to the I-O tables, since by and large ENT=EST.
Due to lack of information, a split of the other accounts is not conceivable in the near future.

It may be concluded that the introduction of (j') in the input-output tables may improve the interaction between formerly rather loosely related fields of statistical analysis: namely the I-O tables, containing the analysis of production, and the SA, concentrated on distribution of income and financing.
These interactions enhance the reliability of the whole body of national accounting information.
A second major point of progress would be the possibility of differentiating the sectoral analysis by classifying the ENTs by economic activities.
This provides a more detailed insight, both in statistical and economic analysis.
However, these advantages are obtained at a price, in this case the additional burden on the construction of the I-O tables. This problem is discussed in the next section.

5. The additional burden on the construction of I-O tables

The additional burden on the construction of the input-output tables, implied by the proposed approach set out above, is shown tentatively in scheme 4. This scheme shows a cross-classification of EST classified by ISIC 1 digit (i) activities and the EST classified by institutional sectors (j'). This cross-classification gives information on the sectoral breakdown (j') for each activity (i). By way of illustration, a classification of the ENT by (k) within each sector is indicated (cf. section 4.2).
As is shown in section 3, the split of (i) by (j') forms the extra burden in composing the I-O tables.

Scheme 4 Connection between activities (i) and institutional sectors (j')



x : subgroup exists

x : " " and is located on the diagonal (EST=ENT)

: whole cell is filled. No detailing by k from I-O tables. Diagonalisation is possible.

(x) : subgroup occurs to a very limited extent.

The first point that strikes the eye in studying scheme 3, is that the additional burden on the economic activity analysis by the introduction of a detailing from (i) to (j') within the framework of I-O tables is limited for most 1-digit activities. For the government sector, the sub-division into economic activities is limited on the assumption that the departmental enterprises are no longer analysed by activity within the framework of I-O tables. In the Dutch situation, the ENT in the sector "financial institutions" hardly contains EST which have to be classified under activities ISIC 1-7 and 9. The situation regarding electricity, gas and water remains unaffected. Detailing according to (j') is not necessary. In agriculture etc., a detailing by corporations and unincorporated enterprises is assumed to be necessary. Compound enterprises barely occur, if they exist at all. In mining and manufacturing (ISIC 2 and 3), three sectors (j') can be distinguished. However, it is expected that unincorporated enterprises are hardly of importance. Therefore, with regard to a significant number of groups within ISIC 2 and 3, the detailing will be confined to two (j') sectors.
In the ISIC activities 5, 6 and 7, a split into 3 sectors (j') is to be expected. ISIC activity 8 is split up into Finance and Insurance (8.1 + 8.2) and real estate (8.3). The first is expected to be detailed into three sectors (j'), the latter compasses the largest detailing according to (j'). Nearly all sectors (j') contain ENT of which some EST's are involved in the exploitation of buildings or dwellings. The activity community services etc., (ISIC 9), is expected to be detailed into three sectors (j').
Reviewing the above, it would appear that the proposed approach will not lead to an insurmountable extention of the activity detailing in the construction of the I-O table.

6. Conclusions and further research

By detailing the activities (i) in the I-O tables by institutional sectors (j'), the link between the I-O table and the SA can be intensified. Complete compatibility with the economic activity analysis has become feasible for the sectors (j'), unincorporated enterprises and other non-compound enterprises, as in these sectors the equality ENT=EST holds. The c.g. classification of the ENT by (k) coincides here with the classification of the EST by (i).

With regard to the compound non-financial enterprises, the input-output table only furnishes information by (i) and (j'). Using the basic statistical material of the CBS however, statistical information on income distribution and financing by (k) is obtainable. The CBS carries out separate surveys aimed at the big ENTs which emphasize information on income distribution and financial transactions. This could all lead to the possibility of detailing the whole (j) sector "non-financial corporations and quasi-corporate enter-prises" by (k), with value added as principal point of impact.
The sector "financial institutions" can be divided within the framework of the SA into the activities (k) banking and insurance.
Last but not least, the proposed approach makes it possible for some accounts to split up the institutional sector households into sub-sectors and into economic activities, as here too EST=ENT.

If the proposed approach is to be further elaborated, a step-by-step implementation seems the most appropriate. The first step will be the differentiation of the (i) into (j'), unincorporated enterprises and the rest treated as one entity. The second step will contain a sectoral split (j') in the activity (i) real estate, and the third will concentrate on isolation of the sector (j'): compound non-financial enterprises in the I-O tables.

Appendix List of abbreviations and symbols used.

Abbreviations

CBS : Netherlands Central Bureau of Statistics
c.g. : Centre of gravity
ENT : Enterprise
EST : Establishment
I-O : Input-output
IS : Institutional sectors
ISIC : International Standard Industrial Classification of all economic activity
p.n.p's: Private non-profit institutions
SA : Set of accounts

Symbols

i : type of economic activity, e.g. ISIC one-digit
j : institutional sectors
j' : sectoring applied in the input-output tables
k : classification of ENT by main (c.g.) economic activity within (j')

References

Al, P.G. and Broesterhuizen, G.A.A.M.; "Comparibility of Input-Output Tables in time". Paper presented at the International meeting on Problems of Compilation of Input-Output Tables, Baden (Austria), May 1985.

European System of Integrated Economic Accounts (ESA), second edition. Statistical Office of the European Communities, Luxembourg, 1979.

Postner, H.H.; "New Developments towards resolving the Company-Establishment Problem". The Review of Income and Wealth, 31 (1), January 1985.

A System of National Accounts (SNA): Studies in methods, series F no. 2 Rev. 3. United Nations, New York, 1968.