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THE NEW INTEGRATED APPROACH TO NATIONAL ACCOUNTS

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THE NEW INTEGRATED APPROACH TO NATIONAL ACCOUNTS

1. Introduction

The European System of National and Regional Accounts¹ (Esa95 – the European guidelines on national accounting) underlines the fact that the annual national accounts aggregates (hereafter only national accounts) should be derived from an input-output framework. Furthermore a complete coherence between national accounts and the input-output framework by means of Supply and Use Tables (SUT) should be guaranteed in reference to the year of estimation considered to be definitive.

Producing SUT as an integral part of the national accounts or deriving national accounts from an input-output framework rises arguments in favour and against both from the theoretical and the operational domains. In this paper we want to describe the Italian experience which is almost 20 years long, starting in 1987.

The aim of this paper is to present our contribution to the debate on the possible alternative methodologies in compiling SUT as the transition from the old approach to the new one has been long and complex. This debate could lead to an update of the new Eurostat Input-Output Manual which is a draft and may be completed and improved in some of its parts².

2. The integrated approach to national accounts, between past and future

Starting from the end of the Eighties, the Italian National Accounts Department (or NA Department) has introduced the balancing of the estimates of the supply and use account by homogenous production branches using a symmetrical input-output table (IOT) product by product³.

The integrated structure of the symmetric input-output table and the national accounts (SIO/NA system) has been used not only for benchmarking but also to update the estimates. Every year a complete table of the total flows, at market prices, was estimated. The approach was based on new values of the frame data of the IOT, and on a series of indirect estimates on the structure of intermediate transactions and of distribution margins.

The preliminary levels of the supply and use aggregates, estimated independently and inserted in this scheme, were then balanced with the algorithm implemented for the national accounts⁴, thus leading to the final estimates. This estimation method ensured greater coherence between the estimates of the demand side and those of the supply side, it increased the degree of exhaustiveness of the Gross Domestic Product (GDP), and guaranteed perfect integration between national accounts and input-output tables.

1 Eurostat (1996).

2 See Eurostat (2002), cit. – Introduction.

3 Picozzi (2000b).

4 See Borgioli (1996).

This approach, which was derived from a methodological choice of the NA Department, and which was not particularly widespread in other European Countries⁵, was, in a sense, ahead of its time. In the Esa95, in fact, it is specified that⁶ the national accounts have to be derived from an input-output framework especially in reference to the year of estimate considered definitive, so that a complete coherence between national accounts aggregates and the supply and use tables is guaranteed.

Italy, therefore, was in advance since it only had to change over from the old symmetrical input-output framework to the new system (SUT/NA). which is based on the supply and use tables, and incorporates a modified balancing system to provide simultaneously the final estimates of the demand and supply aggregates as well as all the flows necessary to form the supply and use tables at the basic prices and at purchaser's prices.

The experience gained with regard to the integration of input-output framework and national accounts estimates led Istat to feel optimistic and at the beginning of the year 2000 the Department for National Accounts affirmed that “[...] it has been scheduled to implement the 1995 table during the forthcoming months and to publish it with great advance with reference to the European Regulations (end of 2002)”⁷.

Istat succeeded in fulfilling the European Regulations deadline (December 2002). However the first SUTs sent to Eurostat “has not been published elsewhere; in fact it has been considered more advisable to think and reflect more deeply on the whole methodology”⁸.

In spite of the experience gained, the optimistic view and the respect of intermediate deadlines, the transition to the supply and use tables has been difficult and full of unexpected circumstances because the estimate of the SUT was not part of the cultural tradition of Italian National Accounts; in fact it was necessary to start a real conversion process of the approach followed to assess all the accounts thus re-considering and re-designing all the logic and methodological sequences which have been considered, for years, as foregone.

In the new account framework there were some major changes:

1. the supply table adopts the approach by economic activity branches and products while the IOT was based on the approach by homogenous activity branches;
2. it has been estimated two new matrices, one for the production and one for the intermediate consumption; the second coherent to the first one;
3. the concepts of basic prices and purchaser's prices substitute the previous concept of producer's prices and market prices.

These innovations made the general organization of National Accounts activity difficult and problematic. At the beginning all the efforts were addressed at the implementation of a new software necessary to compile and implement all the accounts of the SUT/NA system while forgetting the human resources training. All the staff involved in the implementation of the new system (SUT/NA) needs a specific training on SUT which are a powerful and complex tool. A basic knowledge of the SUT is compulsory to provide suitable estimates for the system.

5 The Stone method has recently been applied in the United Kingdom, and experiments are in progress in Canada and the United States.

6 Eurostat (1996), chap. 9.

7 See Picozzi (2000)

8 See Mantegazza e Mastrantonio (2003), La matrice input-output nazionale: stato di fatto e prospettive, Paper presented at the Seminar “L’approccio input-output per il ciclo programmazione-monitoraggio-valutazione”, Rome 18 December 2003

Finally it is necessary to remember that the SUT/NA system as been introduced together with the 2000 benchmark of national accounts aggregates⁹ which had a great impact on the estimates and which introduced further elements to be analysed and integrated.

Let us mention the main innovative elements of the benchmark:

1. The revision of the FISIM estimate and their allocation
2. The adoption of the new classification¹⁰ ATECO 2002
3. The update and the revision of estimates affected by reserves of the GDP Committee
4. The adoption of chain indexes
5. The new processing and editing of company data

After two years of intense work in December 2005 Istat published the main results of the general revision of the annual estimates¹¹ and compiled the first supply and use tables perfectly coherent and integrated with the annual estimates.

3. The new scheme of the national accounts

The new approach at the basis of the integrated estimate of the national accounts aggregates and of the supply and use tables is based on the analysis, correction and, finally, balancing of the discrepancies among the supply and use aggregates, independently estimated, and includes the construction of a constraint system that allows the simultaneous balancing of all the accounts and tables, which compose the supply and use tables framework at purchaser's prices and at basic prices.

This method is applied in reference to each year of estimation of the national accounts, whether it is a benchmark year, a year in which the estimate is definitive or a provisional year¹². The procedure for estimating the aggregates that enter the balancing system and the quality of the information contained in them, obviously, changes, but the method with which the estimates are assembled and analysed remains identical.

Annually supply and use tables, according to the Eurostat input-output manual, should be implemented with a detail of 60 industries¹³ and 60 products¹⁴. According to the Italian approach SUT are implemented with a detail of 101 industries and 101 products.

We start by forming preliminary estimates of all the supply and use tables at purchaser's prices and at basic prices:

1. production matrix at basic prices;
2. cif import matrix use side
3. valuation matrices (distribution margins and matrices on product taxes/subsidies);
4. use table at purchaser's prices

9 See Caricchia (2006)

10 The italian version of the classification Nace Rev 1.1

11 See Istat (2005) CONTI ECONOMICI NAZIONALI ANNI 1992-2000 Principali risultati della revisione generale, Nota Informativa December the 22nd, 2005.

12 For which the estimates will be updated

13 NACE Rev. 1 divisions

14 CPA divisions

The general picture drawn at the beginning with the very first figures estimated, generally presents rather high discrepancies between supply and use totals by product. This is considered normal and even desirable. In fact, the entire procedure involves about 54,000 numbers, which come together to form the aggregates of the supply and use estimated by means of multiple independent sources, each of which must be treated in a different manner in order to be guided towards the definitions of the national accounts. The probability of finding errors, omissions and incongruence is very high. This first phase of the analysis work is particularly long and delicate.

The task of reducing discrepancies is accompanied by the patient analysis of compatibility and coherence. In fact, one must never consider a negligible discrepancy as a single indicator of correctness and coherence of the aggregates that form a supply and use row of a specific product and, subsequently, of the entire system. It is also necessary to make use of a result validation system highlighting all the interrelations between the aggregates, in order to verify and evaluate, at every step of the process including the variation of a specific flow level.

In this sense, one of the key checking variables is the value added by industry which, according to this account construction method, is obtained as the difference between the production by industry (sum of the columns of the production matrix), and the costs by industry (sum of the columns of the intermediate costs matrix). This, therefore, is a transparent variable for the system, which, however, is directly and indirectly affected by any possible change in the levels of the aggregates that contribute to its formation¹⁵.

It is also necessary to keep in mind that the visible interrelations between the total flows at purchaser's prices hide relative relations between aggregates at basic prices and aggregates at purchaser's prices, and between domestic production *input* and importation *input*, which are also to be analysed.

Implicitly all these interrelations among aggregates were also present in the symmetrical framework (IO/NA), but remained in a shady area pertinent exclusively to those who drew up the tables, rather than becoming part of the National Accounts general knowledge¹⁶.

The change-over to the supply and use framework did, in fact, force us to significantly improve our result analysis abilities, since we could count on an instrument which was particularly powerful in identifying gaps and incoherence in the flows of goods and services obtained from different statistical sources, which, despite being based on deeply different definitions and classifications, described, however, the same economic phenomena¹⁷.

As all the errors, omissions, incoherence and incompatibilities are discovered and eliminated¹⁸, the degree of integration among all the sources is reinforced, and the discrepancies reduced until one reaches a level considered acceptable and which, generally, is always found to be below 0.17% of the total supplies.

15 For example, if one changes the level of production of a specific product, this variation has an effect: on the production of all the industries producing this product, on the intermediate consumption of the product in question and, therefore, on the intermediate costs of all the industries that use that product. The combination of all these effects leads to new levels of value added by industry, the coherence of which must be checked.

16 Whenever we refer to the discipline, the word National Accounts will be written in capital letters.

17 Consider, for example, the enterprises' surveys and the Prodcum survey on industrial production: by processing both of these, one can reach an estimate of production that is coherent with the definitions of the national accounts, but, in one case, one obtains a production by industry and, in the other, a production by product. In the symmetrical scheme, the two estimates were not comparable, and the one deduced from the enterprises' surveys, was privileged. In the new scheme, the two estimates are perfectly integrated and their joint analysis improves the coherence of the results.

18 To this purpose, a series of interactive checking tables were created, which allowed for a progressive depth of analysis on growth rates, percentage incidences by row and by column and their variation in historical series, analysis of the per capita values, of the value added-production correlations, of the relations between production by industry and by product...

Table 1 shows the discrepancies in the estimates for the year 2000 that were considered not correctable, and which were then eliminated using the balancing algorithm (the full table, like SUT, is implemented with a detail of 101 industries and 101 products).

Table 1: Supply and use balance by product at purchaser's prices: pre-balancing discrepancies - year 2000 (million Euro)

| Products | Production at basic prices | Imports cif | Net taxes and distribution margins | Total supplies at purchaser's prices | Intermediate consumption | Final consumption | Gross capital formation | Exports | Total uses at purchaser's prices | Supplies – uses |
|-----------|----------------------------|-------------|------------------------------------|--------------------------------------|--------------------------|-------------------|-------------------------|---------|----------------------------------|-----------------|
| Agricult. | 47.121 | 9.258 | 23.399 | 79.778 | 46.784 | 28.480 | 734 | 3.870 | 79.868 | -90 |
| Industr. | 989.954 | 250.471 | 324.892 | 1.565.317 | 703.465 | 381.993 | 223.382 | 257.148 | 1.565.988 | -671 |
| Services | 1.275.985 | 40.802 | -221.269 | 1.095.518 | 501.747 | 541.475 | 22.931 | 33.286 | 1.099.439 | -3.921 |
| Total | 2.313.060 | 300.531 | 127.022 | 2.740.613 | 1.251.996 | 951.948 | 247.047 | 294.304 | 2.745.295 | -4.682 |

Only in this phase, when one is no longer capable of ascribing to a single aggregate rather than to another the discrepancy generated on each row, one balances the system using the tested¹⁹ method by the NA Department.

The balancing method applied includes two fundamental steps:

1. Determining the accounting constraints that the system to be subjected to balancing must meet;
2. Ascribing a reliability (or variance) index to each of the accounting flows, part of the constraint system.

It was therefore necessary to build a constraint system, which allowed for simultaneous balancing of all the accounting tables that contributed to the estimation of the SUT at purchaser's prices and at basic prices, guaranteeing all the accounting identities and imposing:

- The identity for each product (production + import = intermediate consumptions + final consumptions + gross capital formation + export);
- The identity for each industry (production = intermediate consumptions + value added);
- The coherence between the two different types of evaluation (identity between the total supplies and the total uses, at both basic prices and purchaser's prices);
- Coherence of the changeover from the *use* table at purchaser's prices to the *use* table at basic prices.

To each value of each aggregate forming each of the constraint equations, a variance was then attributed, corresponding to its degree of "relative reliability", based on a hierarchy of sources and calculation methods established in the field of the national accounts²⁰.

Once the initial estimates, constraints and variances have been defined, the balancing algorithm supplies a balanced estimate of all the accounting scenarios of the supply and use tables. These tables may be summarised and subjected to an initial analysis by means of the supply and use balance table by product

19 Stone, Champenowne, Meade (1942), Antonello (1990), Borgioli (1996a), Puggioni (1998), Nicolardi (1998) and Mantegazza Mastrantonio (2000a).

20 To the aggregates to which one ascribes a lower level of reliability, due to the underlying basic data or to the calculation techniques with which they were obtained, a relatively higher variance is assigned and, vice versa, to aggregates considered relatively more reliable, a lower variance is assigned or, for example, as in the case of taxes, a variance equal to zero is assigned.

at purchaser's prices, which contains all the information necessary for estimating the GDP at market prices²¹.

Table 2: Supply and use balance by product at purchaser's prices: balancing results - year 2000 (million Euro)

| Products | Production at basic prices | Import cif | Net taxes and distribution margins | Total supply at purchaser's prices | Intermediate consumption | Final consumption | Gross capital formation | Export | Total use at purchaser's prices |
|-----------|----------------------------|------------|------------------------------------|---|--------------------------|-------------------|-------------------------|---------|--|
| Agricult. | 47.133 | 9.258 | 23.337 | 79.727 | 46.712 | 28.415 | 731 | 3.870 | 79.727 |
| Industry | 990.122 | 250.474 | 324.361 | 1.564.958 | 703.007 | 381.921 | 222.884 | 257.147 | 1.564.959 |
| Services | 1.277.232 | 40.804 | -220.679 | 1.097.356 | 500.732 | 540.467 | 22.874 | 33.284 | 1.097.356 |
| Total | 2.314.487 | 300.536 | 127.020 | 2.742.042 | 1.250.451 | 950.802 | 246.488 | 294.301 | 2.742.042 |

The results of the balancing process are subjected to further checks in order to verify how the initial estimates were modified by the reallocation of the discrepancies, since the constraint system applied guarantees the balancing of the tables but not necessarily their coherence. Even for the balanced aggregates, therefore, a series of interactive checking tables were created, which, above all, identify the presence of negative values²². Any further incoherence of the system leads to analysing all the work phases once again until the process is closed and the final estimates are coherent (from an accounting point of view) and balanced.

The methodological approach just described is at basis of the estimates of 14 supply and use tables which refer to the time series 1992-2005. The SUTs are perfectly integrated with the national accounts time-series thus incorporating the joining up between the 1992 benchmark and the 2000 benchmark as well as the main aggregates reconstruction up to 1970 (1970-1991 time series).

4. Updating and re-constructing the system: the double standard

The aim of this study is not to reflect on the nature and extension of the revisions. Rather, it is important to highlight further elements of the procedure developed for the SUT/NA system considering the important methodological innovations introduced. This section is dedicated more in detail to the so-called double standard, a methodology which has been particularly useful for the 1992-1999 time-series reconstruction.

The double standard is based on the availability of two separated and independent data-sets. In fact the time-series re-construction was based on the availability of:

1. the 1992-2000 SUT tables coherent with SIO/NA system, sent to Eurostat between 2002 and 2003 with reference to the European Regulations;
2. the new components of the 2000 SUT table estimated for the benchmark published in 2005.

The double standard consists in implementing simultaneously two complete SUT, referring to completely new elaborations and to updates of old table, thereby obtaining three important results:

1. to verify the direction towards which the system is going;
2. to verify any innovations and anomalies that interest some sectors;

²¹ **Total of production at basic prices + total of net taxes – total of intermediate consumption at purchase prices.**

²² This does not depend so much on the entity of the discrepancy that the system must absorb, but rather on the number of "full cells" on which the residual value of a specific product can be reallocated, on the value of the variance corresponding to each cell and on the underlying constraints.

3. to design a coherent plan for constructing the historical series.

Table 3 highlights schematically the procedure adopted. New data are progressively introduced into a balanced (old) SUT/NA system.

Therefore, the integrated 1992 IO/NA scheme represents the starting point from which coherent (old) 2000 tables are derived. Though the innovations and the transformations necessary for reaching the new integrated SUT/NA 2000 system were very numerous²³, for simplicity of exposition, we will only examine the impact of the following three:

1. The structure of the new production matrix;
2. The new production levels;
3. The new intermediate consumption matrix.

Table 3 – Double standard: process phases

| Description | New production structure | Discrepancy % | New production levels | Discrepancy % | New intermediate consumption | Discrepancy % |
|-----------------------------|--------------------------|---------------|-----------------------|---------------|------------------------------|---------------|
| Agriculture | 2 869 | 4.0% | 5 428 | 7.3% | - 2 586 | -3.5% |
| Energy | - 7 025 | -4.2% | - 2 273 | -1.3% | 8 904 | 5.2% |
| Industry | 9 683 | 0.8% | 51 490 | 4.2% | - 22 762 | -1.9% |
| Building | 6 919 | 5.1% | 14 114 | 9.9% | 14 354 | 10.0% |
| Trade & transports | 43 962 | 16.2% | 71 487 | 24.0% | 26 174 | 8.8% |
| Services to enterprises | - 22 992 | -4.7% | 2 101 | 0.4% | - 4 334 | -0.8% |
| General Gov. + Serv. to Hhs | - 33 416 | -10.9% | - 16 695 | -5.1% | - 5 414 | -1.7% |
| Total | 0 | 0.0% | 125 653 | 4.6% | 14 336 | 0.5% |

The first phase of the double standard regards, as previously said, the production structure. As highlighted in table 3, while the new data²⁴ do not present discrepancies on an overall level since the level of production remains unchanged, they do show some significant discrepancies at a product level: the most important ones affect trade and transports sector as well as services of General Government and to households.

After having acquired the new structure of the production matrix we move on to the second phase, that is the new production levels. Consequently the situation changes significantly. The overall discrepancy is very high and, considering the percentages, especially for trade and transports sector and for building sector. The discrepancy relative to the services to General Government and to households is more than halved.

23 As previously mentioned, the adjustment of the tables to the new estimation of the FISIM and the relative distribution is present both in the old version and in the new one, even though the new FISIM estimation is a new aspect of the 2000 benchmark.

24 The data indicated in the table of this section and of the next one refer to an aggregated version of the level 1 structure of the CPA classification (Sections). In particular, sections 2-3-4 (called industries) and sections 7-8 (services to enterprises) were aggregated. The only change adopted by the standard classification system was the distribution of electricity and gas, which went from being included in section 6 (trade and transports) to section 2 (energy), this owing to a homogeneity question when treating the sources. This aggregation was necessary only in these synthetic tables while the standard tables were constructed with the level of detail required by Eurostat.

Finally (third phase), new data are acquired on the intermediate uses, which, by reducing the overall discrepancy, reduce many problems but confirm the unbalances affecting building and trade and transports sectors, even highlighting a new question relative to energy.

For these products (sectors) the re-construction of the SUTs was completely based upon a complete revision of the previous time-series while, for the other products it was possible to refer to the time-series already produced and available. Therefore the double-standard methodology provides information on the coherence of the SUT/NA system and is an important support for re-constructions and updates when there are important changes in the estimates.

5. Answers to some questions and future plans

Istat is very satisfied for the results attained and the data-sets published, but at same time it has considered as very important to start a period of debate and reflection about our experience, trying to involve both Countries which have a strong tradition in implementing SUTs and Countries, like Italy, which have only recently introduced supply and use framework. The debate, till now, has been essentially within Italian national accountants and it has focused three main aspects here represented with questions to which we try to provide a first answer:

1. What were the strong and the weak elements of the IO/NA system used before adopting the SUT?

The main strength was the overall coherence of the schemes adopted, to the point that, generally, it was possible to reconstruct the historical series of the SUT up to 1992 and have series of integrated national accounts.

The main weakness point regarded the structure of the intermediate consumption' matrix and the concomitant series of data on the value added by homogeneous production branch and at producer's prices, which resulted in being not very comparable with the new estimates of the value added at basic prices by economic activity branch.

2. What are the main problems in implementing and updating a SUT/NA system?

The main problem regards the construction of the valuation matrixes, that is to say, the matrix of trade margins, of transport margins and of VAT. The input-output manual contains aspects that are not very clear. We can mention one among others: who is to compile the matrices and based on what sources? Trade and transport margins are compiled integrating and merging supply and use information and, thus, the matrices should be formed, reconciling different data; but what is the best procedure for integrating and reconciling the information? Istat had to deal with methodological and organisational problems in order to reach a solution, which can, of course, be improved.

3. To what extent can the integration work carried out by Istat be improved?

Regarding the previous point, we must say that, despite the commitment of many, the estimates of the margins can still be improved and generally speaking the SUT/NA system could become more efficient.

The constraints deriving from the balancing are, probably, excessive. A higher efficiency and overall lightness of the system would enable to introduce a series of verification of the coherence between the SUT and the evaluation matrices.

Generally, a central objective of future works will be that of identifying the minimum set of information necessary for updating all the data in order to reduce working times. The new SUT/NA system implies too long and heavy working times for the non-definitive years estimates.

Some new research projects have already been started to make the system more efficient, such as a balancing of the SUT at basic prices and a balancing of the SUT at purchaser's prices no longer simultaneously but sequentially. In general, we are trying to decompose differently the phases of a work that could be organised differently, more functional to the SUT/NA schemes.

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