PRESENT PRACTICES AND FUTURE DEVELOPMENTS

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1. Introduction

The last input/output table of the Italian economy for the year 1992 was disseminated by the National Statistical Institute in June 1999.

The table maintains certain important elements of the previous ones. It is in fact a symmetric table[1] and may be considered a table by homogeneous production branch, as the estimation of labour units according to census data was branched out into primary and secondary productions, and then re-aggregated by homogeneous production branches. The cost structure was estimated with reference to the typical production line of the branch. Value added and production, calculated using labour units in order to expand to the universe the per-capita values derived from statistical surveys, may also be considered as approximate calculations by homogeneous production unit. Lastly, a product-transfer vector was developed taking into account joint productions, other secondary production, in-house developed software and a few residual sales of the Public Administration.

The new table, alike the previous ones, is presented in its départ-usine price and market price versions; in the latter pattern of presentation, even though the aggregates are built on the basis of the definitions of the new accounting system, the table deviates from ESA95[2] recommendations.

In fact, the regulation envisages the calculation of a *use* table at purchase prices, a *supply* table at basic prices later converted into purchase prices, and the calculation of a symmetric table at basic prices.

Therefore, as long as it represents a sort of compromise between the old presentation pattern and the consistency of calculations with the new accounting system, the 1992 table (IOT92) may then be considered only as the starting point for the new annual *supply and use* tables to be drawn up, according to the ESA regulations, by year-end 2002, with reference to the period 1995-1999.

The IOT92 incorporates:

1. the new *NaceRev.1* classification of economic activities, *Coicop* data on family consumption, *Cofog* data on public administration consumption and economic destinations;
2. a new estimation of labour units;
3. the new levels of branch calculations for the benchmark year 1992;
4. an estimation of cost structures obtained from a direct survey;
5. an estimation of the following matrixes:
   - trade and transport margins;
   - VAT
   - imports
6. the integration of market and non-market production calculations by branch of economic activity;
7. a new technique for the simultaneous balancing of all accounting prospects.

The IOT92 was not based on from product-flow calculations carried out independently for each business activity branch, as in the case of former input output tables[3], but according to a tested pattern used every year in the National Accounting to balance resource and use accounts in a framework of building by aggregates and search of a simultaneous system

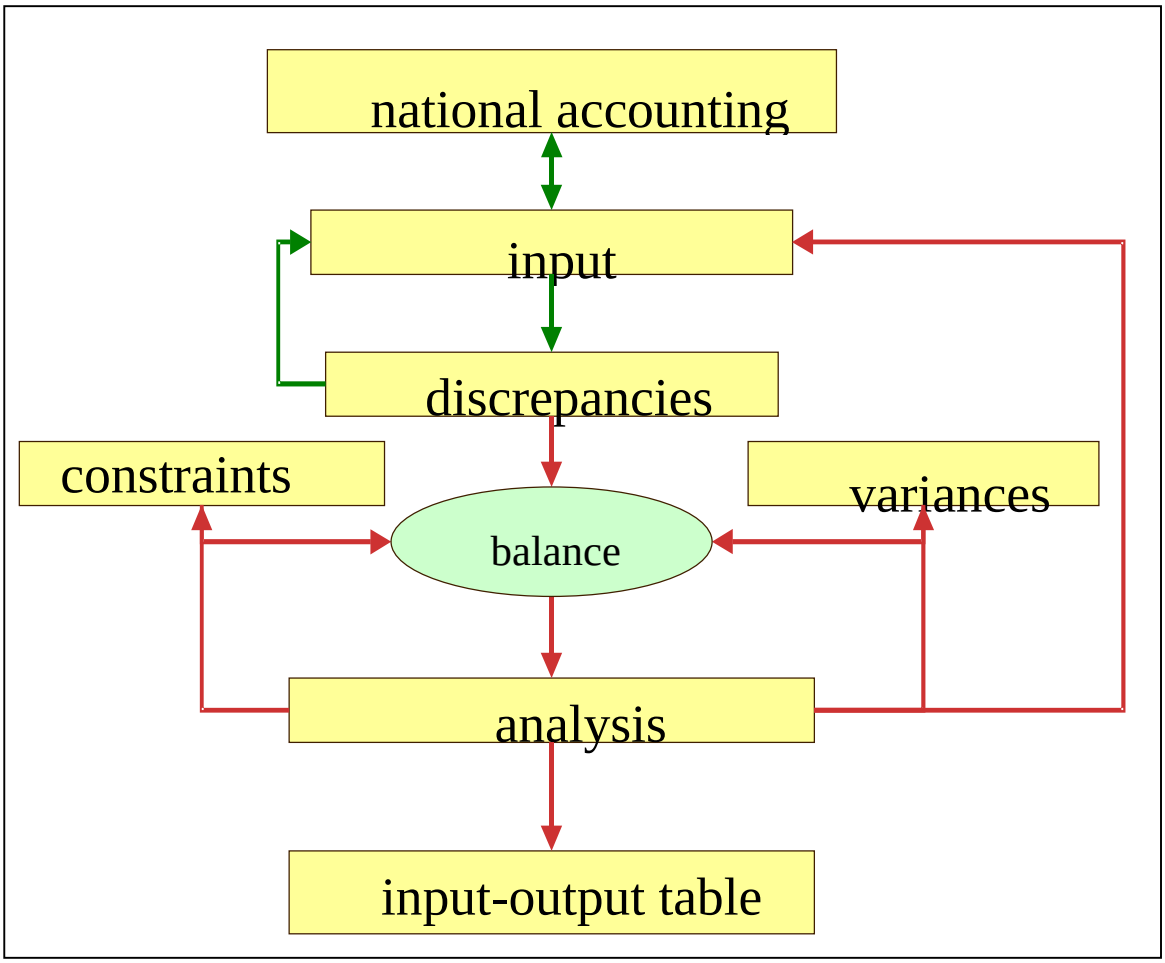
[1] Picozzi (2000a).
[2] See Eurostat (1996), chap. 9.
[3] With the exception of certain special branches such as energy and building construction, that were built by rows.

balance. This entailed a very strong correlation between the preliminary data supplied by the National Accounting and the results of the input-output table.

Therefore, the full description of the techniques used to build the 1992 table is very similar to the description of the techniques used to build all the aggregates for the benchmark year[4].

The following chapters describe the procedure followed to build the input-output table for the year 1992, structured into 92 branches according to the new *ATECO91* classification; the following diagram summarises all stages of the table building process from the preliminary National Accounting estimates.

Diagram 1.1 – The construction of the IOT92



[4] Picozzi (2000b)

2. Inputs Required for the Construction of the IOT92

The input-output table includes a set of calculation sections that may be recapitulated as follows:

Table 2.1 – Sections Calculated by the IOT92

Input-Output Tables	**Type of Flow Calculated**		
Market Prices	Domestic Production	Imported Production	Total Production
Départ-usine Prices	Domestic Production	Imported Production	Total Production
Trade Margins	Domestic Production	Imported Production	Total Production
Transport Margins	Domestic Production	Imported Production	Total Production
VAT	Domestic Production	Imported Production	Total Production

Market price estimation includes:

- basic prices;
- net indirect taxes on products and services;
- distribution costs (transport and trade costs incurred by companies to deliver their products to intermediate and final users).

The trade and transport rows of market-price tables contain only a small part of the production of these two branches - i.e. mostly, the production of related activities such as brokerage of agents and sales representatives is included in trade and the transport of people is considered in the transport branch.

In order to equalise the row and column totals of each branch, the rows of trade and transport margins have to be added to the market-price table, besides the primary sectors. Trade and transport margin rows, in correspondence with trade and transport columns, give the total of all respective margins with a negative sign.

By removing the distribution margins from the market-price table, an estimation of flows at *départ-usine* prices is obtained: the trade and transport rows of *départ-usine* prices tables report both the distribution margins charged to the inputs and the direct costs.

Therefore, the following preliminary data on total flows were required to build the input-output table:

- a matrix of costs by branch;
- a matrix of final uses by branch;
- a matrix of trade margins[5];
- a matrix of transport margins;
- a scheme of the main factors by branch[6].

[5] The rows of trade and transport margin matrixes report the distribution margins charged on the products for wholesale and retail distribution, and the costs of delivering the products of each branch to all intermediate and final sectors.
The row totals of these matrixes correspond to the margin rows of the primary-factor layout in the input-output table and represent the total margins applicable to all sales in each branch; the column totals are the overall trade and transport margins by branch.

[6] Value added at factor costs, indirect taxes and contributions, VAT charged, product transfers, CIF imports and

The imported-production tables also require:

- imports breakdown by recipient branch;
- matrix of tax rates on products;
- matrix of VAT rates;
- matrix of trade margins;
- matrix of transport margins.

Domestic production data were obtained by subtraction.

The following paragraphs describe in brief the direct and indirect techniques used for the calculation of the aggregates needed to build all accounting sections of the IOT92.

2.1 The Final-Use Section

2.1.1 Estimation of Household Consumption

The aggregate represented by private consumption was obtained from a complex integration of different sources. The use of multiple sources in this case was necessary because of the impossibility to rely upon a single, broad and sufficiently regular household survey. This kind of surveys have usually different purposes, as in the case of Italy, and the estimation of a comprehensive level of expenditure matching with the national accounting definitions is not considered as a priority. Therefore, the revision was carried out through an extensive recalculation, for 4,500 products, of domestic availability of consumer goods, and through the integration of the results of this calculation with other available statistical sources (the survey on household accounts, sales indicators in commercial businesses, other quantity and price indicators by specific item – as, for example, transport -, etc.).

The revision focused in particular on services: recalculation of the expenditure for hotels, restaurants and the like, housing repairing; education and healthcare, through the development of new data sources such as the survey on holidays, that on housing repairing, the multi-purpose survey[7]. The calculation of rents (actual and inputted) and of expenditure for cars had already been revised in 1996 (for a description of the techniques adopted see ISTAT, 1997).

2.1.2 Estimation of General Government and NPISH Consumption

The introduction of ESA95 called for a full revision of both calculation techniques and criteria of identification of General Government and NPISH, as institutional sectors dealing basically with non-market production.

In fact, the ESA79 allowed a more flexible application of the accrual principle, especially for income distribution and re-distribution flows. Therefore, as in most European countries, financial flows of general Government were quantified using cash-flows as reference data, while under the principle of accrual established by ESA95, the amounts registered have not only to be attributed with a proper correspondence in time, but should also express the actual value of the underlying transaction.

With reference to both institutional sectors and production activities, the identification and classification of statistical units were substantially innovated insofar as, unlike the ESA79, the new system admits that statistical units may carry out a market activity even when they belong – from an institutional point of view – to a non-market sector.

Thus, a basic data archive had to be created, where institutional units are the units of analysis. This led to identify the various activities performed by institutional units as manufacturers. The archive is based on two information sources:

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related indirect taxes, distribution costs, trade margin and transport costs

[7] For a description of the innovations introduced, see Di Leo, Corea, Massari (1999).

- balances of general Government bodies;
- 1991 census on enterprises and institutions (CIS91).

The first source allowed to obtain the information required to estimate the relevant economic variables to calculate production (and hence consumption), according to the national accounting definition, and to obtain an analysis by economic function according to the *Cofog* classification. The second source provided information on non-monetary variables such as legal status, tax code, number of employees by economic activity, geographical branch, number of local units; such information was used, together with other sources on individual institutions, to estimate labour units by *ATECO* (economic activity) and region.

Thus, each institutional unit was analysed taking into account the production sold at an economically significant (market) price and that sold at a price not exceeding 50% of production costs (non market).

The calculation entailed in particular the evaluation of depreciation as a component of production costs. Furthermore, the adoption of ESA95 implies that the hypothesis of infinite average life established by ESA79 for certain categories of public works has to be abandoned. Consequently, for various infrastructure works[8] a zero depreciation value becomes a positive and significant value.

The depreciation series were obtained by inserting such hypothesis in the algorithm applied to the capital stock estimated on the basis of the permanent inventory technique. For such a purpose, all existing sources were thoroughly revised in order to appraise the gross fixed investments of public administrations, along with the evaluation of their relevance and integrated use.

A correspondence between functions and production activities was also established by developing a bridge matrix to identify the *ATECO* categories that should match the functions envisaged by the *Cofog* functional classification; lastly, the switching from functional classification to an *ATECO*-based classification of production costs was achieved.

The NPISH expenditure for final consumption is considered as entirely devoted to individual consumption and, as such, is wholly included in the aggregate of overall actual household consumption.

The approach followed to define the NPISH sector aimed at optimising the consistency and representativeness of the sources available and may be itemised as follows:

1. Definition of the universe of non-profit institutions according to the information provided by the CIS91;
2. Identification of a sub-set of institutions representative of the universe; information was extracted from the administrative registers of the National Social Security Institution (INPS) and of the Ministry of Finance (VAT return archive); the sub-set was therefore defined by cross-referencing CIS91, INPS and Ministry of Finance registers.
3. Estimation of parameters, for each economic activity category (5-digit ATECO), indicating the relative presence of market and non-market activities carried out by institutions, according to the economic information on the statistical units belonging to the sub-set mentioned in point 2, provided by the administrative registers.

NPISH economic aggregates for 1992 were calculated with indirect estimation techniques. Mean values were defined by employee, economic activity and size class, partly on the basis of administrative registers and partly assessed on available information. The per-capita level of each aggregate calculated for the benchmark year 1992 was then applied to the Labour

[8] These works are generally roads, airports, ports, waterworks, reclamation works. Their average life hypothesis considered in the assessment is 80 years.

Units (LUs, Full Time Equivalent) of the NPISH sector, following the usual procedure to gross up to the universe adopted in the national accounting.

2.1.3 Estimation of Gross Fixed Investments by Production Branch

The estimation of capital formation has been greatly affected by ESA95 principles; in fact, the most significant conceptual innovation is the inclusion in gross fixed investments of produced intangible assets, such as:

- mineral exploration;
- originals of artistic, literary and entertainment works;
- software.

Mineral Exploration

This covers the total expenditure for the search for petroleum, natural gas and non-petroleum deposits and include all costs incurred to make it possible to carry out such explorations.[9] The ESA79 classified these costs as intermediate consumption costs.

In Italy, due to the lack of data on expenses incurred by enterprises, the estimation of these components was carried out on the supply side, by assessing the value of production of economic activities classified under ATECO 75.20.4.

Originals of Artistic and Literary Works

Artistic originals include: original films, sound recording supports, manuscripts, tapes, blueprints, bearing recorded drama plays, radio or TV programs, music performances, sport events, literary and artistic works, etc.[10] Therefore, these are the output of a creative process that should be clearly distinguished from the physical support such output is recorded on. The value of the original lies in the copyright granting exploitation rights at the second stage of the process. The owner of the original may sell the original to another party, use it directly to manufacture copies or license to third parties the manufacturing of copies. In any case, in order to be included among capital assets, the original must be used repeatedly at the second stage of the process, i.e. in the production of copies for at least one year.

The evaluation of originals is based on the general definitions governing the recording phase. The golden rule is that the investment is recorded when the ownership of fixed assets is transferred to the institutional unit that intends to use them in production, except for the cases of financial leasing and own account production[11]. The artistic originals produced to be exploited directly by the rights holder have to be estimated at the basic price paid for similar original, or at production costs, or on the basis of the discounted value of the future returns expected[12]. On the other hand, if the artistic original is being sold on the market, its value is given by the price paid by the buyer.

The estimation of this component took into account the following criteria: films and TV productions were estimated according to production costs, while literary and music originals were estimated on the basis of their expected future returns.

The value of investments in original films is given by the sum of the production costs of Italian films and of the Italian capitals invested in co-productions[13]. For TV productions, the estimation took into account the costs incurred by RAI and Mediaset to produce long-term utility programs. An estimation of the costs for the editing and dubbing of foreign motion pictures was added to these figures.

[9] Eurostat (1996), annex 7.1 par. AN.1121.
[10] Eurostat (1996), par. 3.105b and annex 7.1 par. AN.1123.
[11] Eurostat (1996), par. 3.112.
[12] Eurostat (1996), par. 3.114c, par. 7.36 and UN (1993), par. 6.144.
[13] Source: ANICA.

Literary and music originals were estimated according to the current value of the returns expected from copyright exploitation. For musical productions, data are available from the rights paid to authors through the association SIAE; in the case of books, as there is no official source in Italy, royalties were estimated as a percentage of the yearly book-sale turnover[14].

Software

Investments in purchased software were estimated according to the commodity-flow approach, taking the overall turnover of software companies and subtracting from it the value of software embodied in hardware components, in order to avoid any redundancy; then the net imports of software products were added to the value obtained and the total availability was distributed by category of use (consumption, investment, intermediate consumption).

Besides purchased software, also in-house developed software has to be added to gross fixed investments. This component was estimated according to costs[15]. In particular, the estimation took into account the cost of labour in terms of software developers: the value obtained was then multiplied by a mark-up to include other production costs. The estimation of labour cost was carried out by multiplying the average per-capita remuneration by the number of IT employees[16]. In consideration of sectorial peculiarities, the estimation was made at the level 3 of the ATECO classification. The number of IT employees by economic branch was obtained from the 7th Population Census and it was corrected by assuming that these employees do not work at software development on a full-time basis. The time dedicated to software development was estimated taking into account the different professional profiles.

Important innovations were introduced also for other investment goods: the new system allowed to perform the new calculations at a much higher level of detail than that applied in the past. An accurate analysis of basic data led to identify at a 5-digit level of ATECO as many as 152 economic activities producing investment goods[17] and to estimate the value of the investment goods produced by each of them. As far as investments estimated according to the method of commodity-flow are concerned, at least three major innovations were introduced: the use of information gathered from the annual survey on industrial production, which allowed to disaggregate the turnover by prevailing economic ATECO for some 4,300 products and to re-aggregate it by ATECO product [18]; the different processing of exports, which are now subtracted from the national turnover at the relevant ATECO level before being allocated to the different categories of use[19]; lastly, the methodology of calculation used for the benchmark year was also adopted for the following years, while in the past non-benchmark years used to be subject to calculations of changes at a higher aggregation level.

Constructions

For the benchmark year 1992, the construction sector was completely redesigned. Important improvements were introduced in calculation techniques for extraordinary

[14] Unlike music originals, literary originals are not subject to any rule on copyright and the royalties paid to authors are determined on the basis of specific agreements with the publishers. In order to consider the various types of such agreements, different rates were applied to the book-sale turnover, according to the type of original work (literature, essays, books for young readers, etc.).

[15] For the evaluation method see Eurostat (1996), par. 3.114 and UN (1993), par. 13.44.

[16] Note that for the purpose of estimating in-house developed software, the employees of software companies were not included in the calculation, assuming that their product is intended for sale and not for own exploitation.

[17] In particular, the analysis was based on the percentages of economic destination of the elementary products obtained from the *Prodcom* survey and from the survey on foreign trade.

[18] See Bracci et al. (1998).

[19] The calculation of investment goods carried out for the benchmark year 1992 consisted of subtracting investment goods' exports from the value of internal investment goods' production; exports were calculated by applying to total exports the percentages of economic destination of foreign trade (see ISTAT (1990)).

maintenance and unauthorised construction[20]. The estimation of public works was also revised, in line with a thorough revision of administrative sources[21]. The modifications introduced in the construction sector were those that mostly affected the estimations of investments.

Other relevant innovations were introduced in the calculation of investments in transport means. According to the new technique adopted, all transport means, with the exception of rolling stock, are estimated by multiplying all registered vehicle units by their corresponding price, while in the past this method was applied to cars only.

2.2 Estimation of Primary Factors

In 1992, Istat survey on enterprises covered almost all fields of economic activity and concerned enterprises of all sizes. The survey only left out enterprises with 10 or more employees working in the field of services to the households: education, healthcare, cultural and recreational services. The complete coverage of these sectors (representing about 10% of total market services, but mostly characterised by very small enterprises), started in 1994.

Survey data were processed according to the *NaceRev.1* classification to obtain estimations of per-capita values of production and added value. These estimations were expanded to the universe of labour units (LUs), as used to be done in former accounting. This technique was adopted to calculate market production and the associated value added for the majority of economic branches, excluding estimations on agriculture, energy, constructions, dwelling services, financial and insurance services. Relevant innovations integrated the old calculation method: for instance, a deeper sectorial detail and a subtler differentiation by size class. In addition, the estimation technique described above was used for a greater number of branches, as it was also applied to household services (until then estimated under a demand-side approach). This happened because, since 1992, the observation range of surveys on small enterprises has started to cover also such a sector.

The analysis was carried out at a 5-digit level of *Ateco91* classification (which up to 4 digits corresponds to *NaceRev.1*). All sectors were analysed by eight size classes (against the four considered before)[22]. This allowed to identify more homogeneous production-unit categories, especially as far as services are concerned; moreover, the expansion of per-capita values to the universe of regular and hidden employment data was more accurate than in the past.

The methods already used to correct the understatement of turnover and value added by small businesses,[23] and still applied in the revised practice, appeared to be more accurate, as it could be based on more extensive information[24]. The sectorialization chosen for balancing purposes is made up of 101 branches.

The two elements mentioned (expansion to the universe of per-capita output of surveys on regular and hidden employment, correction of understated turnover and value added of small businesses) are essential to ensure the completeness of estimations on the supply side. For the share of products estimated through such a methodology, the components of hidden employment and understated turnover may be separated with higher accuracy than in the past.

[20] See Di Palma (1998a).
[21] See Nusperli (1998).
[22] The size classes considered are: 1-5, 6-9, 10-14, 15-19, 20-49, 50-99, 100-249, 250 and more.
[23] See ISTAT (1991).
[24] The procedure of correction is based on the dual assumption that businesses in their tax declarations tend to state lower turnover but not lower production costs, and that for each economic activity and size, the income of the self-employed workers cannot be less than the average income of employees. See ISTAT (1991).

The overall incidence of the hidden economy on the GDP cannot be quantified yet, however important steps are being made in this direction. In fact, there are sectors where product estimation is already complete because it comes from a particular approach (e.g. agriculture, energy, constructions, dwelling services), and not because the upgrading has been performed to account for tax evasion or hidden employment. In these sectors it is harder to separate the two components of regular and hidden economy; however, in certain cases, such as for instance by using agriculture census data, the results obtained were satisfactory.

In general, for the statistic coverage of regular economy, Istat has recently made remarkable progresses to achieve a greater exhaustiveness of statistical archives (an example of which may be the recent diffusion of intermediate census data, that allowed to implement the new statistical archive of active enterprises (ASIA).

Information contents and business survey questionnaires were also substantially improved. For the general survey on the accounts of enterprises with at least 20 employees (SCI), since 1996 ISTAT has introduced a new questionnaire, basically aimed at collecting information on the variables for which the ESA95 provides different definitions from those established by the ESA79.

The sample survey on the accounts of small enterprises was also improved. The survey carried out after 1992, covering the two-year period 1993-94, was based on a richer questionnaire than the previous one (with more detailed questions, for instance on changes in inventory). A major modification was then introduced in the 1995 survey, in order to comply with ESA95 definitions. At present, the survey covers all economic activities with the exception of agriculture.

With regard to the estimations of the credit sector, the most significant innovation lies in their broadened coverage of sector production. The survey in fact includes data from the Bank of Italy on movable brokerage companies. Starting from an accurate reconstruction of employment components, brokerage companies other than credit institutions could be expanded to the universe with more accuracy than in the past.

The new estimation of insurance companies - apart from the modifications brought about by the new definition of production established by the ESA95 (including the so-called extra premiums) - has improved the component of intermediate costs, often entered together with personnel costs in the financial statements of insurance companies.

With reference to the sectors of agriculture and energy, the sources available were carefully revised according to practices similar to those used in the previous revision.

Significant interventions in the field of non-market goods and services were accomplished by means of a thorough analysis of the public administration[25] and the revision of data on NPISH[26].

2.3 Foreign Trade and the Import Matrix

The revision of imports and exports of goods and services according to the ESA79 definition, the full reconstruction of the linkages with the balance of payments and the disaggregation of estimates into the 44 Nace-Clio branches, were published with the 1996 revision[27].

In 1996 the items had to be reclassified according to the 101 branches of the new *NaceRev.1* classification, the disaggregation level imposed to balance the accounts. This reconstruction was performed starting from about 10,000 elementary items of the combined

[25] See Malizia (1998).
[26] See paragraph 2.1.2
[27] See ISTAT (1997).

goods nomenclature (CN), and from the more detailed data available on the balance of payment of services. The data processing of goods by economic operator and the analysis of service data by typology of service allowed to distribute import flows according to the recipient sector.

The foreign trade aggregates analysed here are consistent with the "domestic" concept already adopted for household consumption. Therefore, imports do not include the goods purchased abroad by residents, whilst exports do not encompass purchases made in the national territory by non-residents.

A matrix of imports of goods was developed by using for the first time the data on import flows by purchasing operator (Source: unified administrative paper of the Ministry of Finance, Customs Department, where imported goods are separated by statistical item, geographical area of origin and economic activity of the operator).

It was not always easy to process this information; in the first place, the accuracy of the classification by economic activity had to be verified; subsequently, a distribution criterion for the flows directed to trade operators had to be devised. Working at a very high level of breakdown (five digits in the *Ateco* classification) has led to a rather accurate distribution of imported goods.

Imported services were distributed to the various branches according to the classification provided by the Italian Exchange Office, that is detailed enough to allow in certain cases to identify buyer branches directly from the type of service. For those services that could not be allocated on such a basis, a preliminary estimation was carried out taking into account the information obtained from the enterprise cost structure, then balanced with import and domestic production flows.

The building of the import tax matrix (VAT excluded) was based on a thorough processing of the data reported in the unified administrative paper of the Ministry of Finance: the consequent easier differentiation among the various categories of levies, charges and other taxes (approximately 30) facilitated the attribution to the different recipient branches.

2.4 Cost Structure Estimation

The IOT92 cost structure was built with the direct method, based on a much broader information system than that used for the previous tables, using two surveys on enterprises and service costs covering all national production sectors with the exception of agriculture.

The first survey involved 55,000 enterprises, collected from the Economic Accounts of Enterprises (30,000) and from the Survey on Small Enterprises (20,000). ISTAT received some 22,000 filled questionnaires, in branches ranging from Mining to Telecommunications (branches 5 to 77); Real Estate Rental and Lease of Goods and Equipment for Personal Use (branch 81), Information Technology Services (branch 82), Other Services to Business (branch 84).

The second survey involved: 41 credit institutions (branch 78); 11 life insurance and pension fund companies (branch 79); 14 companies providing services to merchant banks (branch 80); 10 real property sale and brokerage companies (branch 81); 11 research institutions (branch 83); 46 central and local public administration bodies (branch 85); 196 public schools and 136 private schools of every type and grade (branch 86); 30 public hospitals and 108 private clinics (branch 87); 18 social assistance organisations and institutions (branch 87); 13 companies engaged in waste collection and disposal and water purification (branch 88); 5 economic organisations (branch 89); 68 recreational, cultural and sporting centres (branch 90); 35 organisations operating in other services (branch 91).

The cost structure of medical centres was obtained by processing the survey on private clinics' costs. Housekeeping services for households and communities (branch 92) have no costs by default.

The distribution of the uses of activities supporting financial brokerage was obtained - by means of a coefficient calculated on the relevant productions - from the distribution of the use of services for the credit business. The distribution of the use of real property services was obtained in the same way from real estate rentals.

The branches of agriculture and energy were still estimated according to the usual direct sources: the survey on the Agricultural Accounting Information Network (RICA), integrated by an appropriate survey on services provided to farms carried out by the National Institute of Agricultural Economy, the Energy Bulletins edited by the Ministry of Industry, the survey on the annual production of the manufacturing industry, which reports quantities and values net of VAT of the main energy sources used (fossil fuel except metallurgical coke, gasoline, gas oil, fuel oil, natural gas, LPG, electric power produced on own account, purchased electric power).

2.5 Matrixes of Trade[28] and Transport[29] Margins

In this revision a strong innovation content has characterised the estimation of the trading sector. The new table was based on the direct construction of trade margin matrixes broken down into five distribution typologies:

- trade of means of transport and fuels;
- wholesale trade;
- non-specialised retail trade;
- specialised retail trade of food products;
- retail trade of other products.

This led to an accurate analysis at the level of data-building of a sector with rather different characteristics. The data-building procedure was developed in such a way as to be repeated every year, therefore allowing to update margin incidence with reference to changes in the distribution pattern and in the margin set up applied by trade operators.

Efforts were also made to integrate data from different sources (Istat surveys on enterprises' accounts, on distribution company sales, census data), in order to achieve the consistency of overall margin estimates based on trade operators data with margin estimates by product and by the various economic destinations of products[30].

The approach based on the estimation of trade aggregates includes all the complex integration process carried out to take into account the hidden economy. In particular, the problems related to the updating of statistical archives were sorted out, the share of turnover not stated by enterprises in their tax declarations was corrected, and the contribution of the hidden employment was considered. Furthermore, the identification of the share of trade activities performed as secondary activities by non-commercial businesses and of the employees engaged in pure marketing activities was correctly achieved.

The main innovations introduced in the estimation of transport margin matrixes consist of a thorough examination of all available sources, from both Istat and other bodies working in the field (though, it does not seem to be easy to integrate the latter with the former, since they have not been designed in view of a harmonised information system). Moreover, the

[28] See Piergiovanni (2000).
[29] See Montella (2000).
[30] See also Piergiovanni, Pisani (1999).

analysis and the harmonisation of the various statistical nomenclatures available for the various types of transport (by air, railway, road, sea and inland navigation) was also carried out. Therefore, it was possible to proceed with the new estimation of total margins and to the calculation by type of good hauled.

The disaggregation of this sector differs from that appearing in the previous tables: in particular, the transport of goods on road and conduits was separated from passenger transport, and inland waterway transport was aggregated to sea transport.

2.6 Matrix of non-deductible VAT[31]

The methodology for the calculation of non-deductible VAT table was revised on the basis of analytic fiscal data (VAT declarations) classified by *Ateco91*. This source provided the average rate for sales by branch (assumed as product rate) and the percentage of non-deductible VAT, calculated by branch of purchasing operators. After having identified which VAT treatment applies to the purchasers of products of a given branch, the percentage of non-deductible tax allows to correct the sales rates for a preliminary estimation of non-deductible VAT in the intermediate section.

The preliminary estimation of non-deductible VAT on consumption (with no deductible amounts) was obtained by applying the average sales rates to the taxable income at départ-usine level, and by doing the same on trade and transport margins. The VAT on gross fixed capital formation was calculated in the same way as for the intermediate section: investments by branch of origin represented the taxable income used as a multiplier for average sales rates, correcting the latter to account for non-deductible amounts by purchasing (proprietary) branch.

This preliminary estimation of the intermediate and final section of the VAT matrix was used as a reference to distribute the total VAT as defined in the National System of Accounts, i.e. the balance between total VAT billed and total VAT deductible.

3 Estimation of IOT92 Accounting Sections

The estimation of the aggregates described in the previous paragraphs is the first step to build the IOT92, but it is not the entire input required to build all accounting sections. Thus, the calculations had to be integrated with indirect estimations.

The first section refers to the market-price intermediate costs of the total flows table; the second section refers to final uses and incorporates estimations of private consumption, collective consumption, gross fixed capital formation, changes in inventories, exports and valuables[32]. The third section refers to primary costs and is composed by the vectors of indirect taxes, contributions, value added at factor costs and product transfer.

The fourth section deals with the vector of CIF imports and related taxes. The VAT vector is left out of primary factors in order to express the VAT constraint separately, as described in the following paragraph. Also the vectors of trade and transport margins derive from the balancing of the corresponding matrixes and are not incorporated in this section of resources.

[31] See Borgo (2000).

[32] This is a new aggregate required by the "1995 European Accounting System" that includes valuables as a third category of assets not employed in the production but acquired as reserve value, together with fixed investments and changes in inventories.

The table of imports is initially built at *départ-douane* prices distributing both imports and the corresponding indirect taxes by branch. As the estimation of the matrix of VAT percentage rates for 1992 is available, also a matrix of the VAT on imports was calculated and added to that of CIF imports plus taxes, obtaining the table of import flows at *départ-douane* prices.

The construction of the table of total flows at *départ-usine* prices requires the matrixes of trade and transport margins, that have to be separated from all flows (both intermediate and final) of the market price table. The total margins by branch (i.e., the sum of the columns of these matrixes) have to be added to trade and transport rows, containing only direct costs evaluated at market price.

The nine matrixes of distribution margins incidence calculated for the IOT92 were estimated net of VAT.

A preliminary estimation of VAT-free market price table had to be performed. On the other hand, the matrix of estimated non-deductible VAT rates is a *départ-usine* matrix, in the sense that the rates were estimated for *départ-usine* flows; hence, to create a matrix of non-deductible VAT on inputs, the rates have to be applied to the *départ-usine* table.

In order to overcome this vicious circle, a matrix of "market-price" VAT was firstly calculated by applying the estimated rates to the table of total market-price flows; afterwards, the *table at market prices net of VAT* was obtained by subtraction.

Therefore, the five tables of trade margin levels and the four tables of transport margin levels on total flows could be quantified by multiplying the correspondent coefficient tables by the market-price table (net of VAT). Similarly, the same coefficients were multiplied by the table of *départ-douane* imports to obtain the tables of margins on import flows.

However, the levels of margins on total flows were still without VAT; therefore, a preliminary table of total flows at *départ-usine* prices net of VAT was built, by subtracting from the flows of the table *at market prices net of VAT* the two matrixes of distribution margins (again, net of VAT).

This allowed to estimate a matrix of VAT levels by applying the rates estimated in the *départ-usine* table and inserting in the 9 rows of trade and transport branches the column totals of the 9 matrixes of VAT on margins, calculated separately with the same rates.

Such a matrix was then expanded to the total VAT collected by the State in 1992; a matrix of actual VAT rates was calculated on this result, allowing to estimate the vector of VAT on domestic production and imports.

The matrixes of VAT on margins were corrected by the same VAT vector to obtain a total VAT on margins consistent with the total VAT for each trade and transport branch, and then added to the already built margin matrixes.

The column total of each margin matrix was entered with a negative sign in each of them, in the rows of the branch corresponding to the margin type.

The matrixes of trade and transport margins were then added by margin type, attaining a single matrix of trade margins and a single matrix of transport margins on total flows. These matrixes contain the value of total margins by branch, with a negative sign in the rows of trade and transport branches, insofar as, by subtracting the margins from non-margin-producing branches in the table of total flows at market price and obtaining the table of total flows at *départ-usine* prices, we may still find in the rows of trade and transport branches their entire production flow, i.e. the value of direct sales plus the distribution margins.

The tables of trade and transport margins on domestic production flows were calculated by subtraction.

Lastly, we obtained the table of imported production flows at market prices by adding the tables of trade margins on imports to the table of *départ-douane* prices.

The tables of domestic production flows at both *départ-usine* and market prices were calculated by subtraction.

4. Balancing the IOT92[33]

Once all the accounting sections and the values contained therein were defined, the discrepancies occurring in each branch were analysed, highlighting possible inconsistencies, processing errors, omissions, incompatibilities generated by the assembly of data calculated independently. This led to an iterative process by which the original estimations of each aggregate were corrected until the discrepancies were not caused by original data but were actual statistical discrepancies.

The data were then balanced with a technique based on the application of the general minimum squares method that allowed to switch from an initial estimation system free from accounting constraints to a balanced system. The redistribution of differences between aggregates was made on the basis of a priori information on the degree of relative reliability attributed to these in terms of quality, exhaustiveness of statistical sources and accuracy of the calculation techniques adopted in the estimation. The balancing process implied the correction of entries considered as less reliable, mostly by redistributing accounting residuals.

In particular, the specific algorithm used to balance the IOT92 was supported by the technique of coupled gradients[34] and could therefore handle accounting structures with tens of thousands equations, providing a simultaneous balancing (and not a cascade balancing, as in the previous input-output tables produced by Istat) of all accounting sections underlying the overall table.

A system of constraints and a matrix of variances had to be built to use this algorithm.

4.1 The System of Constraints

In the input-output system, the definition of equilibrium equations is translated into the equality of each row total with each column total of the matrix[35]. The defined constraints system allows to respect the fundamental equations of the accounting structure of cross-sectorial tables, at the same time monitoring those values with a particular economic relevance, such as the vectors of row or column totals of the different components in which the table may be broken down.

First of all, the market-price balancing pattern sets, for market-price tables, the links between the intermediate and the final section of total flows and the sum of domestic production and import flows.

Row and column constraints are defined for the three flows: row and column totals of intermediate and final sections must be tied, respectively, to the column vectors of total intermediate and final uses for the first constraint, and to the row vectors of total intermediate costs and total final demand for the second constraint.

The constraints of total uses for the three flows follow: columns of total uses will be constrained by the row total of the intermediate section plus the row total of the final section. Total (scalar) constraints bind the constraint of the totals of the matrixes of total flows,

[33] Mantegazza and Mastrantonio (2000)
[34] Nicolardi (1998)
[35] Rows are output flows from original branches directed to intermediate and final recipients; columns are the input flows used in the production process of each branch.

domestic production and import flows with the total values of uses of the three flows for the whole economy.

The basic equation of the pattern is then established, fixing the condition of equilibrium between market-price resources and uses: the vector of total market-price flow uses has to be constrained by the sum of the vector of intermediate costs plus the vector of the total of primary factors by each branch[36], plus the vector of VAT on domestic production, plus the vector of total uses of import flows (inclusive of VAT, taxes and margins), plus the vectors of margins.

Similar constraints are placed on import and domestic production flows at market prices.

The constraints linking market-price and *départ-usine* tables are then defined, i.e. the switching from market-price to départ-usine tables for the three flows is defined by separating trade and transport margins from market-price flows, for both intermediate-use and final-use flows.

The pattern includes also constraints between margin (trade and transport) matrixes.

In fact, the matrixes of margins on total intermediate-use and final-use flows are tied to the sum of matrixes of margins on domestic production flows plus import flows for each category of use.

The rows of marginal distributions of margin matrixes for each type of flow are tied to a column vector of margins on total intermediate uses and to a column vector of margins on total final uses, while their columns are tied to special row vectors. The latter were built as follows: on total flows the constraint is a null vector (the trade and transport rows of the matrixes of margins on total flows include the total margins by branch with a negative sign, which can be added to the direct costs of the corresponding rows in the market-price table); on domestic production flows, it is a vector of negative values equal to the value of trade and transport margins on import flows, because the trade and transport rows report the same values of total margins on total flows with a negative sign, as these services cannot be attributed to the corresponding branches in the rest of the world; the same vector, obviously with a positive sign, is set as a constraint to margins on import flows.

A further constraint was set also on margin matrixes, binding the vector of margin on total uses and the sum of the row total of the matrixes of margins on intermediate-use flows plus the row total of the matrixes of margins on final-use flows.

The same types of constraints imposed to market-price tables are placed on *départ-usine* tables: the condition of equilibrium between resources and uses is also defined at *départ-usine* prices between the vector of total uses of total *départ-usine* flows and the sum of the vector of intermediate costs (being equal to the vector of the market-price constraint, since the column total of margins is zero), plus the sum of primary factors by branch (which is, clearly, always the same), plus the vector of VAT on domestic production, plus the column of total uses of import flows.

In this balance pattern, non-deductible VAT was not included among primary factors[37], but separately constrained by assuming that the vector of total VAT is given by the sum of the column vector of total VAT on domestic production plus the column vector of total VAT on imports; the total value of the VAT vector was then constrained by the value of VAT collected by the State.

[36] The primary factor section (in our balancing pattern this is made up of the column vectors of the value added at factor costs, transfer, indirect taxes and contributions) has to be constrained as well, placing a column constrained between the sum of each item and the vector of total values of each item, and a row constrained whereby the row total of this section is tied to a column vector of the total of primary factors by branch.

[37] See note above.

4.2 Definition of the Matrix of Variances

As said above, a major characteristic of this balancing technique lies in the use of a matrix of variances, which yields to redistribute accounting residuals on the basis of the information available to researchers on the "relative reliability" of the various aggregates found in the accounts.

Aggregates with a lower reliability level - due to the underlying basic data or to the calculation techniques - were given a relatively higher variance, whilst aggregates considered relatively more reliable were given a lower variance. Therefore, the quadrature process redistributes the accounting discrepancies by changing to a greater extent the entries for which the starting estimations are considered relatively less reliable.

The matrix obtained in such a way is then multiplied by the absolute values of the entries to be balanced, attaining a new matrix, expressed in the same unit of measure as the data matrix. Therefore, the distribution of the residuals of the accounting system is carried out in the quadrature process, according to the relative value of the variance of the elements entered in each system equation, and not in a direct form based on the weight system used to generate the matrix of variances.

This preparatory phase of quadrature inputs is particularly crucial, as a wrong specification of the variance matrixes may cause a loss of efficiency in estimators and may even bring about the divergence of the whole system.

For the balancing of the 1992 matrix, we set a degree of relative reliability for the aggregates making up the total flows at market prices (reported in table 4.1), while all other sections were given a variance of 1.

For the balancing of the IOT92, the discrepancies to be redistributed was given by the fact that uses were greater than available resources. The percentage changes of post- and pre-quadrature aggregates reported in table 4.2 provide the “work” carried out by the matrix of variances in redistributing such discrepancies. Aggregates with zero variance maintained their pre-quadrature level, whilst the others changed proportionally to the variance attributed to them: higher changes for variance = 1, less significant changes for intermediate variances.

Table 4.1 – Pattern of variance attributed to total market-price flows

Aggregates	**Variance**
Matrix of intermediate costs	0.0 to 1.0
Intermediate costs	0.1 to 0.5
Household consumption	0.1 to 0.5
Joint consumption of the PA	0.0
Joint consumption of NPISH	0.2
Gross fixed investments	0.1 to 0.2
Valuables	1.0
Change of inventories	1.0
Exports of goods	0.0
Exports of services	0.2
Total exports	0.0
Value added	0.1 to 0.4
Taxes on products	0.0
Contributions on products	0.1
Total contribution on products	0.0
Transfer of products	0.0

VAT	0.6
Total VAT	0.0
Imports of goods	0.0
Imports of services	0.2
Total imports	0.0
Trade margins	0.6 to 0.8
Transport margins	0.3 to 0.7
Total trade margins	0.0
Total transport margins	0.0

The attribution of variance is not a neutral process. Yet, even if the discrepancy that the quadrature algorithm has to distribute is usually not very high (about 0.8% of total resources in 1992), it is true that different variance systems lead to different results. Moreover, it has to be reminded that not only variances, but also the imposed constraints system, do interact in the process of reallocation of discrepanices.

It is thus clear that the balancing process is not a mechanical one but rather an iterative procedure that, if checked step-by-step, brings about consistent and balanced final estimations.

The balancing process is also a transparent and repeatable operating procedure able to ensure, through the attribution of variance, transparency and accessible documentation for all inputs used.

In fact, as the variances are attributed to the different flows involved in the balancing according to the reliability of their sources and of their estimation techniques, exhaustive information is required on the estimation of each aggregate in order to achieve a proper calibration of the matrix of variances.

Table 4.2 – Percentage change before and after quadrature

Aggregates	**Percentage variations**
Gross domestic product	0.47
Value added	0.52
Net VAT and indirect taxes	0.00
Imports of goods and services	0.00
Total resources	**0.40**
Household consumption	-0.71
Joint consumption of the PA	0.00
Joint consumption of NPISH	0.01
Gross fixed investments	-0.38
Valuables	-9.01
Changes of inventories	-3.59
Exports of goods and services	0.00
Total final uses	**-0.44**
Intermediate costs/uses	-0.33

4. Conclusions

In the next future ISTAT will be committed to the annual estimation of *supply* and *use* tables (at current and constant prices).

The experience gained by building the 1992 table and by using techniques to balance resources and uses at the branch level allows us to be rather optimistic about the burdensome task that the National Accounting and Economic Analysis Department is going to cope with.

Future tables will be built, on the one hand, through fast annual updating and, on the other, through fully detailed estimations inserted in a complete I/O pattern scheduled every five years.

In order to achieve these objectives, it is essential to maintain the same degree of integration and involvement of all Department Units, which have characterised the revision work presented in this paper.

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