THE OECD INPUT-OUTPUT DATABASE

PART 1

SOURCES AND METHODS

1. INTRODUCTION

The development of the OECD Input-Output (I/O) database is part of the STructural ANalysis (STAN) exercise undertaken in the Economics Analysis and Statistics Division of the OECD Directorate for Science, Technology and Industry. Despite the important role of input-output statistics in both national accounts and economic analysis, comparable input-output tables for OECD countries have never been developed by the OECD Secretariat, and little policy analysis has been carried out using this type of economic statistics. This first publication of the OECD input-output tables seeks to fill this gap in both statistics and analysis and provide new internationally-comparable data for consistent industrial analysis at a detailed sectoral level.

The compilation work of this database was initiated in the mid-1990s to assist the OECD Industry Committee in making international comparisons of structural adjustment in industry (see OECD (1992), *Structural Change and Industrial Performance: A Seven Country Growth Decomposition Study*, OECD Documents series, Paris). That project provided the initial rationale for developing the Input-Output database and, since then, work on updating and extending the database has continued in the EAS Division, in close co-operation with statistical offices and experts in Member countries. To assist the compilation work and permit the use of internationally-comparable I/O tables, an Expert Workshop was held in March 1993 at the OECD Headquarters in Paris.[1] Moreover, this first OECD input-output project revealed the utility of using input-output techniques to analyse economic issues at a sectoral level and, as a robust empirical tool, the database has to date been utilised in a variety of analytical projects carried out in the Directorate, covering structural change, technology diffusion, productivity growth, globalisation and employment.[2]

The applied input-output work carried out in the EAS Division has, on the other hand, forced the Secretariat to confront the gap that exists between the theoretical use of input-output data that assumes the availability of consistent and complete data and reality, where compromises must be made. In addition, this work has exposed some of the large inconsistencies in definitions and treatments existing between national exercises and the international standards represented by the SNA (the United Nations' System of National Accounts), which can significantly affect international comparisons.[3] In many cases, there is no one correct answer to the problems faced in the applied use of input-output data at the international level. And in some instances, it is likely that users are not even aware of all the problems that exist.

The OECD Input-Output database in its current form is also subject to such inconsistencies, although considerable efforts have been made to impose some uniformity by sharing information about national practices with authorities in Member countries, and by identifying problem areas with them. It may be possible to reconcile those inconsistencies remaining in this first publication in a later version to the extent that further data reconciliation is carried out in national statistical offices and comments from database users can be incorporated. Although the number of countries included in this database is limited (10 OECD countries), the Secretariat hopes that this publication can be used for comparisons and contribute to further harmonisation of national input-output exercises in Member countries.

Part One of this publication provides basic information on the database and is organised into broad topics -- basic format, units, coverage, industry classifications, international comparability, etc. More detailed descriptions of each country's I/O tables are given in the *Country Notes* appended to Part One. Part Two presents detailed data of the national input-output tables included in the database. Because the full database consists of more than 500 tables, the printed version of this publication includes only the so-

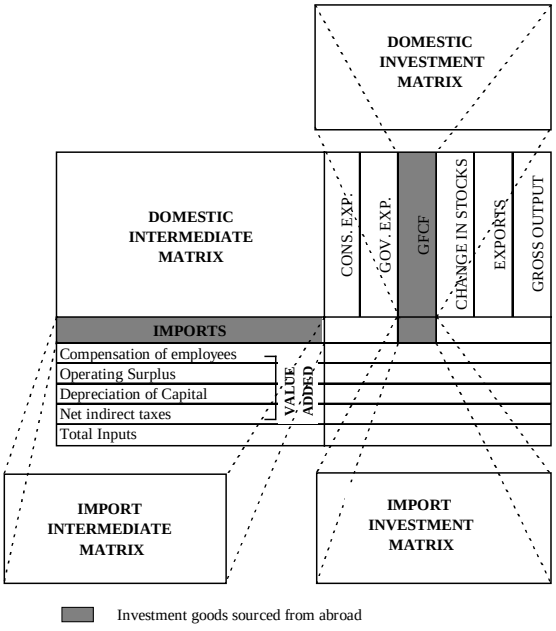
called competing-import input-output tables for each country in each time period. The complete database is available in electronic form.

2. THE OECD INPUT-OUTPUT FORMAT

The most unique feature of the OECD input-output tables is that they break down inter-industrial transaction flows of goods and services into those that are domestically-produced and those that are imported, and into intermediate and capital goods. The database thus consists of six elements (Figure 1):

- domestic intermediate goods flows sub-matrix of the I/O tables;
- imported intermediate goods flows sub-matrix of the I/O tables;
- domestically-sourced investment goods flows sub-matrix of the I/O tables;
- imported investment goods flows sub-matrix of the I/O tables;
- sub-matrices of final demand vectors for expenditures on both domestic and foreign products;
- the sub-matrix of value-added sectors.

Figure 1. **OECD Input-Output System**



Basically, national statistical agencies or input-output experts in countries, rather than the OECD Secretariat, were asked to provide the OECD with these matrices by suitably converting their national tables to the format specified by the OECD and described in detail below. This approach was adopted for two reasons: limited OECD resources; and the fact that, in some instances, a clean map between national categories and the OECD industrial classification based on ISIC cannot be made, necessitating the creation of estimates which could only be made by the national authorities themselves. Nevertheless, this

approach means that some inconsistencies between countries undoubtedly exist in the conversion of national industries to international standards.

The following sections outline the input-output conventions that countries participating in this exercise have been asked to follow and the conceptual and methodological problems encountered in conforming to these specifications.

3. TIME AND COUNTRY COVERAGE

Member countries were asked to supply a complete set of matrices for at least three years, with one year situated prior to the first oil-shock in 1973, the second in the late 1970s, and the third as late as possible in the 1980s (Table 1). In addition, the database has recently been extended to cover 1990 for most countries except Italy and the Netherlands.

Table 1. OECD Input-Output database coverage

	Pre-1973	*Mid/late-1970s*	*Early-1980s*	*Mid-1980s*	*1990*
Australia[1]	1968	1974	×	1986	1989
Canada	1971	1976	1981	1986	1990
Denmark	1972	1977	1980	1985	1990
France	1972	1977	1980	1985	1990
Germany	×	1978	×	1986, 1988	1990
Italy	×	×	1985	×	×
Japan	1970	1975	1980	1985	1990
Netherlands	1972	1977	1981	1986	×
United Kingdom	1968	1979	×	1984	1990
United States	1972	1977	1982	1985	1990

1. Australian data refer to fiscal years beginning on 1 July of the year indicated.

In principle, countries were asked to supply only *benchmark* tables which rely on a complete census of industries rather than submitting *updated* tables based on a partial survey and/or estimation techniques such as the Stone & Brown method (RAS). However, in practice it proved hard to obtain common benchmark-year data from each country and, for that reason, the Secretariat requested that Member countries supply data for years close to those of the United States -- currently 1972, 1977 and 1982.

In general, methods for compiling input-output data differ across countries and even among years in the same country. Denmark is the only country which provided time-series data of SNA compatible input-output tables in both current and constant prices for 1966-90, although the current OECD database includes only five selected data points due to confidentiality restrictions. In contrast, some countries, such as Italy, were unable to supply the OECD with early input-output tables because of their inability to provide comparable data for years before the revision of their input-output exercises were made. Similarly, the last benchmark table available from the United States was for 1982. Due to the analytical need for an up-to-date data point for the United States, an annual update table was used for the 1985 and 1990 data points. In particular, the 1985 table is an update of the 1977 benchmark US table with 1985 data for output, each industry's commodity composition of intermediate consumption, and up-to-date information on the various components of GNP.[4] Likewise, a United Nations' report identifies the 1974 Australian table as being estimated using a modified RAS procedure.[5]

Although imperfect, researchers such as Szyrmer have found that the errors associated with updating procedures decline with a decrease in aggregation level, such as in the 33 sector tables presented according to the OECD classification.[6] Nevertheless, some updating techniques such as the commonly-used RAS method have been shown to introduce significant errors.[7] Since the different availability of input-output years across countries is certainly an obstacle to analytical work using this database, further reconciliation is required.

4. VALUATION

All the tables in the OECD I/O database are expressed in current and constant national currencies at producers' or basic prices. The basic price valuation is ideally intended to precisely describe technological relationships among industries as it excludes distortions in the producers' price system caused by net commodity taxes on products paid by the producer. However, this convention was only followed by two countries in our sample -- Australia and Denmark -- and the majority of countries included in the database use the producers' price system (Table 2). Given this restriction, producers' price net of all VAT is recommended for analytical purposes. However, the exclusion of all VAT is difficult and two countries -- Denmark and Germany -- reported non-deductible VAT in a separate row of the input-output tables. For Japan, the 1990 data include VAT in each cell in the intermediate matrix. The difference between producers' and purchasers' prices -- the trade and transportation margins -- have been allocated to the margin industries (retail and wholesale trade, transportation and warehousing, and insurance).

For imports, CIF (Cost, Insurance, Freight) values, which are equivalent to basic values, are generally used. Although the SNA recommendation is to use FOB (Free on Board) values for exports, it is necessary in input-output to exclude margins or net indirect taxes in order to arrive at producers' or basic values.

National currencies were chosen as the basic unit of measurement because of their ready availability and applicability to sectors such as services which are not easily expressed in quantities. One of the main problems associated with this approach is adjusting the flows for changes in relative prices and quality changes in a sector's production. Another alternative might be to value the tables in a common currency such as US dollars or purchasing power parities (PPPs). The main drawback to valuing the tables in a common currency is that market exchange rates are susceptible to wide temporal fluctuations and do not adequately reflect the value of output which is not traded. PPPs would be a preferable conversion unit since they tend to reflect more accurately the relative cost of output faced by purchasers in the various countries. To date, PPPs are compiled only for expenditures and aggregate GDP, and not for the output of individual industries.

Some researchers have estimated PPPs at a sectoral level using unit value ratios.[8] These have two serious drawbacks: *i)* the derivation of a unit value relies on a quantity measure for the output of all sectors which, as stated above, can be difficult to observe for service sectors; and *ii)* no adjustment is made for changes in the quality of an industry's output which, as described below, can be significant.

Meanwhile, countries were asked to supply the data in constant prices but, because different countries have different base years and used different deflation methodologies, some inter-country incompatibilities were introduced. In addition, different deflation methodologies were sometimes used for different industries in the same country, leading to intra-country inconsistencies. Depending on the application, the problem of using different base years can be reduced by focusing on changes in the growth of particular variables, as opposed to absolute levels. For analyses that focus on real levels, it is possible to re-base the deflators into a common base year and re-deflate the tables. Nevertheless, this approach typically generates two problems: *i)* the new base year no longer corresponds to the year in which the weights used to create the deflator were based, causing some distortions; and *ii)* the tables are likely to be out of balance.

A more serious limitation is the occurrence of widely differing deflators across countries for similar industries. This is particularly true for the fastest growing industry in our sample of countries: computers and office equipment (ISIC Rev.2 Sector 3825). For example, the annual rate of decline in the deflator for this sector was -1.9 per cent per year in Germany (1978-86), -7.1 per cent per year in Japan (1975-85), and

-11.8 per cent per year for the United States (1977-85). Thus, over roughly comparable time periods, the deflator for computers used by Germany versus that used by the United States differs by a factor of almost 15. Although part of these differences may be due to different rates of inflation, exchange rate movements and differences in product mix in each country, it is likely that most of the variation is due to statistical differences in the way the price index for computers was constructed. With very rapid technological change in the computer industry, it is desirable to use a hedonic price index as is attempted in the United States (*i.e.* one that captures the quality improvements in the outputs of the industry).

The lack of hedonic price indices for all sectors can have a large effect on deflated value added. In principle, value added rather than gross output is the preferred variable for measuring output where real value added for a particular industry is calculated using the *double-deflation* procedure, whereby a unique deflator is constructed for each of the industry's inputs and outputs. Real inputs are then subtracted from deflated gross output, resulting in a residual identified as real value added. A problem arises when the deflator for the industry's outputs is falling faster than that for its inputs -- as is the case in the computer industry for the United States and Japan. In these countries, real value added becomes negative in the early 1970s. The problem arises from using of hedonic deflators for the computer industry itself, but not for some important inputs into the computer industry, semiconductors in particular. Until such time as consistent hedonic deflators are developed for all industries where rapid technological change appears in outputs, such problems will persist, limiting analyses of structural change based on value added.[9]

Table 2. Valuation method and base year

	Pricing	*Units*	*Base Year*
Australia	Basic	Million A$	1989
Canada	Producers	Million C$	1986
Denmark	Basic	Million DKr	1980
France	Producers	Million FF	1980
Germany	Producers	Million DM	1985
Italy	Producers	Billion Lira	1985
Japan	Producers	Billion Yen	1985
Netherlands	Producers	Million Gld	1980
United Kingdom	Producers	Million £	1980
United States	Producers	Million US$	1982

5. INDUSTRY CLASSIFICATIONS

The common industrial classification chosen by the OECD for the collection of the input-output tables was designed to identify technology-intensive and/or trade-sensitive sectors -- pharmaceuticals, computers, communication equipment, automobiles, aircraft, etc. -- which are the focus of much of the

analysis conducted within the Directorate of Science, Technology and Industry (DSTI). Consequently, the manufacturing sector is disaggregated more finely than the agriculture, mining or service sectors.

To ensure compatibility with other OECD databases, countries were asked to supply data which adhered to the second revision of the International Standard Industrial Classification (ISIC, Rev.2). All the matrices should therefore present a square industry-by-industry configuration. To achieve this, most countries formed industry-by-industry matrices using the Use matrix (which shows purchases of commodities by industries) and the Make matrix (which shows the principal and secondary production of commodities by industries). A few countries, such as Japan, compiled this matrix by simply converting commodity-based input-output tables using the commodity (activity) and industry correspondence. Table 3 lists the sectoral scheme countries were asked to follow.

Table 3. Sectoral classification

No.	ISIC Rev.2 codes	Description
1	1	Agriculture, forestry & fishery
2	2	Mining and quarrying
3	31	Food, beverages & tobacco
4	32	Textiles, apparel & leather
5	33	Wood products & furniture
6	34	Paper, paper products & printing
7	351+352-3522	Industrial chemicals
8	3522	Drugs & medicines
9	353+354	Petroleum & coal products
10	355+356	Rubber & plastic products
11	36	Non-metallic mineral products
12	371	Iron & steel
13	372	Non-ferrous metals
14	381	Metal products
15	382-3825	Non-electrical machinery
16	3825	Office & computing machinery
17	383-3832	Electric apparatus, nec
18	3832	Radio, TV & communication equipment
19	3841	Shipbuilding & repairing
20	3842+3844+3849	Other transport
21	3843	Motor vehicles
22	3845	Aircraft
23	385	Professional goods
24	39	Other manufacturing
25	4	Electricity, gas & water
26	5	Construction
27	61+62	Wholesale & retail trade
28	63	Restaurants & hotels
29	71	Transport & storage
30	72	Communication
31	81+82	Finance & insurance
32	83	Real estate and business services
33	9	Community, social & personal services
34		Producers of government services
35		Other producers
36		Statistical discrepancy

Value added sectors	Final demand sectors
Compensation of employees	Private domestic final consumption expenditures
Operating surplus	Government consumption[1]
Consumption of fixed capital	Total gross fixed capital formation (GFCF)[2]
Indirect taxes, net	Changes in stocks
	Exports

1. For the United States: Government expenditures.
2. For the United States: Private gross fixed capital formation.

For the so-called *special industries*, the countries were asked to adhere to the following rules:

- Government enterprises that sell products *via* market transactions should be assigned to the industry in which they compete (*i.e.* sales of state-owned electricity should be allocated to Sector 25: *Electricity, gas and water*). Where there is no industry equivalent that these enterprises compete against, the transactions should be classified in Sector 33: *Community, social & personal services*.

- The provision of non-market government services (such as the US Congress or the development of I/O tables by statistical agencies) is usually represented as an addition to value added. This addition should be allocated to Sector 34: *Government producers*.

- Any *Statistical discrepancy* should be allocated to Sector 36.

- Special *accounting* industries such as scrap, used, and second-hand goods, should be noted when the data is delivered to the Secretariat and assigned to Sector 35: *Other producers* or, if judged to be convenient, to the outside of the intermediate transaction matrix.

Although the OECD Secretariat tried to impose consistency in the allocation of activities among sectors, several inconsistencies became apparent upon receipt of the data, necessitating adjustments in order to increase international comparability. Undoubtedly, however, numerous additional adjustments still have to be made to ensure *true* international comparability. Due to confidentiality restrictions, lack of detailed data and an inability to cleanly allocate national sectors to the ISIC scheme specified by the OECD, several countries were unable to provide complete matrices and instead had to include one industry in another. Table 4 lists these inclusions on a country-by-country basis using the classification scheme listed in Table 3 above. One solution (used by the UN-ECE, but not adopted by the OECD) to separate sectors which have been combined is to use the technology of country A to break out the combined sectors of country B, effectively assuming that the two countries have identical direct coefficients for the sectors involved.[10]

As described in Section 8 below, these adjustments included treating government activity as a category of final demand, rather than intermediate demand. Additional adjustments were also made for consistent treatment of the imputation associated with interest on financial services and unique country specific cases such as the Commodity Credit Corporation in the United States and the self-activity sectors (self-education, self-research and self-transportation) and business entertainment expenses in Japan.

Table 4. Missing industries in country Input-Output tables

Australia	Sector 16 is not available separately and is included in Sector 18. Sector 20 consists of rail road equipment only and other transport equipment nec is included in Sector 21.
Canada	Sector 35 contains the imputed rents associated with owner occupied dwellings.
Denmark	Sector 16 is not available separately and is included in Sector 15. Sectors 21 and 22 are not separately available and are included in Sector 20.
France	Sector 27 contains all the margins associated with the intermediate flows and all retail activity associated with motor vehicle sales. Sector 29 does not contain any margin activity. Sector 32 is not available separately and is included in Sector 31 (only for the years 1972 and 1977). Sector 36 includes sales of used products and scrap (only for the years 1972 and 1977).
Germany	Sector 8 is not available separately and has been included in Sector 7. Sector 18 is not available separately and has been included in Sector 17. Sector 20 does not contain any margin activity. Sector 35 includes services of private non-profit institutions and domestic services. Sector 27 contains all the margins associated with the intermediate flows and all retail activity associated with motor vehicle sales.
Japan	Sector 34 consists of the services of public administration and of national and public institutions for education, health, and R&D. Sector 35 is services of private non-profit institutions to households. Sector 36 contains not only activities not elsewhere classified but also office supplies.
Netherlands	Sector 13 is not available separately and is included in Sector 12. Sector 18 is not available separately and is included in Sector 17.
United Kingdom	Sector 18 includes electrical consumer goods and musical recordings.
United States	Post Office operations are included in sector 34 instead of sector 30. Sector 36 includes sales of used products and scrap. Sectors 1, 4, 5, 7, 8, 14, 15, 17, 18, 19, 20, 21, 22, 23, 25, 28, 29, 30, 32, and 33 had some or all of their 1985 activity estimated by using 1977 detailed sector information to scale more aggregate 1985 information in order to achieve a concordance that matched the ISIC input-output scheme.

6. IMPORTED INTERMEDIATE FLOWS MATRIX

The OECD Secretariat asked participating countries to provide a matrix of imported intermediate inputs in current and constant prices for each year of data.

Techniques used to construct the import matrix data vary between countries, but every country in the OECD database more or less made use of the import proportionality assumption in the construction of their import matrices.[11] This technique assumes that an industry uses an import of a particular product in proportion to its total use of that product. For example if an industry such as motor vehicles uses steel in its production processes and 10 per cent of all steel is imported, it is assumed that 10 per cent of the steel used by the motor vehicle industry is imported.

Some countries such as Japan actually carried out a limited survey of the use of imported intermediate inputs by industry which they use to supplement the use of import proportionality.[12] Others, such as the United Kingdom, use additional detail available for certain commodities to supplement the statistical assumption of linearity.

The import proportionality assumption is limiting since some industries like aircraft might use only domestically-produced steel while others might rely totally on imports. To reduce the limitations associated with this assumption, the proportions should be calculated at the most disaggregated level possible. Nevertheless, the level of detail used for this calculation varied widely between countries from over 2 000 different commodities for Germany and Denmark, to slightly over 500 for the United States and Japan, to less than 200 for the United Kingdom. Methodological work calculating the aggregation bias associated with the use of this assumption suggests that the application of this assumption on fewer sectors (536 versus 6 800) results in underestimating by 6 per cent the amount of imports that are classified as being intermediate inputs.[13] For some sectors such as petroleum refining, which rely heavily on imported inputs, the downward bias associated with the assumption can be as much as one-third.[14] These findings suggest that the estimates of imported intermediate inputs calculated for the OECD I/O database are a conservative indicator of the actual input activity.

Due to methodological problems associated with obtaining separate deflators for imported versus domestic goods, a few countries failed to provide import matrices in constant prices. For Australia, deflation was conducted by the Secretariat by using compatible import price deflators (1981-93) for 1986 and 1989. However, for 1968 and 1974 no import deflators were available and the Secretariat had to use gross output deflators to deflate import flow matrices. For the United States, given the restrictions that no information on import price indices is available and that even current price import matrices were estimated using the import proportionality assumption, the Secretariat did not attempt to estimate constant-price data for imports.

Although constant-price import flow tables are available for the other countries, several adjustments had to be carried out by the Secretariat. For example, since constant-price import flow matrices were not available for 1972 and 1977 for the Netherlands, these were created by the Secretariat by applying gross output deflators for these two years to each row of the current-price matrices. For Germany, the original 1978 import flow matrix were rebased to 1985 to obtain consistency with other years. For Japan and the United Kingdom, import deflators were also applied to deflate their current price import flow matrices.

7. GROSS FIXED CAPITAL FORMATION (GFCF) MATRIX

Matrices of investment in equipment and structures are an expansion of the investment (gross fixed capital formation) column in final demand. Two flow tables were specified, one for domestically-supplied capital, and the other for imported capital goods, where each cell indicates industry *j*'s purchases of different types of equipment and buildings, commodity *i*.

The OECD Secretariat has encountered several comparability problems in the compilation of capital flow tables. Foremost among these is the problem of industrial classifications. In many countries the sectoral detail associated with capital flow matrices is more highly aggregated than the intermediate flow data; this prevents a clean correspondence between the national sectoral classifications and the OECD industrial classification. This problem is particularly true for the purchase of capital by using sector (the columns of the matrix) as opposed to use by type of capital good (the rows).

As shown in Table 5, the matrices had to be aggregated for many of the countries in our database, some with significant loss of detail in capital intensive sectors. For example, neither Australia, Denmark,

France nor Japan (before 1985) could separate transportation equipment (ISIC 384) into the requisite sub-industries: shipbuilding, motor vehicles, aircraft, and other transportation.

Table 5. Sectoral Availability of OECD capital formation matrices

Coverage of sectors making capital purchases	Australia[1]	Canada (33)	Denmark (22)	France[2] (26)	Germany (30)	Italy (33)	Japan[3] (24)	Netherlands	UK (33)	USA (26)
1 Agric., forestry & fishing										
2 Mining										
3 Food, beverages & tobacco										
4 Textiles, apparel & leather										
5 Wood products & furniture	×			×						
6 Paper & printing										
7 Industrial chemicals	+8, 9		+8,9,10		+8		+8			+8
8 Drugs and medicines	×		×		×		×			×
9 Petroleum & coal products	×		×				×			
10 Rubber & plastic products	×		×				×			
11 Non-metallic mineral products	×									
12 Iron & steel	+13		+13					+13		
13 Non-ferrous metals	×		×					×		
14 Metal products	+15 to 18, 23									
15 Non-electrical machinery	×		+16	+23						
16 Office & computing machinery	×		×	+17,18			×			
17 Electrictal apparatus, nec	×		+18	×	+18		+16,18	+18		
18 Radio, TV & commun. equip.	×		×	×	×		×	×		
19 Shipbuilding & repairing	+20, 21, 22		×	+22	+20		+20,21,22			
20 Other transport	×		+19,21 to 23	+21	×		×			
21 Motor vehicles	×		×	×			×			
22 Aircraft	×		×	×			×			
23 Professional goods	×		×	×						
24 Other manufacturing	+5, 10, 11			+5			+9,10			
25 Electricity, gas & water										
26 Construction										

27 Wholesale & retail trade			+28							+28
28 Restaurants & hotels	×		×				×			×
29 Transport & storage	+30									
30 Communication	×									
31 Finance & insurance	+32			+32						
32 Real estate & business services	×			×						
33 Commun., social, & pers. serv.	+28, 34					+34	+28			

x: not available.

1. Data are not available before 1986.
2. The data availability shown in the table applies only to 1972 and 1977. For 1980, 1985 and 1990, all sectors are available separately.
3. The 1985 and 1990 Japanese capital formation matrices cover 33 sectors.

Another mechanical problem involves the separation of capital purchases into those goods which were imported and those which were supplied domestically. Where this separation was possible, countries used the total imports of a type of capital (the row sum) as a control total and distributed the imports across using industries in proportion to the share of total capital of that good used by particular industries. Since data from some countries (for example, Japan, the Netherlands and the United States) contain only total (domestic plus imports) GFCF matrices, the Secretariat undertook the separation by using the similar method for 36-by-36 matrices. Like the import proportionality assumption described in the previous section, this estimation technique assumes that all industries use an equal proportion of imported to domestically-supplied capital equipment.

A more serious problem was the deflation of these GFCF matrices, because most countries do not have enough deflators for investment goods for both domestically-produced and imported products. Some countries (for example, Canada and Denmark) could provide both domestic and import flow GFCF matrices in constant prices, but the other countries could not. Although imperfect, where only the constant-price total GFCF flow matrices are available (the Netherlands), the Secretariat employed the import proportionality method to separate them into domestic and import matrices. In that case, import ratios were calculated by using GFCF final demand vectors available from domestic and import input-output tables. Alternatively, where no constant price information was originally available but domestic and import GFCF flow tables in current prices were separately available, the constant price matrices were constructed by using gross output deflators for domestic GFCF tables and import price deflators for import GFCF tables (when import deflators are not separately available, gross output deflators were alternatively used to deflate import GFCF matrices).

A number of country-specific characteristics pose potentially large comparability problems for which the Secretariat could not provide any effective answers to ensure international comparability. These include the identification and inclusion of government expenditures in capital, whether or not leased and rented structures and equipment are allocated to their users or to their owners,[15] the inclusion or exclusion of residential expenditures on equipment and structures and the allocation of expenditures on repairs and maintenance on capital equipment and structures.[16]

Among others, these issues affect the consistency between the row sum of the GFCF matrices and the corresponding GFCF vector of final demand. Ideally, the cell values in these two vectors should be identical, but they are not necessarily the same for half of the 10 countries: while they are identical for Denmark, France, Germany, Italy and the Netherlands, they are different for Australia, Canada, Japan, the

United Kingdom and the United States. For example, the (private plus government) GFCF final demand vector for Japan deviateds from the corresponding row sum of the GFCF matrices by the amount of negative entries of scraps and second-hand commodities in the GFCF final demand vector. For the United States, while both sets of data cover only private capital expenditures (government GFCF is included in a final demand vector government expenditures), the row sums of the GFCF matrices are generally smaller than the GFCF vector in final demand because the former do not include expenditures on structures and scraps. For Canada, several categories of capital expenditures (housing investment, real estate commissions, scraps) are excluded in the GFCF matrices and, for the United Kingdom, some construction expenditures were missing. Lastly, the GFCF matrices cover only private GFCF expenditure on equipment.

Other issues involved in the compilation and use of capital flow tables include the adjustment, if any, that should be made to investment flow tables (which are commodity-by-industry matrices), when they are added to intermediate flow tables which are on an industry-by-industry basis. Another problem is one of timeliness, especially acute in the United States which has not yet released an investment flow table for 1982. Such a long lag forces researchers to estimate more up-to-date tables. By and large, these estimates are made by simply applying the sum of investment made in a particular good by all industries as reported in the final demand category of gross fixed capital formation across all users of that good, assuming that the distribution of use has not changed from the earlier period. Obviously this assumption is limiting for some types of equipment such as computers which today have a very different distribution across industries than was the case 10 years ago.

8. MATRICES OF FINAL DEMAND AND VALUE ADDED

In addition to the matrices described above, Member countries were also asked to supply the columns for final uses (final demand) and the rows for primary inputs or value added of the simple input-output schema. Although the standard OECD format for these categories is not fully broken down, countries were requested to break down data into as much detail as possible in order to achieve a common classification. With respect to final uses, in addition to the column for gross fixed capital formation, for which a full matrix would be provided, other columns would include consumer (household) expenditures, government final consumption, changes in stocks and exports. Demand for imports for these individual categories should also be separated to construct consistent import flow matrices. Similarly, for the rows of primary inputs or value added, they should be broken down into as much detail as possible and should at least include income from employment (wages & salaries plus supplements such as employer superannuation payments), operating surplus, depreciation of capital and taxes & subsidies, following the definitions given by the SNA.

Although the standard OECD format for final demand and value added sectors does not seem demanding, it should be noted that several inconsistencies remain among countries in the current database. For final demand sectors, for example, the US I/O convention does not separate government expenditures into current final consumption and gross fixed capital formation, while for the other nine countries, they can be separated. For these countries, the column of government GFCF was summed with that of private GFCF and put into total GFCF. Another problem can be found in the French data for 1972 and 1977 where private and government final consumption are not separated out.

Table 6. Availability of value added and special sectors

	Australia	Canada (33)	Denmark (22)	France[1] (26)	Germany (30)	Italy (33)	Japan (24)	Netherlands	UK (33)	USA[2] (26)
V1 Compensation of employees	○	○	○	○	○	○	○	×	○	○
V2 Operating surplus	○	○	○	○	○	○	○	×	○	○
V3 Consumption of fixed capital	×	○	×	×	○	×	○	×	×	×
V4 Indirect taxes, net	○	x	○	○	○	○	○	×	○	○
S1 Transfers of products	×	×	×	○	×	○	×	×	×	×
S2 Non-deductible VAT	×	×	○	×	○	×	×	×	×	×
S3 Sales by final buyers	○	×	×	×	×	×	×	×	○	×
S4 Complementary imports	○	○	×	×	×	×	×	○	×	×
S5 Business consumption expenditures	×	×	×	×	×	×	○	×	×	×

○: available; x: not available.

1. Data for 1972 and 1977 are totally missing.
2. Data are available only for 1982.

More seriously, comparable value added sectors are not easily obtainable (Table 6). Several counties set up special sectors (S1~S5) in value added sectors or outside the intermediate matrix. For example, because I/O data for France and Italy were based on commodity-by-industry tables, the *transfer sector*, which adjusts by-products and adjacent products, is necessary to obtain consistency between row and column gross output. For Denmark and Germany, *non-deductible value added taxes* are recorded in an independent row. In Australia and the United Kingdom, *sales by final buyers*, which is defined as the import and export of second-hand goods, waste and scrap, is also separated from the intermediate matrix. Similarly, complementary or non-competing imports are separated from intermediate flow tables in Australia and the Netherlands. Since the adjustment or assignment of these special sectors is difficult, most of these items were left as they were in the original files received from countries except for the adjustment for the *business consumption* sector in Japanese I/O tables which record corporate expenditures for entertainment and welfare of employees. In the original Japanese data, this item appears in the row value added and in the column final demand. Since the SNA and I/O conventions in most countries include this item of expenditures in intermediate inputs incurred in the production process, it was distributed into individual cells in the intermediate matrices by using the sectoral composition of this final demand vector.

9. ADDITIONAL ADJUSTMENTS

Although Member countries provided the OECD with fairly homogenous data following the OECD format, various additional adjustments were necessary to increase comparability across countries. Among

these, this section presents two major adjustments: government sector and imputed bank changes. More country-specific adjustments can be found in the individual country notes.

Treatment of government expenditures

According to the SNA recommendations, producers of government services should be included in intermediate rather than in final demand and treated as a supplier of public services. Most of the countries included in the OECD database followed this classification standard, but data for the United States, the United Kingdom before 1990, and Japan for 1970, treat this sector as the major source of final demand. In consequence, while these countries allocated intermediate inputs of the government sector to the column representing Section 34: *Producers of government services*, the data for the other three countries allocates these expenditures to the government consumption sector of final demand. This difference in the treatment of government activities gives rise to comparability problems across countries and affects the relative weight of final demand in total production, as well as the magnitude of multipliers calculated from the intermediate matrix.

For this so-called endogenisation/exogenisation issue of the government sector, the Secretariat decided to adjust data for other countries in line with those for the United States simply because the converse adjustment would be difficult to perform without additional information. Figure 2 describes how this sector can be transferred into final demand with no change in the volume of total value added before or after adjustment. Though imperfect, this method was used by the Ministry of International Trade and Industry of Japan when they constructed an 1985 international input-output table.[17] To keep consistency among matrices in the OECD format, the adjustment was made independently for both domestic and import I/O tables.

The method is as follows:

- The column *Producers of government services*, rows 1-36 is added to column *Government consumption* and is subsequently set to 0.

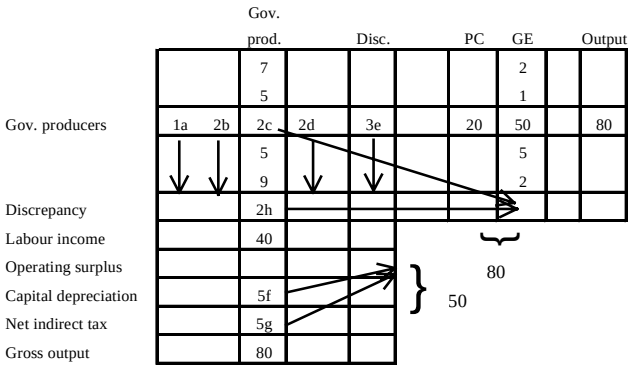
- The Value added elements of column *Producers of government services*, except *Compensation of employees*, are added to the corresponding Value added elements of column *Statistical discrepancy* and are subsequently set to 0.

- The row *Producers of government services*, columns 1-36 are added to row *Statistical discrepancy* and are subsequently set to 0.

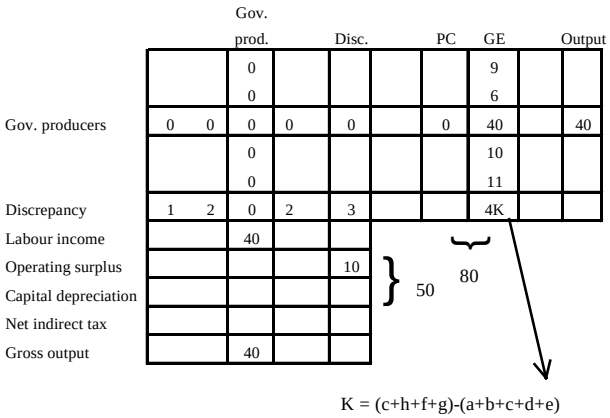
- Finally the intersection of the rows *Producers of government services* and *Statistical discrepancy* with the column *Government consumption* are set so that the row *Gross output* of each of these two sectors equals the column *Gross output*.

Figure 2. Exogenisation of the government sector

Original I/O



Adjusted I/O



PC: Private consumption

GE: Government expenditures (or consumption)

Figure 3. Distribution of imputed interest among intermediate sectors

Original I-O

			Fin		Int. Total			Output
			2					
			3					
Finance & insurance	7	3	10	5	25	10	15	50
			5					
			10					
Labour income			25					
Operating surplus	15	10	-10	8				
Capital depreciation			2					
Net indirect tax			3					
Value Added	40	30	20	30	120			
Gross output			50					

Adjusted I-O

			Fin		Int. Total			Output
			2					
			3					
Finance & insurance	11	6	0	8	25	10	15	50
			5					
			10					
Labour income			25					
Operating surplus	11	7	0	5				
Capital depreciation			2					
Net indirect tax			3					
Value Added	36	27	30	27	120			
Gross output			50					

11=7+40/(120-20)*10

Fin: Finance & insuracne

Treatment of imputed bank service changes

The treatment of *imputed interest* of domestic banks and other financial institutions, which is equal to the difference between the interest received on deposits and interest paid on financial loans, is also different across countries. The SNA recommends that this imputed part be included in the gross output of the financial sector, together with explicit bank service charges. However, because of the difficulty involved in allocating imputed interest to individual industries and final consumers, it is treated as intermediate consumption of a fictive financial sector which has no output and, therefore, a negative value added has to be added to counterbalance the imputed intermediate consumption of this dummy sector. Thereby gross domestic product remains constant by the introduction of imputed interest.

This fictive treatment of imputed interest in the SNA, however, can be used only for balancing the intermediate matrix and does not work properly for analytical purposes.[18] In consequence, the treatment of imputed interest in the input-output exercise has been quite diverse across countries. In the original country files supplied to the OECD, France uses a method similar to that proposed by the SNA, creating a dummy sector in the last column of the intermediate matrix. Although different methods are used, the original files from Australia, Canada, Japan, the United Kingdom (except for 1990) and the United States allocate imputed service changes among intermediate and/or final demand sectors, while those for Denmark, Germany, Italy, the Netherlands and the United Kingdom (1990) do not distribute imputed interest among sectors and, in most cases, include it in a lump sum at the diagonal element of Sector 31: *Finance and insurance*, the same amount is then subtracted from the operating surplus element of this sector.

Since it is desirable from an analytical point of view to distribute imputed interest among sectors, the Secretariat decided to adjust data for Denmark, France, Germany, Italy, the Netherlands and the United Kingdom (1990) to match the data for the other four countries. As shown in Figure 3, this is done by distributing this lump sum element into industrial sectors, but not into final demand sectors, according to sectoral shares of gross value added (sectoral lending balances are more appropriate indicators as weights but

the data were unavailable). Since this adjustment increases sectoral gross output, an amount equal to the imputed interest distributed among sectors was then subtracted from the operating surplus of each sector and, for the *Finance and insurance* sector, imputed interest was added to its operating surplus. These adjustments were performed only for the domestic flow matrix.

10. OTHER INFORMATION

Electronic availability

The complete dataset of the STAN input-output database is available in electronic format from OECD's Publications Office (OECD Publications, Electronic Editions, 2 rue André-Pascal, 75775 Paris Cedex 16, France; Fax: (33 1) 49 10 42 99.

The data are provided on 3 1/2 inch diskettes, suitable for IBM compatible PCs. The data are provided in compressed format. The following executable file stores all the tables for a specific country.

<country code>_IO.EXE

Country codes are AU: Australia, CA: Canada, DE: Denmark, FR: France, GE: Germany, IT: Italy, JP: Japan, NL:Netherlands, UK:United Kingdom, US: United States.

Copy this file onto your C:\ drive. Make sure that the space available on your hard disk (after copying the .EXE file) exceeds 3.5 times the size of the .EXE file. Run this .EXE file by typing the name of the file in DOS or by clicking it in MS-Windows, it will then automatically create a number of Lotus (.WK1) files in which each file corresponds to one matrix: total, domestic or imported matrix of I/O or GFCF matrices in current or constant prices for a specific year and country. The number of files varies among countries depending on the availability of data. The names of these files are given by:

CCMKKPXX.WK1,

where CC is the country code (characters 1-2), M (character 3) is type of matrix (T for total flow matrix, D for domestic matrix and M for import matrix), KK (characters 4-5) is the kind of matrix (IO for input-output matrices and CF for capital flow matrices), P (character 6) distinguishes current prices (C) or constant prices (K), and XX (characters 7-8) is the year of the table. For example, the file GEMINC86.WK1 contains the German current-price import input-output table for 1986 and the file FRTCFK90.WK1 contains the French constant-price total GFCF matrix for 1990. Note that missing sectors in tables are not excluded and are recorded as zero entries.

Other STAN compatible databases

In addition to the input-output and associated capital flow tables, a number of databases have been constructed within the STAN project which have been designed to be used in conjunction with the input-output tables, allowing a wide range of analytical work. To date, these databases cover three areas: major industrial variables, research and development and bilateral international trade.

Industrial STAN

Because of the difficulties involved in making international comparisons with survey-level data and the lack of industrial detail in the OECD's national accounts database, work has been undertaken to produce a

data series with sufficient sectoral detail, compatible with national accounts data and thus providing a high degree of international comparability. The latest version of this estimated database is OECD (1995), *The OECD STAN Database for Industrial Analysis*. This annual publication covers 19 OECD countries[19] and Korea, over a more than 20-year period from 1970 to 1993 and contains national accounts compatible data for production, value added, gross fixed capital formation, number engaged, number of employees and labour compensation. Currently, the STAN database covers only the manufacturing sector.

Bilateral Trade

The Bilateral Trade database contains imports and exports in manufactured products from 1967 to 1990 for 14 OECD countries,[20] the rest-of-the-OECD,[21] 12 non-OECD principle trading partners,[22] and the rest-of-the-world's trade with the OECD[23] in current US dollars. It is based on the OECD's NEXT database[24] but has been modified to match the ISIC classifications used in the input-output database.

Analytical Business Enterprise R&D (ANBERD)

The ANBERD database provides a time series of R&D expenditures for 22 manufacturing sectors extending from 1973 to 1992 (OECD (1995), *Research and Development Expenditure in Industry*, Paris). This publication contains the official business enterprise R&D data for the 24 OECD Member countries as well as estimated expenditures for 12 OECD countries where the official data was missing or of insufficient quality for analysis.[25]

NOTES

[1]. The list of participants in this meeting included: Wassily Leontief (New York University), Karen Polenske (MIT), Peter Blair (OTA, US Congress), Masahiro Kuroda (Keio University, Takayuki Kiji (MITI), Hirochika Ota (MITI), Chiharu Tamamura (IDE), Josef Richter (Federal Economic Chamber of Austria), Bent Thage (Denmark Statistik), Jacques Magniez (INSEE), Terry Barker (Cambridge University) and Vu Quang Viet (UN). The Secretariat wishes to thank them for their peer reviews of the OECD work and for the presentation of their papers at the meeting.

[2]. For example, the following recent DSTI studies extensively used this database: Wyckoff, A.W. (1993), "The Extension of Networks of Production across Borders", *STI Review*, No. 13; Sakurai, N. (1995), "Structural Change and Employment: Evidence for 8 OECD Countries", *STI Review* No.15; Sakurai, N., G. Papaconstantinou and E. Ioannidis (1995), "The Impact of R&D and Technology Diffusion on Productivity Growth: Evidence for 10 OECD Countries in the 1970s and 1980s", presented at the Conference on the Effects of Advanced Technologies and Innovation Practices on Firm Performance, co-organised by the US Department of Commerce and the OECD, May; OECD (1995), *Technology Diffusion, Productivity and Industrial Performance*, OECD Documents series, Paris (forthcoming).

[3]. For the reviews of different input-output practices among 53 countries during the 1970s and 1980s, see Vu Quang Viet (1994), "Practices in Input-Output Tables Compilation", *Regional Science and Urban Economics*, 24, pp 27-54, North-Holland.

[4]. US Department of Commerce (1990), Bureau of Economic Analysis, "Annual Input-Output Accounts of the US Economy, 1985," *Survey of Current Business*, January.

[5]. United Nations (1987), *National Accounts Statistics: Study of Input-Output Tables, 1970-80*, United Nations Publication No. E.86.XVII.15, United Nations, NY, p. 27.

[6]. Janusz Szyrmer (1989), "Trade-Off Between Error and Information in the RAS Procedure", in Ronald Miller, Karen Polenske and Adam Rose (eds.), *Frontiers of Input-Output Analysis*, Oxford Books, New York, p. 270.

[7]. R.G. Lynch (1984),"An Assessment of the RAS Method for Updating Input-Output Tables," *Proceedings of the Seventh International Conference on Input-Output Techniques*, United Nations Publication No. E.84.II.B.9, United Nations, NY.

[8]. Unit value ratios (also called industry-of-origin purchasing power parities) are calculated by dividing the sales value of a product by the corresponding quantity. See Dirk Pilat and Bart van Ark (1992), "Productivity Leadership in Manufacturing: Germany, Japan and the United States, 1973-1989," revised version of Research Memorandum No.456, University of Groningen, March, for work on unit value ratios.

[9]. Kubo *et al.* raise the issue that the basic concept of "real value-added is theoretically ambiguous, with no obvious way to measure it." See Yuji Kubo, Sherman Robinson, and Moshe Syrquin (1986), "The Methodology of Multisector Comparative Analysis," Chapter 5 in Hollis Chenery, Sherman Robinson, and Moshe Syrquin (eds.), *Industrialization and Growth: A Comparative Study*, Oxford University Press, p. 127. Note that negative value-added may arise for other reasons as well; whenever constructed deflators for outputs are rising less fast (or falling more rapidly) than deflators for inputs. Negative double-deflated value added has been known to appear in both agriculture and oil.

[10]. United Nations (1982), *Standardized Input-Output Tables of ECE Countries for Years Around 1970*, United Nations Publications No. E.82.II.E.23, Annex II, United Nations, NY.

[11]. Algebraically the assumption can be expressed as:

$$d_i = [1 - (IMP_i / (ID_i + DFD_i)]$$ **Error! Main Document Only.**

where d_i is the domestic portion of the use of commodity *i*; IMP_i is the total amount of imports of commodity *i*; ID_i is total intermediate demand for commodity *i*; and total DFD_i is total domestic final demand for commodity *i*, which is equal to final demand inclusive of imports, less exports.

[12]. For an example of an industry- (commodity-) based survey of imports and exports to and from using/producing sectors, see MITI (1989), *The Japanese-US Input-Output Table*, Research and Statistics Department, Tokyo, p. 113.

[13]. See Mark Planting (1990), "Estimating the Use of Imports by Industries," paper presented at the Annual Meeting of the Southern Regional Science Association, Washington, DC, March 22-24, and Kiji T. and T. Hidaka (1991), "Preparation of International Input-Output Tables," paper presented at the UN University Tokyo Conference on Global Change and Modelling, 23-31 October, Tokyo, Japan, pp. 2-7 for estimates of the biases associated with this assumption.

[14]. Planting, *op. cit.*, Table 1, p. 15.

[15]. For example, the Japanese tables adopt the user principle except for leased computer equipment, office machines and car rentals which are allocated on an owner basis. See MITI (1989), *The 1985 Japanese-US Input-Output Table*, Research and Statistics Department, Tokyo, p. 119.

[16]. For example, repairs and maintenance are treated as intermediate expenditures by Japan and the United States while a significant percentage is attributed to investment (final demand) in Norway and Italy. See Chenery, H.B. and T. Watanabe (1958), "International Comparisons of the Structure of Production", *Econometrica*, Vol. 26, No. 4, p. 491.

[17]. See *The 1985 Japan-US-EC-Asia Input-Output Table*, Research and Statistics Department, Ministry's Secretariat, Ministry of International Trade and Industry, Japan, August 1993.

[18]. Vu Quang Viet, *op. cit.*, p. 52.

[19]. The countries covered include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Mexico, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States.

[20]. This group includes Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, New Zealand, Norway, Sweden, the United Kingdom, and the United States.

[21]. Included in this group are Austria, Belgium, Greece, Iceland, Ireland, Luxembourg, Portugal, Spain, Switzerland, and Turkey.

[22]. This group includes Brazil, Hong Kong, Indonesia, India, Malaysia, Mexico, Philippines, Singapore, South Korea, Thailand, China, and Taiwan.

[23]. Included in this group are the Eastern European countries, the USSR, the African countries, most South and Central American countries, and the Middle East and most of the Far Eastern Countries.

[24]. See OECD (1991), "Bilateral Trade Database," STIID, mimeo, December, and OECD Department of Economics and Statistics (1991), *Foreign Trade by Commodities*, 1990, Volumes 1 and 2, Paris, for additional information about this database.

[25] The 12 countries are Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, and the United States.