Input-output systems in current and constant prices in the European Union after the introduction of ESA95

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Paul Konijn[1]

Eurostat, Luxembourg

abstract

The European System of Accounts 1995 (ESA95) obliges all Member States of the European Union to construct yearly supply and use tables and five-yearly (product-by-product) input-output tables in current and constant prices, in at least a breakdown of 60 products (according to the CPA classification) and 60 branches (according to NACE, rev. 1). This will yield within a few years from now a database of comparable tables of all EU countries. The opportunities that this will give for economic analysts are investigated.

However, behind the surface of this database, the actual statistical practices, i.e. the compilation methods of the tables, of the different countries will still vary considerably. This paper describes, in a qualitative way, different characteristics of the input-output systems in place in different countries. We will look at, e.g., the level of detail, the integration within the system of national accounts, the choice of units, the treatment of secondary products in the product-by-product input-output table, etc. Users of data should be aware of any underlying assumptions that are made when compiling the data.

As regards constant price tables, SNA93 and ESA95 did unfortunately not make an explicit choice concerning the choice of base year. In the process of harmonizing GDP growth measures within the European Union, Eurostat is now trying to harmonize the choice of base year by demanding the use of the previous year's prices (i.e. 'chain indices'). The consequences of this for the construction of supply, use and input-output tables in constant prices are investigated.

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1. INTRODUCTION

From next year (1999) onwards, all 15 Member States of the European Union are obliged to submit data to Eurostat following the definitions and methodology of the new European System of Accounts 1995 (ESA95 for short). The ESA95 itself is based on SNA93. As is well known, SNA93, and hence ESA95, include an input-output (IO) system in the system of national accounts. The ESA95 therefore also obliges the Member States to submit supply, use and IO tables to Eurostat. Eurostat will publish these tables in either paper or electronic form. See De March and Beutel (1998) for more information on the requirements of ESA95.

In a few years time, a considerable database of comparable supply, use and (symmetric) IO tables in current and constant prices will arise. This will obviously give enormous opportunities for IO analysts and other economists. In section 2 we will go briefly into the possibilities for analysis given by such a database.

However, if we look at the data in a bit more detail, we will discover that the statistical practices in Member States still differ. The question therefore can be raised if these differences have a significant effect on the comparability of the tables. Some of the characteristics of statistical practices in four Member States will be discussed in section 3.

Section 4 will specifically focus on the compilation of constant price IO systems. Eurostat is currently giving high priority to the harmonization of constant price calculations. Again, we will describe some characteristics of the constant price IO systems for the same four countries. The measures Eurostat proposes to take to harmonize constant price data, and their effects on the IO systems will be investigated.

Section 5 will conclude with some general remarks.

2. OPPORTUNITIES FOR INPUT-OUTPUT ANALYSTS

The ESA95 supply and use tables for the years 1995-1999 of level 60*60 should at the latest be submitted to Eurostat in 2002. After that, supply and use tables of year t-3 should be submitted annually. Some countries have negotiated exceptions to these requirements. E.g. Germany and Austria will until 2005 compile supply and use tables only two-yearly, Ireland will submit the first tables only in 2005, and Finland will use less detail until 2005. In 2005 all exceptions should cease to exist so that all Member States submit each year the same set of information.

The symmetric (product-by-product) IO table for 1995 will be required in 2002, the one for the year 2000 in 2003. Of course, exceptions exist for these tables as well. This submission includes three IO tables: one with total intermediate and final consumption (of imported and domestically produced

products), one with only the consumption of imported products and one with only the consumption of domestically produced products.

It should be realised that these are formal obligations to the Member States, laid down in law. Until now, all data submissions to Eurostat took place on the basis of a 'gentleman's agreement' based on ESA79 (the predecessor of ESA95). There was for example no obligation to compile supply and use tables, as they were not contained yet in ESA79. See De March and Beutel (1998) for an overview of the IO tables currently available at Eurostat.

Obviously, the resulting database of supply, use and IO tables under ESA95 gives enormous opportunities for detailed analysis of e.g. product flows in Europe, of productivity differences between countries, of production structures, consumption structures, etc. The introduction of ESA95 will facilitate a direct comparison of data in IO tables from different countries, whereas currently differences in classifications, booking conventions, etc. prohibit this.

The supply and use tables for example can directly be used to compare consumption and production structures of different countries. Shares of specific products in final consumption, shares of industries in countries' GDP (or in the GDP growth as constant price tables will also be compiled), shares of categories of final use in GDP, productivity growth in different industries, etc. can all easily be calculated and compared.

With the symmetric IO tables the indirect impacts of consumption of goods and services can be calculated. Supplemented with for example labour or energy data in physical terms, labour and energy contents of products in different countries can be analysed. That can then be used for example to calculate the direct and indirect energy and labour contents of the trade flows between the countries.

All tables to be submitted should contain a breakdown of imports and exports in intra-EU and extra-EU flows. This is useful for the compilation of supply, use and IO tables for the EU as a whole. That would require further information or assumptions on the use of the intra-EU flows by industries. For intercountry supply, use and IO tables an additional breakdown of the intra-EU flows by country is required. (The Intrastat system of foreign trade data does provide such a breakdown, but the reliability of these data seems not sufficient yet.)

The database of comparable supply, use and IO tables also form a valuable basis for the further development of comparable Social Accounting Matrices and other satellite accounts on e.g. environmental aspects of the economy.

3. INPUT-OUTPUT SYSTEMS IN CURRENT PRICES

3.1. Introduction: harmonization work of Eurostat

Eurostat plays a central role in the harmonization of national accounts in the European Union. One aspect of the harmonization work is the ESA95. Another important role is played by the so-called 'GNP Committee'. This

committee investigated for the past eight years various aspects of the national accounts of the Member States that influence the reliability and comparability of GNP figures for the purpose of the contributions of the Member States to the EU budget. E.g. the compliance of the GNP figures of the Member States with the ESA79 was consistently checked. Another part of the work is to check the exhaustiveness of the accounts, in order to have the most comparable GNP data as possible.

In the exhaustiveness project Eurostat frequently noted that the existence of an integrated IO framework is an important tool for the verification of the completeness of the accounts.

Nevertheless, the use of an IO framework as instrument for the integration of national accounts data has never been obligatory and is not made obligatory by the ESA95 either. The harmonization process is based on the principle of subsidiarity, which means that Eurostat only prescribes the outputs of the national accounts, i.e. *what* has to be measured and according to which *definitions*, but that the countries are free to decide *how* to measure. That means in this concrete case that countries are obliged to compile supply, use and IO tables, but the method of compilation is not prescribed.

The principle of subsidiarity is important because of the differences in statistical systems in the Member States. Large differences exist for example in the systems of enterprise surveying. As long as the starting point, i.e. the system of statistical sources, is different for each Member State, the methodology of combining these sources in national accounts and IO systems will remain different.

Eurostat is therefore also working on the further harmonization of the inputs of the statistical process. Examples are the Regulations on business registers and structural business statistics. With the implementation of these Regulations, a further harmonization of national accounts' methodologies will become possible.

3.2. Input-output systems in current prices in some EU countries

In this section we will briefly look at the main characteristics of the IO systems of some European countries. It is not meant to be an exhaustive overview, but rather to give some of the flavour of the differences in statistical practice in these countries. The countries are chosen such that the main differences that can exist are highlighted.

The relationship of the IO system with the national accounts is one of the main characteristics that will be investigated below.

Germany

In Germany the supply, use and IO tables play no significant role in the compilation of GDP and other major variables of the national accounts. The first years under ESA95, supply and use tables and symmetric IO tables will be compiled two-yearly. The basis for the compilation of the tables are the data compiled independently in the production and expenditure approaches, on output, value added, consumption, investments, foreign trade, etc.

For the calculation of intermediate consumption two approaches are used. The "input" approach uses mainly data from cost structure surveys (enterprise data, some annual, some four-yearly) to breakdown the total of intermediate consumption determined in the production approach into 58 product groups. This is subsequently transformed into data on intermediate consumption of homogeneous branches using the commodity technology assumption.

The "output" approach is a commodity flow system of around 3000 product groups and 58 industries where for each detailed product group the destinations of output and imports by homogeneous branch are determined (often on the basis of common sense). This commodity flow system is subsequently aggregated to 58 product groups. The results of the input and output approaches are then balanced in a symmetric product-by-product IO table. After the balancing of the IO table, the use table is re-calculated, so that a completely consistent set of supply, use and product-by-product IO tables become available.

The Netherlands

The Netherlands have a long-standing tradition of integration of IO tables in the national accounts. Since 1987 the balancing of data for the national accounts takes place in a detailed (about 800 product groups and 250 industries) supply/use framework.

The unit of observation is mostly establishment (or local kind-of-activity unit as it called in the ESA95). Most production surveys contain information on both production (in a quite detailed product breakdown) and intermediate use (also with product detail, but much less), and are annual. Therefore, each year a complete product breakdown can be made, in current and in constant prices, and the balancing can take place at this detailed level. GDP and other major variables are determined in this balancing process; hence the supply/use framework plays an essential role in the national accounts.

The symmetric IO tables however are a corollary of the system and play a very marginal role in the compilation of the accounts. An industry-by-industry table is compiled every year as a more or less automated step after the compilation of the supply and use tables. The product-by-product IO table is for the moment only compiled on an experimental basis.

France

In France, the system of supply/use balances and product-by-product IO table is integrated simultaneously. For about 500 products a balance is drawn up of supply and use in current and constant prices. These balances do not contain a breakdown of intermediate consumption by branches or industries. This breakdown is made in volume terms for about 90 products in the product-by-product IO table, on the basis of IO coefficients that are determined in a benchmark year using a special cost structure survey and expert knowledge on production processes.

Breaking down intermediate consumption according to IO coefficients will not lead to a balanced system: there will be differences for each product

between the total of intermediate consumption in the respective supply/use balance and the totals of intermediate consumption calculated according to the IO coefficients. An iterative balancing procedure then takes place to simultaneously balance the supply/use balances and the IO table (not only affecting intermediate consumption but also other categories of final use, notably changes in inventories). The results of the sector accounts on the value added of branches (income approach) are also taken into account. GDP follows from the integration of the IO table with the sector accounts.

The structure of the resulting IO table is to a large extent determined *a priori* by the IO coefficients. A reason for this system is that data on intermediate consumption by product (from enterprises nor from establishments) are not annually available. Data on output (with product breakdown) come from annual surveys to enterprises.

The supply and use tables required under ESA95 will be compiled on the basis of homogeneous branches (at least until 2005), instead of establishments. This will mean that the supply table is diagonal, i.e. no secondary production is distinguished. A supply table based on enterprises could be compiled however. Using the product-by-product IO table, a corresponding use table can be calculated. This is an option for the future.

United Kingdom

The UK has introduced an integrated IO framework a few years ago. In the past, product-by-product IO tables were compiled every five years, as an extension to the national accounts, rather than an integral part of them, without having a role in the compilation of GDP etc.

Since 1992, however, a system of "IO balances" is developed which is used for the balancing of national accounts data. The term IO balance refers in fact to a supply/use framework in a breakdown of 123 industry and product groups. The row and column classifications are fully symmetric.

Data on intermediate consumption with product breakdown are sometimes annually available, sometimes less than annually. In general, the surveys are being improved to collect more product data.

The compilation of the product-by-product IO tables is said to be continued on an annual basis as from the year 1995.

Conclusions

It becomes clear from the above short descriptions that the methods of compilation of supply, use and IO tables are quite different. Their roles in the system of national accounts vary from country to country *and* from table to table. This will affect not only the comparability of main aggregates such as GDP, but also of the tables themselves. The methods of calculation of the IO coefficients, for example, are very different. In France, they are more or less fixed for a benchmark year, and then eventually adjusted in the balancing process. In The Netherlands, the balancing process does not involved the symmetric IO table, which is determined more or less automatically

afterwards. The assumptions used in the compilation processes therefore are very different. Users of the IO tables have to be aware of these differences.

The differences in the systems are often due to differences in statistical sources. In particular, the availability of enterprise or establishment data on intermediate consumption with a product breakdown seems to be the determining factor for the way the IO system is set up.

Therefore, if IO systems were to become more comparable, the most important contribution would be to harmonize statistical sources. As said above, Eurostat is also taking steps towards this aim. Benefits could for example be expected from the Regulation on structural business statistics, a European Union wide enterprise survey that is currently in development. However, this Regulation does unfortunately not demand data on intermediate consumption by products.

4. INPUT-OUTPUT SYSTEMS IN CONSTANT PRICES

4.1. Introduction: harmonization work of Eurostat

Until recently, the harmonization work of Eurostat concentrated on the national accounts in current prices. This was mainly induced by the fact that the demand for comparable data for administrative purposes only concerned the levels of aggregates such as GNP and government deficit, and not their growth rates.

The harmonization of constant price data however got more and more important since the heads of state of the EU agreed on the so-called Stability and Growth Pact last year. This political instrument of ensuring the stability of the Euro uses 'real GDP' (i.e. GDP corrected for price changes) to determine when a Member State is in a severe recession, in which case an exception for an excessive deficit can be made. Here we therefore find the first administrative use of constant price national accounts data.

It appears however that the current state of comparability of constant price data is low. The reliability of these data might not be very high either, as for example the estimation of the volume growth of services is clearly underdeveloped.

The incomparability of data is, among other things, due to a lack of sufficient guidance in SNA93 and ESA95. For example, the choice of base year is more or less left open, although a preference is expressed for the use of 'chain indices'. Differences in base years between countries (besides many other issues) can however have a serious impact on the comparability of the volume growth rates of the economy.

Therefore, Eurostat is now giving high priority to the harmonization of price and volume measures. This has however also an impact on the IO systems, as we will see. We will first briefly describe some of the main characteristics of constant price calculations in the same countries as above. Then, we will look at the measures that Eurostat wants to take to improve the comparability of

constant price data on the short and long term. Then, we will investigate the consequences for the IO systems.

4.2. Input-output systems in constant prices in some EU countries

As for current prices, we will briefly discuss some of the main characteristics of constant price IO systems in some EU countries.

Germany

Deflation is carried out at a very detailed level (more than 3000 products). For outputs this is done in a classification of 60 industries, for intermediate consumption in 60 homogeneous branches. On the basis of an aggregation to 60 products, aggregate price indices for intermediate consumption are calculated which are then used to compile the constant price use table with an industry classification. The constant price tables are compiled in a step after the compilation of the current price tables.

At the moment, the base year in use is 1991. When ESA95 is implemented the base year will become 1995.

The Netherlands

Supply and use tables in prices of the previous year are compiled simultaneously with the current price tables, in the same level of detail. The level of GDP and the GDP volume growth rate are therefore determined simultaneously in a process where the supply/use framework plays a fundamental role as balancing instrument. As for the current price tables, the symmetric IO tables in prices of the previous year are a corollary to the supply and use tables in prices of the previous year.

France

The balancing of supply and use is carried out simultaneously in current prices and prices of the previous year at the most detailed level, in connection to the symmetric IO table in volume terms. The results are subsequently chained to a fixed reference year (which is 1980 at the moment, but will be moved to 1995). These data are then adjusted to compile an additive set of data, including the supply, use and IO tables, expressed in this fixed reference year. Hence, the IO framework is available in both prices of the previous year and prices of a fixed reference year.

United Kingdom

Constant price calculations are carried out within the production and expenditure approaches to GDP, but do not yet use an IO framework. The constant price supply, use and IO tables are still in development. The current price IO balances are however used to derive weights for the constant price calculations.

4.3. Measures to be taken

A legal text (a Decision of the European Commission) is currently in preparation, which contains a number of clarifications to the guidance on price and volume measures given by ESA95.

First of all, it says that Member States should calculated price and volume measures in the national accounts at the most detailed level possible, at least at the level of 60 products that has to be distinguished in the IO system. It is recognised that the more detailed is the product classification, the more accurate deflation can be carried out. Clearly, the supply/use framework plays a central role here in the determination of the product classification.

Secondly, for the sake of comparability and easiness of use, Member States should use Laspeyres volume and Paasche price indices (in the national accounts).

Thirdly, Member States should derive the weights for the aggregation of volume indices of different products from the values in the previous year; i.e. the previous year should be the base year. This would yield more accurate growth rates than if the weights would be derived from a fixed base year. At the moment, various different base years are in use in the Member States. In the course of the next few years, in principle all Member States should move over to using the previous year system. See annex for an overview of the base years currently in use and future developments.

Together with the use of Laspeyres volume and Paasche price indices, the use of previous year's weights yields an additive set of national accounts data in prices of the previous year. If another reference year has to be used, the indices need to be 'chained', and additivity will be lost[2].

Besides these three general principles of calculation of price and volume measures, the Commission Decision will contain various requirements for the deflation of specific products. It also establishes a research program for the next few years to investigate the deflation of problematic products such as financial intermediation, construction, business services and non-market services.

4.4. Consequences for input-output systems

As said earlier, ESA95 also requires the compilation of supply, use and symmetric IO tables in constant prices. The specific problem for supply, use and IO tables is that they have to be additive. It is clear that IO tables in constant prices of which the row and column totals do not equal are useless (as far as the use of the volume data in monetary terms is concerned, the growth rates and price indices will of course still be useful).

It should be realised however that additivity of constant price data is nothing more than the fortunate consequence of the use of Laspeyres volume and

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[2] The term 'chaining' is often misused to denote the use of previous years weights, while in fact it only concerns the recalculation of price and volume measures to another reference year.

Paasche price indices. Additivity of constant price data cannot be justified by referring to accounting identities as for current price data, since these identities do not hold if prices and volumes are combined which do not come from a real economic situation.

The problem that arises is that there will be for some years two groups of countries (see table in annex): those that will use a fixed base year's weights and those that will use previous year's weights. The first group will compile supply, use and IO tables expressed in prices of the fixed base year, while the second group will compile them expressed in prices of the previous year. Hence, as long as countries are not using the same weighting system, there will not be a set of constant price supply, use and IO tables in the same reference year.

A solution to this situation, which is in fact applied in France (see above), might be to 'chain' the IO tables back to a fixed reference year and subsequently remove the mathematical discrepancies arising from the chaining by one or another method. This then will yield additive tables, but the growth rates derived from such tables do not correspond to the growth rates that were calculated previously on the basis of previous year's weights. In France, consequently, two different growth rates of the economy exists, one on the basis of the previous year's weights and one arising from the additive IO system in a fixed reference year. This is an acceptable situation as long as users accept and understand these differences, and use the appropriate set of data for the appropriate purposes. It is important to stress that the 'official' growth rates of the economy should be those derived with the previous year's weights.

It is sometimes suggested that changing the base year annually requires a supply/use framework. This does not seem to be true in principle, although a supply/use framework facilitates its implementation. What is required for annually changing the base year is the availability of current price data for the previous year (which have to be used as weights) in the detailed product breakdown desired for an appropriate deflation. Detailed product data are however usually not immediately available. In practice, in many cases for the preliminary estimates of economic growth less detail is used, while the detailed deflation procedures are only applied for the definitive calculations.

5. FINAL REMARKS

The role of supply, use and IO tables in national accounts will become more and more important. Although there is no formal obligation for countries to use an IO framework as integral part of their system, more and more countries are implementing supply and use tables as main integration instrument, both for current and constant prices.

This has obviously an effect on the actual structure of the IO systems. Their characteristics will be determined by national accounts requirements rather than IO analysts' requirements.

We have seen that the characteristics of the systems also depend largely on the availability of data. As long as the statistical sources underlying the IO

systems differ in terms of coverage, frequency, variables, quality, etc., among countries, it cannot be expected that the methodology of compiling supply, use and IO tables will be much further harmonized.

Users should be aware of the different compilation methods. A same appearance does not always mean real comparability.

ANNEX

Current and future practices of EU Member States on the choice of base year

	Base year currently in use	Base year in use at introduction of ESA95 in 1999	Change to previous year base[1]
Austria	1983	1995	2005
Belgium	1990	Previous year	
Denmark	1980	1990	2000
Germany	1991	1995	2005
Greece	Previous year	Previous year and fixed base year	
Spain	1986	1995	2003
Finland	1990	1995	2005
France	1980 and previous year (GDP growth rate derived from 1980 base)	1995 and previous year (GDP growth rate derived from previous year base)	
Ireland	1990	1995	2004
Italy	1990	1995	2003
Luxembourg	1985	Previous year	
Netherlands	Previous year	Previous year	
Portugal	Previous year	Previous year	
Sweden	1991	Previous year	
United Kingdom	1990	1995	2003

[1]This information is taken from the annex to the draft Commission Decision on price and volume measures, concerning the transitional periods demanded by Member States for the application of the previous year as base year.

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