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Symmetric Input-Output Tables: Compilation Issues

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Introduction

There exists no internationally agreed or generally accepted definition of what precisely is an input-output table, except for its format (rectangular or square) and the type of classifications (products or industries) applied. Based on the historic origin of the input-output tables and in particular the various kinds of analyses for which they are being used, it is, however, possible to identify some basic characteristics that analytical users may reasonably be expect to find. Thus the table should facilitate analysis of the production and demand structures of the economy, and more specifically the tracing of direct and indirect effect through the intermediate part of the table, so that final demands and primary inputs can be linked.

In practise it is a matter of judgement and resources available how much weight should be given to the various steps in the compilation of an input-output table and how to assess more or less ideal user requirements. When compiling a symmetric input-output table (SIOT) from the supply and use tables (SUT) framework it is therefore possible to choose different points of departure. One is to start from abstract economic theory and define some ideal requirements to the SIOT that during the actual compilation process are being relaxed and/or approximated by applying various assumptions. Another is to start with the main emphasis on the type of data actually available, and - while keeping the requirements for economic analysis in mind – to obtain the SIOT with a minimum manipulation of basic data. Traditionally the more general term "inter-industry table" has been used for this latter approach.

In this paper it is argued that any type of SIOT that can be compiled in practice depends heavily on industry related flows in the sense that the institutional characteristics of the industries are the main determinants of the data in the SIOT. In practise all input-output tables are deemed to be of the inter-industry type. On this background it is further argued that the compilation of SIOTs as *industry by industry tables based on the assumption of fixed product sales structures* (in the SNA terminology "industry technology") should be preferred. This type of table is not an approximation to a more ideal table, but exists in its own right as part of "best practices" official statistics, fulfilling central quality criteria, including user needs.

It is the aim of this paper to give a simple and hopefully pedagogical exposition of some basic questions that must be decided before compiling an input-output table in practise[1]. As such it contains no new methods for compiling input-output tables. Its main contents are a discussion of the rationale for the "best practices" methods that are actually being followed by the major compilers of input-output tables. As these methods are regularly being challenged from a more theoretical point of view, the paper discusses the relevance of this criticism. In addition to arguments based on abstract economic theory the opponents can also find some support in the *1968 SNA* chapter on input-output tables, and what has been carried forward from it to the *1993 SNA*, including the UN *Handbook on input-output tables* (1999) and to the 1995 ESA. It has been pointed out that a misleading terminology in the 1968 SNA contributes to the confusion about compilation methods, but the main argument in this paper is that a misconception of the very nature of the data from

[1] This paper can be seen as a follow-up to the paper: *Symmetric Input-Output Tables and Quality Standards for Official Statistics* that I presented at the 14th Input-output Conference in Montreal, Canada in 2002.

which input-output tables are derived - and consequently of the empirical foundation of input-output analysis - are at the root of the controversy.

Main advantages of the industry approach

The following are the main arguments in favour of the industry by industry table based on the assumption of fixed product sales structures:

- This approach does not require assumptions that are at odds with what is actually known about the economy from observed data. The type of assumptions needed are not different from those already widely used when compiling economic statistics (weak assumptions not based on economic theory), and the methods chosen are proportionate to the data available.
- The fact that institutional characteristics cannot possibly be removed from an SIOT, no matter which compilation methods are used, is explicitly recognised in this type of table, underlining its inherent character of an inter-industry table
- It preserves to a high degree the micro-macro link so that current national accounts data and detailed basic statistics can be used in combination with the input-output table.
- The approach permits the maximum use of the detailed information in the SUT, and does in general not require supplementary data collection.
- The approach is consistent with some of the well-estalished the quality requirements for official statistics, such as comparability with other types of statistics and transparency of the compilation method, and it facilitates the timeliness of the results and the maintenance of comparable time series.
- The approach is resource efficient and thus supportive of a wider and more frequent compilation of input-output tables internationally.
- It is a "best practices" method used in most of those countries that have over a considerable number of years produced input-output tables as official statistics integrated with their national accounts.[2] There is no single alternative method used internationally, but where basic statistics are based on enterprise units only, country specific methods have in some cases been developed.

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[2] Those countries that have over a considerable number of years produced annual SUTs and SIOTs as an integrated part of their national accounts (such as the Netherlands, Canada, Norway and Denmark) are using methods, which have converged over time, and are now very similar. The methods used in these countries are characterised by:

- Rectangular SUT with a high number of products relative to the number of industries.
- If SIOTs are produced, they are of the industry-by-industry type.
- The methods used in the construction of the SIOT are based on market share assumptions
- Standard total requirement tables and other analytical tables published in connection with the tables are based on the assumption of an industry technology.
- The SUT and/or SIOT are widely used for analytical purposes and as core elements of econometric models in research institutes and economic ministries.

In the United States tables are compiled as square make and use matrices. The product detail is thus not exceeding the industry detail. On the other hand 498 industries are distinguished. The official publication of the input-output data does not contain a SIOT, but a matrix of commodity by industry direct requirement coefficients. The method is described in: Jiemin Guo, Ann M. Lawson and Mark A. Planting: *From make-use to symmetric I-O tables: An assessment of alternative technology assumptions.* BEA (Paper presented at the 14th IO-conference, Montreal, Canada, 2002)
The OECD input-output database, which is closely connected to the STAN (Structural Analysis) industrial database, requires industry-by-industry tables, and in those cases where only commodity-by-commodity tables have been reported by countries, they are being converted to industry-by-industry tables. This type of table is preferred because it is useful for analytical purposes, as it can be related to other kinds of basic industrial information, research and development expenditures, innovations etc. See Nadim Ahmad. *The OECD input-output data base* (Paper presented at the 14th IO-conference, Montreal, Canada,2002).

- It follows from the above that this type of table is the one most widely used for economic analysis.

A basic principle when compiling statistics is that whenever results of the same or higher utility to the user can be obtained in a less complicated (i.e. more transparent) and/or less resource demanding way, that should be done. When choosing the industry by industry SIOT the two key words are *transparency* and *resource efficiency*. This is in particular facilitated by a one-way compilation process rather than successive rounds of iterations, and by the exclusive reliance on the data already in the balanced SUT. The compilation of the SIOT from the SUT is a simple transformation process that does not require additional collection of basic statistics.

The compilers and users of input-output tables should always remember that the economy consists of thousands or millions of producing units, of which hardly even two are completely identical, and that there are millions of different products and even more production processes. (This is also noted in 1993 SNA par. 15.126). In this vein the industry by industry approach avoids the concepts of homogeneous products or production processes, and does not apply any assumptions that are contrary to well established knowledge about the economy. It is furthermore realised that the variability of the primary products within industries is much more important than the variability caused by the existence of secondary production. Therefore the efforts devoted to special treatment of secondary production should be proportional.

There need not be any close relationship between theoretical model assumptions made by analytical users, and the assumptions that form part of the compilation techniques, as the two types of assumptions play quite different roles. In data construction the purpose of assumptions is to make up for shortcomings in the data sources, whereas assumptions are needed in economic theory and analysis to characterise techniques and/or behaviour, and to simplify the real world multiplicity in order to build manageable models. In practice, users will normally take the SIOT for granted, assuming it possesses the broad characteristics mentioned above, and make whatever simplifying assumptions are needed for a particular analytical use. The inherent lack of a precise theoretical interpretation of the data in any IO- table does in general not worry analytical users, and the compilers should not be too sensitive on their behalf.

This point is reinforced by the fact that in practice all analytical users of input-output tables are implicitly assuming an *industry technology*, no matter how the tables have originally been compiled. The reason is that even though the cells of a particular row in the SIOT represent different baskets of (more detailed) products, it is in any input-output analysis implicitly assumed that these different baskets are produced with the same input structure. Similarly it can be shown that when SIOTs are compiled on the assumption of a product technology, it must necessary be assumed that different bundles of more detailed products are produced by identical input structures, thus following the definition of the industry technology. From an analytical point of view the distinction between a product and an industry technology is thus not so clear-cut. (See also footnote 7).

In practice the availability and quality of data and their classification in existing basic statistics are not only the starting point, but also the main determinant of the final SIOT, no matter which methods are used in the compilation process. Thus the major part of the data contents (as much as 90-95 per cent) of any SIOT will still reflect the structural and *institutional characteristics* of the units (establishments or enterprises) from which the data were originally collected. On this background it becomes a rather speculative question to which type of methodological “pure” table the final outcome belongs or which types of tables are best suited for analytical purposes. And this situation permits the compiler to proceed in a pragmatic way, giving priority to transparency of methods and resource efficiency.

Strong and weak assumptions

Chart 1 illustrates the four standard methods set out in the *1968 SNA* for deriving SIOTs from the SUT. According to the SNA there are two types of tables, product-by-product and industry-by-industry tables that each can be derived using either the assumption of a product technology (assuming that a product has the same input structure in whichever industry it is produced) or the assumption of an industry technology (assuming that all products produced by a particular industry have the same input structure). Application of the product technology assumption will usually result in some negative elements that afterwards have to be eliminated by introducing additional assumptions and/or data.

Chart 1. The four alternative symmetric input-output tables in the *1968 SNA*

	Product-by product table	Industry-by industry table
Product Technology	(a) Negative elements	(b) Negative elements
Industry Technology	(c) No negative elements	(d) No negative elements

These standards methods are also discussed in summary form in the *1993 SNA* and the *1995 ESA*, and in more detail in the UN *Handbook on Input-Output Tables* (1999).

It has been pointed out that the terminology first introduced in the 1968 SNA is misleading, when the term "technology" is used also in connection with the construction of a SIOT of the industry-by-industry type from supply and use tables (SUT)[3]. An overview of the revised terminology used in this paper in is shown in *chart 2*. The main distinction is not between two technology assumptions, but between technology assumptions on the one hand, and sales structure assumptions on the other. With this distinction the boxes that contain product-by-product tables based on sales structure assumptions, and industry-by-industry tables based on technology assumptions become empty**.** The two types of standard tables (b and c) are not considered further in this paper, as it is difficult to find any rationale for them, except that they can be mathematically derived by the same procedure that leads to tables (a) and (d).

Chart 2. An alternative terminology for symmetric input-output tables.

	Product-by product table	Industry-by-industry table
Technology Product technology Industry technology	 (a) Negative elements (b) No negative elements	Empty
Sales structures Fixed product sales structures Fixed industry sales structures	Empty	 (d) No negative elements (b) Negative elements

A "technology" assumption is a strong assumption in the sense that it is based on a simplified economic theory that cannot be underpinned by the observed statistical data. Sales structure

[3]Konijn P.A. and A.E.Steenge: *Compilation of input-output data from the national accounts*, Economic System Research, no 1, 1995.

assumptions are weak assumptions as they broadly speaking only utilize observed sales structures for the reference year. The nature of the latter type of assumption is not different from the assumptions widely used in the editing and grossing-up etc when compiling other types of official statistics.

Although the formal characteristics of the four tables (a)-(d) in the two charts remain the same, the criteria for the choice of compilation method becomes more transparent in chart 2. Thus, it is seen that the industry-by-industry table based on the fixed product sales structure (d) does not involve any technology assumptions (as do a and c), and does not require additional assumptions or data sources to adjust for negatives (as do a and b)[4]. Furthermore, table (d) retains the links to the national accounts data and basic statistics, and compilation is less resource demanding. It should also be noted, that the *overall sales share* in a row is not based on an assumption, but actually observed. The assumption only concerns the break-down of the individual row elements. Even if this assumption is not fulfilled at the element level this will only marginally affect the analytical properties of the resulting table. These points are elaborated in the numerical examples below.

The market share assumption represents the minimum manipulation of data that will lead from the SUT to the SIOT. This was the method generally used to construct SIOTs before the 1968 SNA terminology was introduced, and this is still the preferred method in those countries where IO tables are compiled on a current basis as an integral part of official statistics.

Another important advantage of the market share method is that the SIOT can be derived directly from the *rectangular supply and use tables*, without any intermediate aggregation to square supply and use tables. Consequently, the question of defining characteristic products and making a formaldistinction between primary and secondary production does not arise, and as illustrated both in the numerical and empirical examples below this method reduces the aggregation loss of information[5].

Numerical examples with rectangular supply and use matrices

The elementary statistical differences between (1) A product-by-product SIOT based on the assumption of a product technology and (2) An industry-by-industry SIOT based on the assumption of fixed product sales structures are often obscured when they are presented on mathematical terms

[4] In the theoretical literature (most recently T. ten Raa and J.M. Rueda-Cantuche "The Construction of Input-Output Coefficients Matrices in an Axiomatic Context: Some Further Considerations,", *Economic Systems Research* 15, 2003) the fulfilment of certain axioms (material balance, financial balance, scale invariance, and price invariance), have been seen as defining criteria that can be directly used in the compilation of the SIOT from the SUT. The results of these theoretical exercises depend, however, on the assumption that the real world can be correctly depicted by a limited number of homogeneous products that are produced with a similar number of unique production functions that are defined in terms of their inputs of these products. It is, however, not possible to generalise these theories to the real world case, where many products with different input structures are produced by each activity, no matter how narrowly defined. The theoretical foundation of the above “proofs” has recently been challenged in Louis de Mesnard: *On the consistency of commodity-based technology in the make-use model: An Economic-circuit approach* (Paper presented at the 14th IO-Conference,Montreal Canada, 2002).
Basically such axioms are necessary assumptions for carrying out input-output *analysis*, and as such they can be assumed to be valid no matter how the input-output table has been constructed. In this respect they are of the same type as many other simplifying assumptions that must be made before any economic analysis can take place (linear expenditure system, constant elasticity production functions etc). Such assumptions do not apply to the data compilation.

[5] The annual Dutch symmetric industry-by-industry input-output are constructed directly from a rectangular system with 800 product groups and 250 industries. de Boer, S and others, Supply and use tables at current and constant prices: An experience of fifteen years, SCB (1999). At present the annual Danish symmetric tables are derived directly from a rectangular system with 2,750 product groups and 130 industries

only. In the following a simple numerical example[6] is used to illustrate the essentials of the two methods and to highlight the advantages of compiling industry by industry SIOT based on the assumption of fixed product sales structures directly from the rectangular SUT. The rectangular SUT (chart 3) is taken as the point of departure.

Chart 3. Supply and use table

	SUPPLY TABLE			USE TABLE			
	Agricul-ture	Manufac-turing	Total	Agricul-ture	Manufac-turing	Final demand	Total
Agricultural products	130	0	130	0	80	50	130
Manufacturing products	20	200	220	60	30	130	220
Manuf. Prod 1	*20*	*60*	*80*	*30*	*30*	*20*	*80*
Manuf. Prod 2		*140*	*140*	*30*	-	*110*	*140*
Wages and salaries				60	20		80
Operating surplus				30	70		100
Total	150	200		150	200	180	

Manufacturing product 1 is produced both in agriculture (20) and manufacturing (60), and the use table shows that the two products have different use patterns.

It should be underlined that the use of the two industries agriculture and manufacturing in this numerical example is just for illustrative purposes. In practice there will at the SUT level be very little secondary production across the borderlines between broad industry groups such as agriculture, mining, manufacturing etc (the tabulation categories of the ISIC/NACE). Most secondary production belongs within the same broad industry group as the primary production, in particular manufacturing industries, and is most often produced in the neighbouring classes.

Product-by-product table in the assumption of product technology

The assumption of a product technology implies that the 20 units of manufacturing product 1 produced in agriculture are assumed to be produced with the *average* input structure of manufacturing. In the transformation table (*chart 4*) below the transfer of the inputs used in the production of the 20 units from the column for agriculture to the column for manufacturing is shown. The column composition of the transfer is identical to the composition in the manufacturing industry. It should be noticed that the assumption of a product technology can only be implemented in this simple way because manufacturing has only output of manufacturing products. For illustrative purposes the output transfer is also shown in the supply table, but this is not normally done in practise.

In this transformation process the individual manufacturing products play no role. This is illustrated by the Xs in the transformation table. They can take on any values that fulfil the vertical sum restrictions, -3 and 3 respectively, and in this calculation it is not possible to trace what happens at

[6] As parts of this paper was originally written as a comment to chapter 11 of the Draft version of Eurostat's *The ESA input-output manual – Compilation and analysis* , Luxembourg 2002, the point of departure is the numerical example used there, but further elaborated with the introduction of two manufacturing products – an extension which is essential for the understanding of the implications of the various methods.

the detailed product level. Nor can the product details of the original use table be related to the resulting product-by-product table, as the column definitions to which they belong, have been changed from an industry concept to a product concept.

Chart 4. Transformation table

	SUPPLY TABLE			USE TABLE			
	Agricul-ture	Manufac-turing	Total	Agricul-ture	Manufac-turing	Final demand	Total
Agricultural products	0	0	0	-8	8	0	0
Manufacturing products	-20	20	0	-3	3	0	0
Manuf. Prod 1				*X*	*X*	*0*	
Manuf. Prod 2				*X*	*X*	*0*	
Wages and salaries				-2	2		0
Operating surplus				-7	7		0
Total	-20	20		-20	20	0	

The resulting product-by-product table (chart 5) is thus – in spite of its name – a black box when compared to the product detail available in the use table. It is also seen that even though manufacturing produces two different products (their difference is also illustrated by their different use structures) we have to assume that they are produced with identical input structures in order to obtain the square product-by-product table. The characteristics of *the industry technology*, namely that different products are produced with the same «technology» are therefore also implicitly build into the *product technology* assumption, and may influence the result to a considerable extent. It is also seen that the institutional characteristics from the purchase pattern of manufacturing are being imposed on agriculture.

The product-by-product table has, except for the aggregated product groups in the *square* SUT, lost all comparability to other types of data set in national accounts and basic statistics. Furthermore it contains a negative element that is obviously unrealistic, and requires further adjustments. This adjustment must necessary be arbitraty, as the information in the data base available has already been utilised to a maximum extent, given the product technology assumption.

Chart 5. Product by product symmetric input-output table

	SUPPLY TABLE			PRODUCT-BYPRODUCT SIOT			
	Agricul-tural products	Manufac-turing products	Total	Agricul-tural products	Manufac-turing products	Final demand	Total
Agricultural products	130	0	130	-8	88	50	130
Manufacturing products	0	220	220	57	33	130	220
Manuf. Prod 1		*80*	*80*	*X*	*X*	*(20)*	*(80)*
Manuf. Prod 2		*140*	*140*	*X*	*X*	*(110)*	*(140)*
Wages and salaries				58	22		80
Operating surplus				23	77		100
Total	130	220		130	220		

Industry x Industry table on the assumption of fixed product sales structures

When the assumption of a fixed product sales structure is used, the first step is to subdivide all elements of the row for manufacturing product 1 in the use table in the proportion 20:60 which is the overall market shares for agriculture and manufacturing for this product as shown in the supply table. The assumption is that for all users (cells) of this product the two producing industries have market shares identical to their shares in the total market. It is important to notice that these overall market shares are *observed,* so that the assumption only pertains to the subdivision of the individual row elements under this constraint. (If there happens to be specific information available that modifies the fixed product sales structure assumption, it can of course be introduced).

The two sub-rows for manufacturing product 1 obtained by this procedure are shown in *chart 6* below. They show agriculture and manufacturing as supplying industries. The assumption of fixed market shares is identical to an assumption about identical horizontal distributions for each individual product independently of producing industry. Considering that the overall market share for each industry is known, this is obviously a rather weak assumption. No matter how many products or industries the rectangular SUT contains the procedure is the same. When all products that are supplied from more than one industry have been subdivided in this way, the transformation table is still rectangular, but the number of rows is now larger and equal to the number of elements in the supply matrix (in this example 4). Each row in this expanded matrix has a product as well as industry identification. In the next step the rows of the expanded matrix are added by industry to obtain the industry-by-industry table (*chart 7*)[7]. This transformation does not imply any deductions and/or transfers, but only row wise subdivisions and additions, as illustrated in the tables below.

[7] It may be mentioned that if more and more subproducts (lines) in the expanded matrix are defined as characteristic products in the industries that actually produce them (which implies the definition of a tailor made product classification) the industry by industry table on the assumption of fixed product sales structures is the limiting case for a product by product table (using the new product classification) on the assumption of a product technology, see Konijn P.A. and A.E.Steenge: *Compilation of input-output data from the national accounts,* Economic System Reseach, no 1, 1995. In the article it is concluded that: “This result shows that, in cases of insufficient resources to apply the activity technology in full, the industry by industry variant of the industry technology model is the second best solution”. The activity technology described in the article is mathematically equivalent to the product technology, but applies another unit that is somewhere between industries and “products”, the activity. This also implies that the SUT will be different

Chart 6. Subdivision of manufacturing product 1

	SUPPLY TABLE			USE TABLE			
	Agricul-ture	Manufac-turing	Total	Agricul-ture	Manufac-turing	Final demand	Total
Agricultural products: From Agriculture	130		130		80	50	130
Manufacturing products:							
Prod 1: From Agricult.	**20**		**20**	**7,5**	**7,5**	**5**	**20**
From Manuf.		**60**	**60**	**22,5**	**22,5**	**15**	**60**
Prod 2 From Manuf.		140	140	30	-	110	140
Wages and salaries							
Operating surplus							
Total							

Chart 7. Industry by industry SIOT compiled from rectangular SUT.

	SUPPLY TABLE			INDUSTRY BY INDUSTRI SIOT			
	Agricul-ture	Manufac-turing	Total	Agricul-ture	Manufac-turing	Final demand	Total
Agriculture	150		150	0+7,5 = **7,5**	80+7,5 =**87,5**	50+5 = **55**	130+ 20=1 50
Manufacturing		200	200	22,5+30 = **52,5**	22,5+0 = **22,5**	15+110 = **125**	220+ 20 =200
Wages and salaries				60	20		80
Operating surplus				30	70		100
Total	150	200		150	200	180	

It should be noted that the product details of the use table are carried forward all the way to the resulting industry-by-industry table. Contrary to what was seen for the product technology case above there is no black box here. When needed for analytical purposes it is possible to specify at the SUT level of detail the products that are being used by the individual industries and categories of final uses and combine them with the SIOT. For analytical uses relating to energy, environment, imports, ICT and productivity etc. it is often useful to apply some product details along with the industry-by-industry table. Furthermore this type of table can be directly linked with other data sets from national accounts and primary statistics such as labour, fixed capital formation, research and development expenditures and capital stock by industry.

It should be noted that the derivation of the SIOT from the SUT does in this case not require that the rectangular SUT is first aggregated by products to a square format. Neither (and for this very

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from the tables that are part of the national accounts. In the article it is pointed out that this approach is resource demanding and requires additional data to those already included in the SUT.

reason) does the derivation of the industry-by-industry table outlined above require any formal distinction between primary and secondary production. As the numerical example shows, detailed product information, that would have disappeared if the rectangular SUT had from the outset been aggregated to a square format, plays an important role in deriving the SIOT.

To illustrate what happens if assumption of fixed product sales structures were alternatively used *after* an aggregation of the SUT to square format tables the numerical example is repeated using square supply and use tables.

Chart 8. Subdivision of manufacturing products

	SUPPLY TABLE			USE TABLE			
	Agricul-ture	Manufac-turing	Total	Agricul-ture	Manufac-turing	Final demand	Total
Agricultural products	130	0	130	0	80	50	130
Manufacturing products:							
In agriculture	20		20	5,5	2,7	11,8	20
In manufacturing		200	200	54,5	27,3	118,2	200
Wages and salaries							
Operating surplus							
Total							

Chart 9. Industry-by-industry table compiled from square SUT

	SUPPLY TABLE			INDUSTRY BY INDUSTRY SIOT			
	Agricul-ture	Manufac-turing	Total	Agricul-ture	Manufac-turing	Final demand	Total
Agriculture	150	0	150	**5.5**	**82.7**	**61.8**	150
Manufacturing	0	200	200	**54.5**	**27.3**	**118.2**	200
Wages and salaries				60	20		80
Operating surplus				30	70		100
Total	150	200		150	200	180	

The intermediate and final transactions parts of the resulting table (chart 9) differ from the results obtains directly from the rectangular SUT (chart 7) even though the SUT and the basic compilation method are identical. The differences illustrate the *information loss* suffered by not using all the information contents of the detailed data in the SUT. It is obvious that the SIOT compiled directly from the rectangular SUT (chart 7) should always be preferred to the one compiled after the aggregation to square SUT (chart 9) has taken place. The aggregation error caused by starting out from the square SUT will be larger the more detailed the product classification is. This aggregation loss of information will happen no matter which compilation method is applied to obtain the SIOT from the square SUT. In *table 2* this aggregation error is illustrated with data for Denmark for the year 1997.

Implications of a distinction between domestic output and imports

So far it has implicitly been assumed that domestic output and imports of products belonging to the same product group have been lumped together in the SUT (and in the SIOT). However, analytical users are often interested in a distinction between effects on the domestic economy and on imports. In order to facilitate this, the elements in the SIOT must be broken down according to domestic and import origin. This breakdown should take place at the most detailed product level possible, and therefore preferable in the rectangular SUT. No matter what type of data are available or which method is used, this split obviously means that market shares (and in practice market share assumptions) will be build into the core part of the input-output analytical framework.

When the split between supply from domestic industries and imports is made on the assumption of constant import ratios along the row (except for exports where actual information is usually available) this market share assumption is identical to the one used in the construction of the industry-by-industry SIOT on the assumption of fixed product sales structures. It can be demonstrated that the resulting “domestic” and “import” matrices are very sensitive to the level of product aggregation at which the split takes place. (This can be seen as an analogy to aggregation error suffered when compiling the SIOT from the square rather than the rectangular SUT). Thus the import matrices resulting from a split at a detailed SUT level will better reflect reality than those obtained if the split were carried out at the level of the square SUT or directly in the SIOT.

The split between domestic output and imports must usually be based on the market share assumption, and will probably affect the final outcome for the domestic SIOT more than the choice of a "technology" assumption. Whereas the application of a product technology assumption to transform the “domestic” SUT into a SIOT would seem to lack logic it is quite straightforward to use the assumption of the fixed product sales structure to obtain the domestic industry-by-industry SIOT . The same procedure can be used to transform the (rectangular) import supply matrix into an industry-by-industry format.

Empirical evidence of various compilation issues[8]

a. Illustration of heterogeneity along the rows of the use table.

Table 1 shows the variation in the implicit price indices along the rows in the Danish *use* table, which are for this purpose aggregated to the ESA P60 product level. The constant price calculation takes place at the 2,750 product group level, and as a main rule (except for energy and a few other products) the same price index is being used for all elements along a row of intermediate consumption at that level. Both the current price and the constant price (1995 prices) use tables are aggregated from the 2,750 products use tables. The variation in the price index along a row in the P60 use table thus reflects the variation in the product composition by element along the row. So even though the “mutually exclusive” condition is fulfilled, there is obviously no “homogeneity”. It should be noticed that this measure only reflects the additional heterogeneity that results from the aggregation form the 2,750 product-level to the P60 level. Most of the 2,750 products are themselves aggregates of even more detailed products that cannot be captured statistically. The total heterogeneity thus exceeds what is measured by this method. It is not possible to comment on the results in detail, but it is worth noticing that only for product groups where there is a shortage of source data both on the allocation of product to users and on relevant price statistics, such as are the

[8] For practical reasons these illustrations are based on 1997 data even though the most resent annual input-output table for Denmark now refers to the year 2001.

cases for certain categories of services, the results may on the surface appear to lend support a homogeneity assumption.

b. Comparisons between different types of symmetric input-output tables

The columns for intermediate consumption for the industry, Manufacture of chemical products are shown in *table 2* for alternative compilation methods for the SIOT (corresponding to the numerical examples above). As it is mainly industries with secondary production that are of interest in this connection, the results for industries outside manufacturing industries are shown in more summery form in the table.

Columns for two types of industry-by-industry tables are shown:

(1) The official Danish input-output table, compiled directly from the rectangular SUT (2,750 products and 130 industries), assuming fixed product sales structures (type d- rectangular), subsequently aggregated to A60 level for comparison purposes.
(2) A SIOT compiled from the A60/P60 square SUT assuming fixed product sales structures (type d-square)

And columns a product-by-product table:

(3) A SIOT compiled from the A60/P60 square SUT assuming product technology. (Type a).

The differences between columns 1 and 2 illustrate the aggregation loss suffered by compiling the SIOT from the square rather than from the rectangular SUT. It is seen that practically all elements in column 2 are affected by aggregation errors and some significantly

Even though the individual elements in the industry-by-industry and the product-by-product tables are strictly speaking not comparable, it is nonetheless of interest to take a look at the differences in input structures. The differences between columns 2 and 3 illustrate the effects of the two alternative assumptions. Some big differences are found, and column 3 contains – as expected – some negative elements. Total purchases are different in the two types of tables, because total output from chemical industry (23.731) is different from the total output of chemical products (22.284). The differences between the input structures are therefore best illustrated by the percentage distributions shown in the last three columns of the table.

The alternative calculations of the SIOTs show that the results have the expected characteristics. It is not possible here to analyse and explain the differences between the various tables, but when taking a broader look at the results, the similarities are more outstanding than the differences. This is not surprising against the background of the dominating diagonal elements in the supply matrix. Without taking into account how the negative elements in column 3 can be removed, the tables may, within the margin of error of the basic data and the construction methods, be seen as giving approximately the same picture of the industry, and may lead to practically identical results when used for analytical purposes. This being the case the simpler and less resource demanding compilation method should be chosen.

c. Comparison of analytical results

A more thorough method to test the similarities of the different types of tables is to carry out experiments with models based on the tables. Even though the results of such experiments are not directly applicable in statistical considerations, they can give some useful hints about the implications of alternative assumptions used in the compilation of the SIOT. This is in particular the case if it can be demonstrated that alternative assumptions have only a very limited effect on the outcome of some standard analytical uses.

In *table 3* the effects on primary inputs of the various categories of final demand have been calculated using two alternative types of input-output tables. For example the effect on wages and salaries of total private consumption is 162.226 millions DKK in the industry-by-industry case and 162.102 millions DKK in the product-by-product case. The difference of 124 millions DKK is extremely small, and seen on the background of the general reliability of the data it should not worry analytical users. The same is true for the other differences shown. Except for taxes on products which is a net figure the differences do in no case exceed one per cent of the variable, and are in most cases much smaller. It should be noted that in this type of analysis the classifications of both the exogenous variables and the results are independent of the classifications used in the intermediate part of the input-output table.

Accuracy of data and classification issues

There are many aspects related to accuracy and completeness of source data and classifications in basic statistics that speak in favour of the pragmatic solution represented by the industry by industry SIOT compiled on the assumption of fixed product sales structures.

The differences between product-by-product and industry-by-industry tables are in principle caused by the existence of secondary production (although when the industry by industry table is compiled directly from the rectangular SIOT the distinction primary/secondary production need not explicitly to be made). The supply table shows the extent of secondary production as off-diagonal elements (when it is aggregated to a square matrix). The observed extent of secondary production depends on the level of aggregation of both products and industries and secondary production does therefore not possess any observable characteristics of its own[9]. The elusive character of the concept of secondary production makes it difficult to justify that it should be of particular interest statistically just because it is produced in two or more industries at a certain level of industry or product aggregation.

For most countries the square supply matrix is characterised by showing secondary production for manufacturing industries or manufacturing products only. For other industries the diagonal elements are totally dominant. There are two reasons for this. Firstly, for service industries the diagonal structure is usually simply due to the fact that no product specifications are available, so that total output from KAUs (or even legal or institutional units) must be assumed to be characteristic output of the industries in which the units are classified in the business register. Secondly KAUs for industries such as agriculture, construction and trade are often defined in a more product-oriented form in the national accounts than in the business register so that all secondary activities in these industries already have been transferred to the primary industry in the completed SUT, or data are constructed in such a way that from the outset no secondary production exist – agricultural output as the sum of agricultural products, construction as the sum of the value of new construction and repairs etc.

For this reason as much as perhaps 75 per cent (depending on the type of economic units applied) of the total value contained in the use table may be completely unaffected by whatever method is used

[9] When secondary production "disappears" because of aggregation, it takes on the same role as ancillary production which according to the SNA should never be separated out – although in an input-output perspective ancillary products, such as for example transportation of own products, influences the input structure in the same way as secondary production.

to construct the SIOT (these elements are without any changes moved from the use table to the SIOT). In practise the transformation problem is thus largely limited to the manufacturing industries and their output of industrial products. Considering the simplified way the rest of the economy is dealt with (primarily due to lack of relevant data sources), the efforts and theoretical refinements attached to the transformation procedures for manufacturing industries should be proportionate.

The size of sampling and non-sampling errors associated with the primary data on which the SUT is based, and the fact that a considerable part of the data contents of the SUT is usually obtained by grossing-up methods, extrapolations, estimates of a more or less subjective nature and even model calculations should be taken in to account when choosing the compilation method for the SIOT. Furthermore primary statistics on purchases for intermediate consumption by products are at the best collected for kind of activity unit (KAU), and in most cases the statistical coverage of purchases is irregular and and/or highly aggregated. Another important source of error in the detailed output and input data is connected with the transformation from observed data on *sales and purchases* to the national accounts concepts of *production and intermediate consumption*, and the fact that sales and purchases are not evenly distributed over the year (the changes-in-inventories problem).

Thus the effects of non-sampling errors such as misclassifications and biases in grossing up methods may alone be more important than the total secondary production. There are no ex post methods by which such errors can be identified and corrected when they have already passed the test of a balanced SUT.

When compared to the real world diversity of products and production processes, even detailed basic statistics already represent a major aggregation. Statistics on products are collected at a maximum detail of say 10,000 products, and that only in selected areas such as foreign trade statistics and perhaps output from manufacturing industries. Furthermore products that are identical in a physical sense are different in an economic sense when they are sold at different prices to different purchasers. This may happen because of the way transportation costs are invoiced. The concept of basic prices is defined to specifically include this possibility.

Technical production processes for individual products (even if defined in monetary terms) are not within the realm of official statistics and thus no observed data for the various production technologies are available. Economic statistics deals with transactions, not technical transformations. To begin collection of data on sub-industry production processes as part of the input-output compilation is a Sisyphus work that has, for the reasons mentioned above, no natural limitation, and will almost invariably become biased by the specific knowledge and insight that the compilers happen to have, and lead to a non-transparent compilation process.

Independently of the approach chosen it is unavoidable that each single *element* in a SIOT represents a unique basket of products. The measured degree of “heterogeneity” of contents of these baskets is closely related to the most detailed level of product that is identified (as illustrated in table 1).[10] In most countries the supply and use tables are compiled for rather aggregated product groups, often not more than a few hundred groups, and a level of 2000-3000 groups is very detailed

[10] It might be useful in this context to refer to the problems encountered in selecting the items for which prices are collected when compiling price indices (for example consumer price indices and producer price indices). Here each item must be defined much more precisely than by just referring to the most detailed product nomenclature. The same is, of course, true in the collection of prices for use in the International Comparison Project. Thus, official statistics have to deal with the product universe at a much more detailed level than 10.000 product groups to compile a sound price index.

in an international context. Only when there are more product groups than industries in the SUT (and in the compilation of constant price tables) is it possible to identify the variation in the basket along a row of the *use table*.

The most important prerequisite for the collection of basic statistics is the *business register* and the types of units it contains. In practice, KAUs are created differently in different countries, depending on whether they have been defined top-down (i.e. a relatively modest breakdown of institutional units) or bottom-up (i.e. as aggregations of all existing local production units). The latter case follows the definitions set out in the 1993 SNA and the 1995 ESA, and leads to a more precise activity classification than the former.

Each KAU has its own unique institutional and organisational characteristics which may influence the composition of its purchases as much as the underlying technical production processes do. Two KAUs producing identical products may have quite different input (purchase) structures, depending on the degree of reliance on purchase of semi-fabricated products, outsourcing of certain activities, whether it owns its capital equipment and buildings rather than leasing or renting them etc, and in general on the degree of vertical integration of the various production processes. It is essential to realise there is no way to eliminate the *institutional characteristics* of an economy from a SUT or SIOT. As institutional arrangements change over time in individual countries and may vary considerably across countries it is obvious that the input-output table interpreted as a description of a technical production system has serious limitations, no matter how the tables have been compiled.

Statistically the KAUs thus represent the maximum elimination of institutional arrangements that can be obtained. The KAUs are designed with this purpose in mind, and there are no official statistics for cost structures below this level. If basic statistics in a country only pertain to legal or institutional units, or top-down defined KAUs that come very close to legal units, there are no mathematical methods available that can disentangle this data set to obtain columns that relate to KAUs or product groups.

Quality requirements in official statistics

During the last decade a set of guidelines, or quality frameworks, have been developed by some countries and the major international organisations involved in statistics, in particular the IMF and Eurostat. The common quality terms of the two organisations are shown in the following box.

Chart 10. The Quality Dimensions – IMF/Eurostat common quality terms

Dimension	Key question
Relevance	Are the data what the user expects?
Geographical comparability/Methodological soundness	Are the data in all necessary respects comparable across countries?
Accuracy and reliability	Can the data be trusted?
Consistency/Coherence	Are the data coherent with other data?
Timeliness	Does the user get the data in time and according to pre-established release dates?
Accessibility	Is the data easily accessible and understandable?

Source: Annex 2. Data quality: A comparison of IMF's data quality assessment framework (DQAF) and Eurostat's quality definition, in Principles for PEEI Quality Analysis. Doc: 2003/FROCH/047

When the compilation of symmetric input-output tables is seen as a relevant task for statistical offices, the fundamental principles concerning quality standards for official statistics must be observed also in this task. The starting point when discussing quality in statistics is how well user's needs and expectations are met. Relevance for the user is the overarching requirement. This is the output oriented view taken by the EUROSTAT quality framework. On the other hand the processes that produce statistics need evaluation and revision with regards to costs and benefits of the resource allocation. In the IMF quality framework particular attention is paid to this latter aspect. Although not part of the definition of quality, the costs involved in the production of statistics (including the burden on respondents) acts as constraints on quality. In recommending methods for the compilation of a SIOT as an integrated part of official statistics it should be taken into account how they can be made to comply with the quality requirements in a balanced and resource-efficient way.

The relevance of a particular statistics, such as the SIOT, should in principle be assessed on the background of a survey covering potential users of the statistics, questioning their preference related to the various quality dimensions. However, where such statistics are already widely used, it is possible to observe the actual practices and take note of any problems and shortcomings that have been identified. Input-output statistics obviously belongs to this category, as there already exist a well-established an extensive use of this type of statistics for analytical purposes. Many countries have over a considerable span of years compiled SIOTs either with five-yearly or irregular intervals, and some countries compile annual SUT and SIOT as an integrated part of their national accounts. From the experiences accumulated by these countries it is possible to identify practices that can be taken as guidelines for further or new development of input-output frameworks in countries with less experience in this field – an approach which is recommended with the process-oriented part of the quality frameworks.n

Further practical compilation issues, including redefinitions

When input-output statistics are compiled in practice it is essential to take into account the desired properties of the SIOT already when the SUT is planned. By making appropriate choices of classifications and structure of the SUT it is possible to construct a data base which is relevant and useful both in the current national accounts and decided with a view to compilation of the SIOT with a minimum of efforts and data manipulation.

Basically the compilation of the industry-by-industry SIOT from the SUT on the assumption of fixed product sales structures is quite straightforward as outlined above. There is no need for assumptions about production techniques or sophisticated mathematical exercises to construct the SIOT. The industries of the SUT and the SIOT will be defined in exactly the same way, and thus contain the same units.

When an industry by industry SIOT is compiled on the assumption of fixed product sales structures the point of departure is that the data in the SUT need no further adjustment before applying the formula that transforms it into the SIOT. This follows from the fact that the data in the SUT cannot possibly contradict the assumptions on which this method is based, nor can the contents of the resulting SIOT give any new information that can point to a need for changes to the data of the SUT. An assessment of the appropriateness of the SUT as the basis for the compilation of the industry by industry SIOT must therefore be based on a priori considerations. The most important characteristics to consider are *the industrial classification* used, the *product detail and classification*, and the *type of economic units*.

In general it should not be seen as an option to choose some ad hoc or tailor-made *industrial classifications* when classifying the units – even if it would in some sense "improve" the SIOT . The advantage of sticking to the established international industrial classifications such as the ISIC (or NACE in the EU) is that the comparability to other types of economic statistics and the national accounts is not compromised.

When an industry by industry SIOT is compiled on the assumption of fixed product sales structures there are no special conditions that the *product classification* should fulfil. In order to avoid aggregation loss of information already from the outset, it should in general be attempted to work with as many products as the basic statistics allow, and the products in each group should preferably have some similarities concerning use. The information contained in the supply table is all that is needed to transform the use table into the SIOT. Product classification with a build-in industry affiliation (such as is the case in the CPC and CPA) are therefore not necessary. For goods it may actually be better to use a classification such as the Harmonised System (HS) because of its higher degree of detail and stability over time.

Concerning *the economic units* there are several aspects to consider. According to the SNA the relevant unit in the production part of the national accounts (and thus also the SUT) is the kind of activity unit (KAU). For national accounts purposes it is, however, recommended to make a further breakdown (create new KAUs) for KAUs that have production in two or more *tabulation categories* of the ISIC (i.e. broad industry groups such as agriculture, fishing, mining, manufacturing, construction etc), (see SNA par. 5.30-5.34) if that has not already been done in basic statistics. In principle this condition should apply to both horizontally and vertically integrated KAUs. These additional breakdowns (in the following called *redefinitions*) are typically made "by hand" based on the best available information and judgement of the national accountants. When redefinitions are carried out already as an integrated part of the current national accounts work, this will at the same time facilitate the balancing of the SUT because the input structures will be less complicated. If the units are primarily of the enterprise or legal unit type the redefinition process becomes even more important.

If the economic units applied in basic statistics are of the *KAU type*, three different situations can be distinguished: (1) No redefinitions take place in the national accounts or SUT before the SIOT is calculated, (2) Redefinitions have been carried out for all national accounts data and in the SUT prior to the calculation of the SIOT, and (3) Redefinitions are not carried out when the current national accounts are compiled., but applied when the SUT and the SIOT (or perhaps just the SIOT) are worked out. In the first two cases the consistency and comparability between the classifications of the current national accounts the SIOT are upheld, but not in the third case. If the units used in the basic statistics are primarily *enterprise units*, the same procedures apply, but the redefinitions become even more necessary, as there will in this case be a greater overlap between *tabulation categories.* If the national accounts and the SUT are compiled on basis of the enterprise type data, the degree of overlap can be seen in the supply table.

It should be stressed that the redefinition discussed here is quite different from the transfer of all secondary production that takes place when the product technology assumption is applied. Firstly the redefinitions deal only with that part of secondary production that belongs in another tabulation category. Secondly the redefinition procedure can be controlled in detail while it is being carried out. The results will come as no surprise and contain no negative elements. The redefinition procedure[11] will mainly relate to such activities as agriculture, energy, construction and trade.

[11] This redefinition or *two-step process* emerges from the practise in several countries. It is explained in detail for the United States in Jiemin Guo, Ann M. Lawson and Mark A. Planting: *From make-use to symmetric I-O tables: An*

For some activities a redefinition should already for other reasons have taken place. The European System of Agricultural Accounts requires for example that all agricultural activity is covered by the accounts, and there are very limited possibilities to retain non-agricultural secondary production within the system's definition of agriculture. Similarly all dwellings are usually grouped together in one single industry independently of the actual owner industries. Trade activities outside the trade industries must be definition already have been separately identified in the national accounts, as only the trade margins and not the gross turnover of the traded products should be counted as output.

In practise the redefinitions will usually not be carried out at economic unit level, but at the industry level, so that for example trading activities in all industries other than trade are redefined to the trade industry and given the input structure observed for that industry. Thus the redefinition method – in addition to improving the analytical properties of the SIOT – also contributes to solving some difficult and potential resource-consuming problems in the balancing of the SUT. It would for example be difficult to make a reliable distribution of building materials to all those industries that have some construction activity as a secondary activity. But when all construction activity has been redefined to the construction industry, it is afterwards quite easy to distribute and balance the products that are typically inputs in construction. The redefinition procedure is especially useful when only data referring to enterprise units are available from basic statistics, as it is very difficult from the primary data normally available to establish a reliable input structure for producers that produce a great variety of goods and services.

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assessment of alternative technology assumptions. BEA, paper presented at the Input-output conference in Montreal, Canada 2002. The article also analyses the differences between the resulting tables when redefinitions are not applied (case 1 above), and when they are applied (case 2 above). The redefinition method is also used in Canada and Denmark, whereas industry by industry tables in Norway are of the case 1 type to retain to a maximum degree of micro-macro link. The industry by industry SIOT of the Netherlands seems to fit somewhere between case 1 and 2. In France the first step (redefinition), based on enterprise units, is carried to such an extreme that the supply matrix becomes diagonal. The supply matrix is thus also the SIOT, and the second step (compiling the SIOT) becomes superfluous.

Table 1. Measures for the variation of prices along a row of the intermediate use table (P60). Denmark 1997

Results calculated from implicit price indices: Current 1997 value/1997 value at 1995 prices	Maximun percentage deviation	Dispersion	RWMSPD
01 Products of agriculture, hunting and related services	24,37	6,65	2,85
02 Products of forestry, logging and related services	64,73	21,84	21,35
05 Fish and other fishing products, services incidental to fishing	38,65	10,04	4,34
10 Coal and lignite; peat	123,93	57,27	15,55
11 Crude petroleum and natural gas; services incidental to oil and gas extraction excluding surveying	76,80	28,73	15,26
13 Metal ores	6,77	4,74	4,51
14 Other mining and quarrying products	18,77	6,53	2,31
15 Food products and beverages	17,47	3,09	7,75
16 Tobacco products	2,23	0,72	0,69
17 Textiles	6,14	2,41	2,21
18 Wearing apparel; furs	8,32	2,57	2,02
19 Leather and leather products	8,84	4,58	1,76
20 Wood and products of wood and cork (except furniture), articles of straw and plaiting materials	11,52	4,18	1,72
21 Pulp, paper and paper products	19,04	5,90	3,60
22 Printed matter and recorded media	10,62	3,02	2,68
23 Coke, refined petroleum products and nuclear fuel	49,82	17,42	8,73
24 Chemicals, chemical products and man-made fibres	8,62	3,84	3,16
25 Rubber and plastic products	8,75	3,40	4,06
26 Other non-metallic mineral products	10,46	3,25	1,46
27 Basic metals	24,85	5,05	4,42
28 Fabricated metal products, except machinery and equipment	5,71	2,46	2,08
29 Machinery and equipment n.e.c.	4,52	1,27	1,03
30 Office machinery and computers	27,94	12,62	9,70
31 Electrical machinery and apparatus n.e.c.	2,40	1,13	1,13
32 Radio, television and communication equipment and apparatus	8,80	4,68	4,48
33 Medical, precision and optical instruments, watches and clocks	35,25	6,98	9,61
34 Motor vehicles, trailers and semi-trailers	3,94	1,91	2,06
35 Other transport equipment	7,02	1,75	2,35
36 Furniture; other manufactured goods n.e.c.	13,75	6,68	11,06
37 Recovered secondary raw materials	10,33	10,59	10,05
40 Electrical energy, gas, steam and hot water	27,68	10,06	6,20
41 Collected and purified water, distribution services of water	2,21	0,35	0,01
45 Construction work	1,03	0,27	0,22
50 Trade, maintenance and repair services of motor vehicles; retail trade services of automotive fuel	10,80	3,39	2,76
51 Wholesale trade and commission trade services, except of motor vehicles and motorcycles	23,78	7,89	4,69
52 Retail trade services, except of motor vehicles & motorcycles; repair services of personal and household goods	17,28	4,22	4,75
55 Hotel and restaurant services	2,22	0,66	0,75
60 Land transport and transport via pipeline services	10,73	1,65	1,56
61 Water transport services	14,36	7,54	7,84
62 Air transport services	2,83	1,36	1,79
63 Supporting and auxiliary transport services; travel agency services	17,54	6,01	4,72
64 Post and telecommunication services	1,97	0,51	0,64
65 Financial intermediation services, except insurance and pension funding services	11,38	10,79	5,34
66 Insurance and pension funding services, except compulsory social security services	0,05	0,01	0,00
67 Services auxiliary to financial intermediation	5,96	1,68	2,93
70 Real estate services	4,02	0,78	0,35
71 Renting services of machinery and equipment without operator and of personal and household goods	20,43	4,15	2,76
72 Computer and related services	4,26	1,74	1,70
73 Research and development services	2,96	1,75	0,80
74 Other business services	1,88	1,03	0,90
75 Public administration and defence services; compulsory social security services	0,45	0,20	0,18
80 Education services	2,21	1,02	1,07
85 Health and social work services	7,69	5,38	3,22
90 Sewage and refuse disposal services, sanitation and similar services	4,76	1,39	0,83
91 Membership organisation services n.e.c.	1,52	0,22	0,00
92 Recreational, cultural and sporting services	22,91	7,64	6,94
93 Other services	0,86	0,31	0,40

RWMSPD = Root weighted mean square percentage deviation

Table 2. Columns for Manufacture of chemicals and chemical products in alternative SIOTs. Denmark 1997

Input of domestic output and imports	Industry by industry tables		Product by product tables	Industry by industry tables		Product by product tables
	From Rectang. SUT.	From Square SUT	From Square SUT.	From Rectang. SUT.	From Square SUT	From Square SUT.
	Millions DKK			Pct. of purchasers value		
Agriculture, hunting and fshing	10	98	-470	0,04	0,41	-2,11
Mining and quarrying	265	305	250	1,12	1,28	1,12
15 Manufacture of food products and beverages	2.408	1.994	1.632	10,15	8,40	7,32
16 Manufacture of tobacco products	74	26	1	0,31	0,11	0,01
17 Manufacture of textiles	114	37	-5	0,48	0,16	-0,02
18 Manufacture of wearing apparel; dressing and dyeing of fur	15	19	14	0,06	0,08	0,06
19 Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	4	3	1	0,02	0,01	0,01
20 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	85	65	38	0,36	0,27	0,17
21 Manufacture of pulp, paper and paper products	374	396	405	1,58	1,67	1,82
22 Publishing, printing and reproduction of recorded media	222	238	-2	0,94	1,00	-0,01
23 Manufacture of coke, refined petroleum products and nuclear fuel	128	183	166	0,54	0,77	0,75
24 Manufacture of chemicals and chemical products	8.668	9.147	9.822	36,53	38,55	44,07
25 Manufacture of rubber and plastic products	706	693	618	2,97	2,92	2,77
26 Manufacture of other non-metallic mineral products	428	415	412	1,81	1,75	1,85
27 Manufacture of basic metals	54	114	99	0,23	0,48	0,44
28 Manufacture of fabricated metal products, except machinery and equipment	420	368	306	1,77	1,55	1,37
29 Manufacture of machinery and equipment n.e.c.	462	377	265	1,95	1,59	1,19
30 Manufacture of office machinery and computers	31	25	15	0,13	0,11	0,07
31 Manufacture of electrical machinery and apparatus n.e.c.	137	110	91	0,58	0,46	0,41
32 Manufacture of radio, television and communication equipment and apparatus	75	71	26	0,32	0,30	0,12
33 Manufacture of medical, precision and optical instruments, watches and clocks	251	150	118	1,06	0,63	0,53
34 Manufacture of motor vehicles, trailers and semi-trailers	22	15	14	0,09	0,06	0,06
35 Manufacture of other transport equipment	38	36	34	0,16	0,15	0,15
36 Manufacture of furniture; manufacturing n.e.c.	45	57	38	0,19	0,24	0,17
37 Recycling	1	1	0	0,01	0,01	0,00
Other domestic supply	8.339	8.433	8.057	35,14	35,54	36,15
Total of specific deliveries	23.375	23.375	21.944	98,50	98,50	98,47
Tourism	92	92	87	0,39	0,39	0,39
Imports not classified by industry			0	0,00	0,00	0,00
Taxes on products	127	127	127	0,53	0,53	0,57
VAT	137	137	127	0,58	0,58	0,57
Total intermediate consumption at purchasers values	**23.731**	**23.731**	**22.284**	**100,00**	**100,00**	**100,00**

Table 3. Comparisons of analytical results from an industry-by-industry table and a product-by-product table. Denmark 1997.

	Private consumption	Government consumption	Fixed capital formation	Exports
	Millions DKK			
Industry-by-industry table (A60)				
Imports	96423	19789	70377	172036
Taxes on products	118808	14423	26836	18
Other production taxes	579	1439	-682	-2411
Wages and salaries	162226	198418	81329	131557
Gross operating surplus	182818	50459	42656	105691
Total	560854	284529	220515	406891
Product by-product table (P60)				
Imports	96549	19536	70093	172506
Taxes on products	118723	14446	26785	94
Other production taxes	598	1468	-726	-2437
Wages and salaries	162102	199171	81732	130608
Gross operating surplus	182883	49907	42632	106119
Total	560854	284529	220515	406891
Difference (A60 results less P60 result)				
Imports	-125	253	284	-471
Taxes on products	85	-23	51	-76
Other production taxes	-19	-28	44	25
Wages and salaries	124	-753	-403	949
Gross operating surplus	-65	552	24	-428
Total	0	0	0	0

Note: A60 indicates an industry-by-industry table calculated on the assumption of fixed product sales structures, and P60 a product-by-product table calculated on the assumption of a product technology. In both cases imports have a priori been eliminated from the use table by assuming fixed import shares in each row (except for exports) at the level of 2.750 products. This makes it possible to treat imports as an endogenous variable. The horizontal sums of the differences by category deviate slightly from zero because changes in inventories and the effect special treatment of FISIM have been omitted from the table.