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THE INPUT-OUTPUT DATA BASE FOR A
DEPARTMENTAL STUDY OF THE US ECONOMY

Michel Juillard *: Make I-o benchmarks compatible with NIPA   annual data*

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The departmental approach requires a great unity and comparability
between the differemt sources of data we need to use simultaneously.
In particular, the yearly data available for each industry have to be
compatible with the input-output tables for the entirety of the period
under examination.

This requirement limits the degree of desaggregation of the industrial
classification to which it is possible of working: the basic
information in this study is available for 41 industries from 1948 to
1980. Moreover, if the yearly data are consistent on the entire
period, it is not the case for the input-output tables, which have
never been revised to conform to the conventions of the most recent
tables. In this paper we will exposed the necessary transformation
required to unify the methodological framework of the input-output
tables, the capital flow tables and the yearly industrial data.

The input-output tables

The BEA, Department of Commerce has successively published benchmark
input-output tables for 1947, 1958, 1963, 1967, 1972, and 1977. These
tables varie in the degree of detail of the classification and in the
treatment of methodological problems such as imports or secondary
products. For the larger part the same methodology has been used twice
in a row: 1947 and 1958 are more or less comparable, so are 1963 and
1967, and finally 1972 and 1977. The most serious break with the past
happens with the publication of the 1972 study. As the National Income
and Product Accounts are currently benchmared against the 1977

input-output study, it seemed appropiate to transform the earlier tables to conform as much as possible with the standard used for 1972 and 1977. This objective was atteined with various degrees of accuracy. Only the treatment of imports for final use of previous years could not be updated to the new formula because of lack of information and an intermediary solution was chosen.

The necessary transformations concern the industrial classification, the treatment of imports, secondary products and the industry "eating and drinking places".

The classification

The industrial classification used in the input-output tables published by the BEA are based but distinct from the Standard Industrial Classification (SIC) (U.S. Executive Office of the President, 1947, 1957, 1967, 1972, 1977) used for the economic census. The degree of detail vary with the different studies: for 1947 an 1958, the productive system is desaggregated in 79 industries, or a 2-digit IO classification; for 1963 and 1967, 368 industries are available, or a 4-digit IO classification; in 1972, the degree of detail reachs 496 industries, or a 6-digit IO classification; finally, in 1977, 537 industries are available in a new version of the 6-digit IO classification. The U.S. national accountants tried as much as possible to maintain the consistency of the classification through the years, so that the classfication remained compatible at the higher aggregation levels wich are available for several consecutive years. For this reason, the 2-digit IO classification remained more stable and has integrated in a consistent way the changes in the SIC classification.

However, the list of dummy industries, which are used to describe acivities which can hardly be assigned to particular industry for conceptual or statistical reasons, has changed between the different studies. In 1972, the dummy industries are the government industry, which transfers the valued added by the employees of the federal, states or local administration to the final demand, the rest of the world industry, which accounts for the income of the production factors located abroad, the non-comparable imports industry, the households industry, which accounts for the compensation of the household employees, the inventory valuation industry, and the scrap and second hand goods, which is teated in the 1972 study as the secondary product of several other industries. Before 1972, other secondary products were added to the list of the dummy industries: office supply and business trips, representation and gifts. In 1958, there is also research and development. The importance of the differences in the list of the dummy industries is limited in dealing whith the activites which are not present in the later studies as othe secondary products.

The classification of 41 industries chosen for this study represent an intersection between the IO classification and the 2-digit SIC classification used in the NIPA, only source of consistent data on employment and value added on the entire period under examination. However, the reader must be aware of the differences remaining between the industrial classification used in the input-output studies and the NIPA. Both are based on the SIC, but input-output studies incorpore explicit redefinitions whose scope changes for different years. These redefinitions attempt always to obtain more homogenous industries. For example all force account construction are redefined in the construction industry in the IO studies but not in the NIPA. Other examples are rent and royalties redefined to real estate industry and

wholesale activites carried directly by manufacturers redefined from manufacturing into trade industry. No attempt were made to resolve these discrepancies between IO studies and NIPA accounts.

The secondary products

The basic statistical unit of the economic census is the establishment, genrally characterised by a unique location, in opposite to the company which is based on the juridic criterion of propriety. The establishment is assigned to the industry corresponding to its primary production. Nevertheless, the establishment may have several types of production, the other ones are then called secondary products. The interest of the IO analysis for the technology asks for the greatest possible homogenity in the definition of the production processes, to insure the greatest stability to the technical coefficients. For this reason, the national accountants try to reclassify the secondary products in order to obtain more homogenous production processes.

This reclassification of the secondary products can be dealt with in three ways: first, when the technology of production of the secondary product is clearly different from the technology used to produce the primary product, the activty resulting in the secondary product is simply redefined as belonging to another indsutry along the line of the assumption of "constant commodity technology". This treatment is used in all six tables. Secondly, the secondary product may be the object of a fictitious sale from the actually producing industry to the one this product would be the primary product. The transfer method is used in the 1947, 1958, 1963, and 1967 tables to deal with the reclassifications made with the assumption of "constant industry technology". This method has the defect of increasing artificially the

share of intermediary products in the production without technological ground. The third method, used for the tables of 1972 and 1977, corrects this problem radically in describing industries and commodities separately. This method which is inspired by Von Neumann model (1945) requires the separation of the input-output table in two tables. The first one describes the use of the different commodities by the different industries and the functions of the final demand. The second displays the production of each commodity by the different branches.

To unify the treatment of the secondary products in the six tables the latest method was also applied to the earliest tables. These operations have been accomplished at the highest degree of detail possible: 79 industries for 1947 and 1958, 368 industries for 1963 and 1967.

The first problem deals with number of specific redefinitions: from 1972 and on, and contrarely to what was done before, the electricity produced and sold by the manufacturing, mining, and railroad sectors is systematically redefined as produced by the electricity industry. The same is true for the resales commodities taking place in the manufacturing sector which are redefined in the wholesale trade industry and for the rents and royalties which are systematically redefined in the real estate industry (BEA, 1980, p.49). In the studies before 1972, these reclassifications were dealt with using the transfer method, implying therefore the opposite assumption of "constant industry technology".

If in the published tables, only the total transfers by industry is available, the magnetic tape data files distributed by the BEA contain the detail of the transfers by commodity and industry. It is therefore possible to use either of the two assumptions of constant technology. It is important to realise that the information of the transfer table

is equivalent to the one included in the MAKE table. The transfers indicate the quantity of secondary products produced by each industry. On the other hand, a table without the transfers represents the direct allocation of primary products and their use by the different industries and functions of the final demand. The row totals of this table represent the total production of each commodity. By comparing these totals and the column totals of the transfer table, it is possible to find by difference the quantity of each commodity wich is produced as primary product of the corresponding industry.

It is therefore possible to use the transfer table to rebuild USE and MAKE tables for the years prior to 1972. The manipulation of the two matrices is nevertheless heavy and this study doesn't use the difference between commodity and industry. On the opposite, what is important here, it is the articulation between the productive capacity of the different industries and their utilization in the different macro-economic functions. An industry by industry table would therefore be sufficient. In applying systematically the assumption of constant industry technology to the secondary products described outside of the main diagonal of the MAKE matrix, it is possible to rebuild an input-output table which descibes the transactions between industries. These transactions are of course made of heterogenous commodities as primary and secondary products are mixed together. To obtain such a table, it is enough to premultiply the USE table by the column coefficients of the MAKE table.

In this context, the treatment of the scrap and second hand goods doesn't find an ideal solution, even if the small amounts they represents have little influence on the final results. If these products are treated as the other secondary products and attributed to the other industries in the proportion in which they are producing them, they appear as input required by the production and any increase

in the level of activity of an industry which uses scrap will generate in the input-output model an increase of the demand for scrap and second hand goods. On the other hand, because the business sector resells used cars to households and buildings to the government, the gross private investment in fixed capital column of an input-output table has a negative amount for scrap and second hand goods. The mechanical redistribution of this negaitve amount among the industries producing scrap and second hand goods results in the appearance of negative amounts in several cells of the investment column, because these industries which are relatively large producers of scrap such as steel for example do not produce investment goods. The advantage of treating scrap and second hand goods as other secondary products is to insure the balance of the account of each industry. It is the method currently used in this study for the tables from 1947 to 1972.

To avoid generating a demand for srap and second hand goods, the BEA (1980) recommands an alternative method, which takes scrap and second hand goods out of the total production of each commodity. This technique has the disadvantage of destroying the equilibrium between ressources and uses for each industry and requires that an implicit adjustment be incorporated in the value added. It is the method used for 1977 in this study. It should be underlined one more time that the amount of scrap and second hand goods is at most a few percents of the total production and that the problem is more of conceptual nature that important for its empirical consequences.

The imports

In all the tables non-comparables imports, the ones which don't have an equivalent in the domestic production, are shown as coming from a

dummy industry entitled non-comparable imports. This industry doesn't have any input and the corresponding column is therefore empty. The row describes the utilization of non-comparables imports by the different industry and the functions of the final demand. To insure the global balance of the table and to show the total amount of imports in the final demand, the total of the non-comparable imports is entered with a negative sign at the intersection of the non-comparable imports row and the net export column (before 1972) or in the imports column (in 1972 and 1977). The non-comparable imports are recorded at the foreign port value and the transoceanic margins are recorded in the appropriate industries. One should note that if the transport or another activity recorded as margin is accomplished by a foreign carrier, it is a comparable import of services and it is dealt with accordingly.

In the tables prior to 1972 - in a way similar to the treatment of secondary products - comparable imports of intermediary goods are added as input to the industry which would produce them in the U.S.. The comparable imports of commodities directly used for the final demand are directly imputed to the different functions of the final demand in cumul and in the same row as the non-comparable imports. In this case also the imports are recorded at the foreign port value. In the 1972 and 1977 tables, the comparable imports of intermediary goods are separately recorded as negative entries in a special column of the final demand reserved for the imports. In this case, the imports must be valuated in a unit as close as possible of the value of the same commodity on the domestic market, they are therefore recorded at their value at the domestic port of entry, duty included.

The details provided for the tables prior to 1972 are sufficient to show the comparable imports of intermediary goods in the new methodology. Unfortunately, they don't allow to know the detail of the

commodity imported directly for final use. In order to maintain the unity in the methodology og the six tables, one must take the comparable imports out of the final demand in the table for 1972 and 1977 and show them on a particular row as in the prior years. The detail of the operations necessary to present the comparable imports of intermediary goods in the table from 1947 to 1967 in a format similar to the one used for 1972 and 1977 is as follows. These operations use data which don't figure in the written publication of the BEA, but are only available in the magnetic tape data files. The comparable imports of the earlier tables must be evaluated to their domestic entry port value by adding the transoceanic margins to their foreign port value. These amounts are then written with a negative sign in the new column of the final demand reserved for the imports. In order to maintain the balance of the accounts, the addition of the transoceanic margins must be compensated by substracting them from the industry which produces the margin services (transportation, wholesale trade and insurance). As the imports are recorde with a negative sign in the new presentation, the above adjustment is in fact an algebraic addition.

For the final demand, it is the old solution which has been kept because of the lack of data. The tables from 1947 to 1967 are therefore kept intact in this domain. The imports used for the final demand in the 1972 study have been identified by comparing a 1972 table presented in the old methodology (BEA, 1979) with the new table. For 1977, the comparable imports used directly for the final demand have been estimated on the assumption the share of market of imports was constant what ever the destination of a given commodity with one exception: export and government use have been excluded from the potential users of imports. This choice is justified on the basis of the comparison of the two tables available for 1972.

Eating and drinking places

In the tables from 1947 to 1967 eating and drinking places are included in the retail trade industry, but they are treated separetely in 1972 and 1977. If it was only a desaggregation of the industrial calssification, there would be no problem in keeping the consistency between both presentations. However, the trade industry is a margin industry which records only the margin added at the time of the business transaction. When eating and drinking places are treated as trade, the food appear as directly sold by the food industry to the consummer (households or another industry) and only the costs and the value added of preparing the meal are accounted for in the trade industry. On the opposite, when eating and drinking places are treated separately, the food appears as input of the eating and drinking places industry and the output of this industry includes not only the costs and the value added of preparing the meal but also the value of the intermediary goods. The change in treatment has therefore for result a important change in the proportion between input and value added in the input-output tables. In order to correct this inconsistency between the different studies, the elements necessary to compute separately eating and drinking places in the earlier studies have been roughly estimated between 1947 and 1967.

The first point was to determine the total output of eating and drinking places. For 1947 this task was made easier with the information included in the original version of a table published by Leontief(??) and Evans and Hoffenberg (1952). The original study, although incompatible in its methodolgy with later studies, treats eating and drinking places separately. For 1958, 1963, and 1967 the

figures published by the Economic Growth Project at the Bureau of Labor Statistics (??) were used.

The main destination of eating and drinking places production is of course households consumption. This item is reproted in the NIPA (U.S. Department of Commerce, ??) in table 2.4 line 4. In each year the share of households consumption represents between 75 and 80% of the total output of the industry. For the other destinations of the product it isn't possible to find direct information. The following estimation method has been used. Starting with the demand structure for eating and drinking places in the 1972 study, an iterative method is then used to insure that the amount of input shown in each industry is compatible with the tentative level of demand for eating and drinking places product.

The input structure is determined in two step. As we have mentionned it, eating and drinking places are treated in the earliest studies as a "margin" industry integrated with trade. It follows that basic inputs are shown directly at the destination and that the margin is shown on the row of the trade industry. For each study the amount of basic inputs used for private consumption expenditure is shown in a separated tables which describe the bridge between the input-output classification and the detailled categories of the final demand (Simon, 1965; BEA 1971, 1974). In particular, these tables display for the category meal and beverages the contribution of each industry. If we are ready to assume that the method of production for private consumption is the same as the one for other destinations we can then determine the amount of inputs used by eating and drinking places. In these tables, the quantity corresponding with trade represents the margin added in the preparation of the meal. If eating and drinking places are represented separetely, this margin has to de decomposed between material inputs and value added. It is the second step of the

transformation. Without additional information, one must assume that this input structure is identical to the one of trade with one exception: oil products are a relatively large input of the trade industry because of the transport also carried by this industry. However it is hardly a characteristic of eating and drinking places.

Technical coefficients matrix

Once the input-output tables have been made as homogenous as possible in their methodology and aggregated in 41 industries, one can proceed in computing the technical coefficients in the usual matter: each entry of the table is divided by the total of the corresponding column. One must underlined that only the technical coefficients are used in the computation of the department data. Therefore it diminishes somewhat the importance of the methodological differences which remains between the tables.

Capital flow tables

The Bureau of Economic Analysis has published three tables of capital flows companions of the input-output studies of 1963, 1967, and 1972. These tables decompose the column "Gross private fixed capital formation" of the input-output table and show the commodity composition of the investment made by each industry described in the input-output study. What is described is these tables is gross investment and includes both replacement and expansion of the production capacity.

Combined with data on the stock of capital by industry these tables provided the basic information for establishing the depreciation coefficient matrices. Before doing these computations, it is also

necessary to make the capital flow tables comparable and to estimate them for 1947, 1958 and 1977.

Problems are identical to the ones met for the input-output tables. The rows of the original capital flow tables describe the utilization of homogeneous commodities rather than of heterogenous industry products. It is therefore necessary to premultiply these tables by the coefficients of the MAKE matrix of the corresponding years as it is done for the input-output tables.

However there are other problems of compatibility between these three tables. The most important is certainly the changes in the definition of capital goods and respectively intermediary goods. The formal definition of capital goods remained the same: equipment or structure which are in use for more than a year or are depreciated for tax purpose. But partly because technological change, partly because statistical revisions the list of capital goods changed. The most important case concerns dies for machine tools which were accounted for as intermediary goods before 1972 but are treated as fixed capital goods thereafter. The consenquces are particularely noticeable in the motor vehicle industry. Nuclear fuel also changed of category. We didn't try to ajust for these modifications.

Capital flow tables for 1947 and 1958 were estimated using a rAs adjustment method starting with the capital flow table of 1963, the investment column of 1947 and 1958 input-output tables, and the investment by industry provided by the Office of Business Analysis for the same years. The same method was used for 1977, using this time the capital flow table for 1972.

Capital flow tables describe only gross investment. Depreciation coefficients are obtain in the following manner. Total depreciation by industry comes from the statistics published by the Ofiice of Business Analysis at the Department of Commerce as part of their capital stock

data base. These series are computed using a perpetual inventory method.