



***VOLUME MEASURES AND PRODUCTIVITY ANALYSIS FOR THE NON-MARKET SECTOR: THE ITALIAN EXPERIENCE***

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## ***Abstract***

In 1999, the Italian national Statistic Institute has produced for the first time estimations for National Accounts according to ESA95. A great relevance has been assumed by the figures calculated at constant prices, where there has been a wide effort to implement as much as possible ESA95 recommendations on the calculation of price and volume components.

This paper will present the methodology and the main results obtained for the non-market sector. First of all there will be a presentation of the general framework of the volume estimation for the total economy and then the methods used for General Governments(GG) and Non Profit Institutions Serving Households (NPISHs) will be illustrated. It will be done with reference to the theoretical schemes, stated by Eurostat, and for the various service industries in which GG and NPISHs, activities has been split according to the new accounting system. We will try to go further on with some consideration on the measure of productivity for the GG sector, which should be considered only as a first exercise in this stimulating and extremely interesting field, in that we consider at this stage only the labour productivity.

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## **Introduction**

The deflation of General Government net product is part of the more general issue of value added deflation in economy. Thus, to estimate GDP at constant prices, a double deflation system based on price indices for output and intermediate consumption of several branches has been implemented. The adopted methodology is based on branches of economic activity. The Italian nomenclature<sup>1</sup> is desegregated into 101 branches for national accounts processing. For publications these branches are aggregate into 92 industries.

The analysis by branch no longer considers separately the activity of General Government and of Non Profit Institutions Serving Households (NPISHs) which, in the past, were included in some branches devoted only to non-market services.

The methodology to estimate non-market output of economy in real terms is to be analysed within this framework.

The following steps had been carried out for the non-market segment:

1. Identification of branches where the activity of non-market producers is more meaningful;
2. Identification of the output typology of each branch, through services provided, to determine the most adequate estimation method;
3. Selection of output indicators, if an output based method had been adopted;
4. Detailed analysis of available sources with reference to employee labour input, if an input method had been adopted, to better fulfil Eurostat recommendations;
5. Construction of the following aggregates: Output, Intermediate Consumption and Final Consumption at constant prices;
6. Calculation of price indices for Output and Intermediate Consumption used to estimate GDP at constant prices;
7. Value added at constant prices estimated by using double deflation.

## **Non-market output**

Estimates at constant prices were calculated dividing economic activities in market and non market, in compliance with SNA93 and ESA95 guidelines. Non-market output is represented by output produced by institutional units whose major part of output is provided free or at not economically significant prices<sup>2</sup>.

General Government represents the largest share of non-market producers, though Non Profit Institutions Serving Households play a role, which is becoming more relevant as time goes by. Few data are available on this sector, thus the adopted methodology has been the same used for the industry of General public services<sup>3</sup>. Non-profit institutions represent a remarkable share of GDP in the following branches: education services, activities of associations n.e.c. (about 99 % of branch total value added for the benchmark year 1992) and social care (about 29 % of branch value added); the activity of these branches was 83 % of the overall Value Added for NPISH in the reference year. Owing to few available data on provided services and because they represent a very low percentage of GDP (about .8 % in 1992 at current value), an employee labour input based methodology was adopted<sup>4</sup>.

## **Services provided by General Government**

ESA95 defines General Government as the sector “which includes all institutional units which are other non-market producers whose output is intended for individual and collective consumption,

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<sup>1</sup> It is derived, and coherent, with the NACE.Rev1. Nace.Rev1 is the EU classification of economic activity which replaced Nace-Clio. It only considers the kind of activity, regardless of producers and whether output is provided free or not at economically significant prices. Market or non-market classification is meaningful only within branches listing for non-market producers.

<sup>2</sup> See ESA95 par. 3.26

<sup>3</sup> This industry coincides with NACE.Rev1 class L.

<sup>4</sup> Thus, unless otherwise specified, any reference to General Government is to the whole non-market sector

and mainly financed by compulsory payments made by units belonging to other sectors, and/or all institutional units principally engaged in the redistribution of national income and wealth”<sup>5</sup>. For our purposes, the relevant function is the production of services fulfilling individual and collective needs; profit-making is not the scope of these services, as social goals prevail<sup>6</sup> (education, health, social care, etc.), as well as the need to provide basic services necessary to the complex organisation of a country, and that cannot be provided by private producers (police, security, law, national defence, fiscal administration, foreign affairs). On the other hand, measuring this specific kind of production is not easy, due to objective difficulties in measuring, because of the specific nature (intangible and not for sale) of examined goods.

The starting points for our work have been:

1. definition of the observation field according to National Accounts and ESA95, which includes all non-market units;
2. measuring in volume terms, using prices for the base year 1995;
3. identification of service typologies; this has been done with reference to the COFOG nomenclature, and then adopting a bridge-matrix, a correspondence between branches of economic activity and Cofog functions has been performed.

The SNA93 definition of service was adopted: services are considered on-demand derived outputs and typically change consumer conditions, as a result of the activity of producers carried out on consumer demand.

### **Definition of service**

The provision of services is defined as the changes in the conditions of consumers determined by the activity of producers. This definition<sup>7</sup> shows the intangible nature of services. Hill's viewpoint, that can be found in ESA95 definitions, defines services in a very different way from goods, where attention is shifted from producers to consumers, who are the activating elements of production. If there are no consumers then production is not economically significant, i.e. teaching without pupils does not imply a production activity, since there are no beneficiaries of this service. Service providing is an activity involving contemporarily producers and consumers, and the production of a service cannot be divided from its use or consumption. So service output<sup>8</sup> should be measured through the extent of changes in consumer conditions, and not only examining the activity of producers.

The approach examined in this paper aims at defining output from the activity of producers. To consider the effects on users, is mainly related to notions of welfare economy where output is measured through the effects recorded on entities related to general government areas, i.e. health, law, or police, that can be represented using multi-dimensional variables. The aims and results of service consumption are elements mainly related to the efficacy of provided services and not to productivity, thus, in principle, they cannot be assumed as reference for the quantitative measure of provided services<sup>9</sup>. On the other hand, measuring the effects of services on users could be important to determine service quality indicators.

Our method assumes the activity of producers as the viewpoint to measure services; though, consumers are still important, as output measures detail only actually provided services and not the potential available output. Users-consumers play a remarkable role in measuring service output if that service is similar to market services, where there is willingness to pay a price and the transaction between producers and consumers demanding a specific service can be identified.

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<sup>5</sup> ESA95 par. 2.68

<sup>6</sup> The provision of social services mainly coincides with the individual services, while the remaining part of services is represented by collective services.

<sup>7</sup> It is based on Hill (1975)

<sup>8</sup> See Picozzi and Pisani (1994)

<sup>9</sup> Certomà, Lo Moro, Malizia (1995)

Due to the specific features of General Government as producer, for some services<sup>10</sup> the role of the consumer individual initiative in the production process is not important and is not involved in measuring the output.

### **Typology of services**

Services provided by General Government may fall into two main categories<sup>11</sup>:

- services provided to individuals, i.e. whose consumers or beneficiaries are individually identifiable. Consumption of these services requires individual initiative on the part of those concerned;
- pure collective services, i.e. services which are consumed jointly by the entire population.

#### *Services provided to individuals*

Private and semi-public services concern personal services. User approval is required for their consumption. In this way, it is possible to define clearly the transactions between producers and users and output can be measured through the number of transactions. Health services fall into this category, they are matched by similar market services

The most adequate methodology should use a volume index calculated as the weighted average of several quantitative indices, or using an algebraically equivalent variant, i.e. the reduction of real values using price indices. For non-market output, weighting should be based on costs incurred, as market prices are not available.

Semi-public services fall in the first category as well, they are defined as the activity of a unit involving individuals or goods of other units with the approval of each of them. A large number of General Government services are included in this typology, their most outstanding characteristic is the existence of limits to the number of involved units. Education, leisure and sport activities are an instance, where several users contemporarily benefit the service. The correct measure in volume terms of these services should consider the extent to which they are used and their congestion, which may affect the quality of service.

#### *Pure collective services*

The second typology of services are actions of a unit affecting individuals and goods of the entire population; no transaction between producers and consumers is required, and consumer do not have any initiative as to production. Pure collective services are part of a specific and typical area of General Government activities concerning the regulation of collective life: they cover a vast range of activities such as general public services, national defence, foreign affairs, justice and the police, town planning and the environment, economic policy. Since these services are consumed collectively, indirectly and continuously (i.e. public security and defence), the volume of their output cannot be measured by the extent to which they are utilised, even considering the difficulty in identifying a transaction unit.

The borderline for output cannot be determined by the same methods as for other goods, the measure of output for pure public services should be based on other principles. For these services, producers and consumers cannot limit the access.

Services provided to individuals (private and semi-public) require measures of output referred to quantity indicators; nevertheless quality should not be neglected, for instance by referring to the congestion level and resources supplied per each student (education ) or patient (health).

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<sup>10</sup> Here we are referring to the collective services, above mentioned.

<sup>11</sup> See ESA95 par. 10.41

## Activities of General Government

The activity of General Government covers several sectors of economy; assuming the desegregation in 101 branches of economic activities, the activity of General Government is relevant, if not predominant in 11 branches. The 11 branches identified through the analysis of output and value added are the following:

- Water provision
- Research and Development
- General Public Services
- Education
- Health services for inpatients
- Health services for outpatients
- Social services
- Waste collection
- Associations n.e.c.
- Leisure, culture and sport
- Other services

Activities falling in the examined branches were examined to identify institutions and provided services. Institutions were identified to outline correctly the extent of examined production in terms of completeness. A correct identification of the service is based on the breakdown of that service into its components (basic services). For example, in education, several levels can be identified, as well as vocational training and related services (typologies of services) provided by Public Bodies with different territorial authority (Government, Regions, Provinces, Communes).

## Classification of deflation methods

At an international level<sup>12</sup> a classification of the most suitable methodologies to estimate market and non-market services at constant prices has been defined, according to some specified requirements. Methodologies are classified by their compliance with these requirements. A three-level classification has been determined: A class (the most suitable methods), B class (to be applied only when A class cannot be applied) and C class (not to be applied), which is illustrated below for non-market services.

- **A Methods based on output indicators that contemporarily fulfil** the following requirements:
  1. **Completeness:** all outputs are considered
  2. **Productivity:** changes in productivity are taken into account
  3. **Consistency:** the method is consistent with National Accounts principles
- **B Methods based on output indicators that consider all final products, but do not fulfil** other requirements, such as:
  1. **Quality changes;**
  2. **New products;**
  3. **Weights** related to the **base year**
  4. **All final products** are considered;
  5. **Consistency over time**, the method does not measure the same output every year.
- **C Methods based on output indicators not covering all final products or input methods** using **labour force** to **extrapolate the base year output**

Of course output based methods are preferred, but it has been acknowledged that adequate indicators are not always available. Thus methods using even input indicators can be adopted if

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<sup>12</sup> Eurostat, 1998 see the classification suggested for the Task Force on Education

other requirements<sup>13</sup> are fulfilled, so that they would be homogeneously applied to have comparable data for EU countries in the short to medium term, especially for pure collective services.

## **Education**

The adopted method ensure that the following requirements are met:

- complete coverage, since every type of education service is covered
- stratification of services, that are divided in the following categories: kindergarten, primary, junior secondary, senior secondary (general), senior secondary (specific), university, further education, vocational training, other;
- quality is measured through inputs used to provide services or their final results.

The measure of volume of the examined branch refers to the different levels of teaching<sup>14</sup>. Being a semi-public service, the correct measure of output should consider the number of users. ESA95 establishes that the "quantity of teaching" should be an adequate measure, i.e. the number of hours spent per pupil. Due to the difficulties in using this measure, it has been assumed that the number of pupils should be an adequate indicator, hypothesising that the ratio of pupils to tuition should not change over time; however this ratio is monitored over time.

To consider the quality of service, corrections have been introduced in the measure of volume related to two remarkable elements: pupils per classroom and teaching aids. Quality was measured through input (classrooms and equipment) rather than on the achievements of pupils<sup>15</sup>.

The quality of teaching depends on the number of pupils per classroom, supposing that if the number of pupils increases, then the teacher's individual attention per pupil decreases, thus the average number of pupils per classroom is a suitable indicator to represent the quality of the service, with reference to congestion. A transformation function has been constructed, where the pupil indicator for a class is represented by the real output of a class. This function transforms the actual number of pupils into the "standard" number of students who benefited a "standard" quality service. The global volume index  $L_t$  for Education, in base 1995, is given by the weighted average of volume indices  $L_{h,t}$  calculated for each field of activity. The index  $L_t$  is calculated using the Laspeyres formula.

## **Health: treatments for inpatients**

Output indicators have been used to measure the volume of services for this branch. The guidelines for using output indicators come from a former research<sup>16</sup> and they are consistent with ESA95 indications and Eurostat recommendations from the Task Force on health services<sup>17</sup>.

At this stage of estimation, which coincides with the introduction of ESA95, processed data for health activities differs from data used in the previous research<sup>18</sup> for the following two main reasons:

- the function Health<sup>19</sup>, as defined in the functional classification Cofog, is linked with the activity of Public Bodies, divided into 2 branches: hospital treatments for inpatients and outpatients departments;

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<sup>13</sup> Eurostat, 1998 Final report of the Task Force on non-market services for Nace L, general public services

<sup>14</sup> The other, more general activities, required to provide the service fall in the output of General Public Services (branch 92, class L of the classification NACE.REV1), as they are needed to regulate and organise the service.

<sup>15</sup> See the contributions by Guerrucci 1995 in Certomà, Lo Moro, Malizia (1995) and Nusperli (1999).

<sup>16</sup> See Certomà, Lo Moro, Malizia (1995)

<sup>17</sup> As for education, the measure of volume for the output of this branch concerns treatment in hospital and other non residential structures, that is services provided to in-patients or outpatients. More general activities, related to general administration, fall in the category of General Public services.

<sup>18</sup> For a complete explanation of the change in the used output indicator see Collesi (1999)

<sup>19</sup> General administrative services are not included.

- the quantity indicator for output volume has been changed, from hospitalisation days to the number of in-patients, for the two reasons below:
  1. basic statistics used in the previous work required remarkable adjustments due to the high variability of time series;
  2. hospital services are financed<sup>20</sup> on the basis of the number of treatments classified by DRG (Diagnosis Related Groups), and no longer by hospitalisation days.

It is believed that the indicator number of in-patients should be very close to treated illnesses by the classification DRG since, in our calculations, inpatients have been distributed in hospitalisation units, using 20 hospital disciplines<sup>21</sup> currently adopted in health statistics. Data used have been adjusted using different procedures. The variable average length of hospitalisation was detailed over time, by specific hospital discipline and with reference to total treated illnesses<sup>22</sup>. National average hospitalisation decreased and, as a consequence, quantity indicators for the analysis by discipline have been adjusted. The new adjusted structure of average hospitalisation indicators has been used to calculate the inpatients indicator, used in volume measures. The decrease in average length of hospitalisation matches the new DRG based approach, hospitals should become more efficient in treating illnesses, reducing the average hospitalisation, but improving the quality of treatment, i.e. reducing inpatients stay<sup>23</sup>.

The measure of volume of hospital treatment does not integrate any quality adjustment insofar. The volume index for hospital treatment has been calculated in a similar manner to the education one. The quantity indicator treated cases by DRG has not been used because this type of financing has been recently introduced and reliable time series are not available yet.

### **Input based methods**

Reliable quantity indicators for the services provided cannot be easily measured for branches related to public collective services. This is true also for branches for which quantity indicators could be theoretically available, but are neglected in statistical surveys. The remarks in this paragraph could be applied to all activities of General Government and Non Profit Institutions Serving Households, if adequate output indicators are not available, besides pure collective services.

Non market price is available for General Government output, which is valued on the basis of costs incurred to provide services. These cost elements are the reference for evaluations at constant prices if a direct output measure is not possible. The following cost elements should be separately deflated:

- compensation of employees (wages and salaries in cash and in kind, actual and imputed social contributions paid by employers)
- intermediate consumption
- other taxes on production minus other subsidies on production
- consumption of fixed capital

Compensation of employees (the largest part of value added) has been deflated using the average wage method.

The average wage method is based on the average wages of categories of General Government employees, for the base year. A large database<sup>24</sup> with data related to General Government

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<sup>20</sup> The way of financing health services has changed in 1995, but it is still changing.

<sup>21</sup> The analysis of disciplines is illustrated in Malizia 1995; such as: General medicine, General surgery, Obstetrics and gynaecology, Paediatrics etc.

<sup>22</sup> The same profile was outlined by geographical area.

<sup>23</sup> On the contrary the length of hospitalisation was longer when the number of hospitalisation days was the way to finance.

<sup>24</sup> For a wider explanation of this methodology see Collesi and Nusperli (1999) and Collesi (1999)



employees and their wages by level and activity, for each examined branch has been the starting point to determine two matrices levels by activity.

Employment data are ordered in the employment matrix, so that the elementary item is given by the number of employees for that level, for each year in the concerned time series; for part-time employees we have considered the number of full-time equivalent units. A similar approach was adopted for the wages and salaries in cash for the base year: in that case we have one column only in the wage matrix. The processing of data considers all the producer units of General Government whose activity falls completely or partly in the input-deflated branches.

Salaries and wages in kind should be deflated using a price index for related goods and services. However the indicator for wages and salaries in cash has been used, due to the difficulty of identifying goods that are included in wages and salaries in kind and because it is not a significant element.

Actual and imputed social contributions were deflated using a similar approach. The analysis of General Government compensations has shown that social contributions are a percentage of compensation, thus determining an implicit rate for the base year. This rate was used to calculate the total aggregate compensation of employees.

A Laspeyres volume index has been used, where compensations for the base year 1995 represent the weighting structure. This index is given by the ratio of compensations at constant prices for the current year to compensations for the base year

The used stratification assumes that changes in the employee labour input resulting from advances in career, modification in employment by profession as well as in average seniority should enter the volume component as well as changes in the overall dynamic of civil service<sup>25</sup>.

### **A methodological issue: the fixed-base index**

For the deflation procedure of the Italian National Accounts a fixed-base index methodology has been used. First of all it has some desirable characteristics, such as additivity; secondly it is clearer to the users, it is more understandable at a first reading, and last but not least it doesn't need a changing weighting structure from year to year. On the other hand, instead, it has some regrettable characteristics such as lost of representativeness for years far from the base year and furthermore it shows an upward bias, when a recent year is compared with a long distance base year, due to fixed weighting scheme<sup>26</sup>.

To avoid this problem chain-indices should be used, in that in the comparisons they permit to take into account all the changes in the weighting scheme occurred in the meantime. These indices consider that the ratio between two periods depends not only on the extreme points but also on the entire interval, so to incorporate all trends implicit in its. Up to now only experimental researches have been carried out on this subject but, from 2003 it will be necessary to change from a fixed-base system to a chain one for the constant price estimations.

During these first years of ESA95 implementation, it has been recognised that it could also be used another method to measure change in volume; Fisher index has been suggested as the best method to measure changes both in volume and in prices but it has, also, be considered that Laspeyres indices for volume measures and Paasche indices for price measures are good substitutes<sup>27</sup>.

### **Application problems of chain-indices to General Government figures**

Here follows a description of:

1. the weights used according to the Laspeyres index for quantity indicators

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<sup>25</sup> Calculations based on stratification by homogeneous levels implies the possibility of calculating fixed-base indices per type of activity, i.e. for the various levels included in the classification Nace.Rev1.

<sup>26</sup> See Pisani (2000)

<sup>27</sup> See ESA95, cap. 10

2. the problem of application of the chain index to GG because of the changing weighting scheme. This will be performed according to the industry reference scheme adopted for the calculation.

For the volume estimation performed by output indicators of two relevant industries of General Government activities a fixed-base quantity indicator has been adopted. The calculations of the weighting schemes for the base year 1995 have been quite time spending. In fact, we ought to recall that the services we are dealing with are non-market services, so they don't have a price which can be known by statistics, currently calculated for instance for the consumer price index<sup>28</sup> (CPI) or for the production price indices or for any other kind of statistics performed during the ordinary activities of a national statistical institute. In absence of such a price it can be used the cost of providing the service.

For output based methods the Laspeyres index used has as the weighting structure the unit costs of the different kinds of services for the base year, and as quantities the quantity indicators related to the examined periods.

### *Education*

The first industry concerned is that of educational services, which are provided at different levels of Government institutions. The service has been split according to the different levels of education, so that we have several (units of) elementary educational services. 1995 costs to provide each of the services have been assumed as weights to combine the basic indices. Next step has been the balancing process of the weights, by the twofold level of institution (who produce) and service provided (what has been produced), to be consistent with National Accounts estimates for output of General Government, for the education industry. As an example for services provided by State, Government expenditure by level of education, coming from the State Budget, have been used as weights, aggregating all the different expenditure items incurred for the provision of the services. For the other institutions a similar procedure has been used.

A further step has been necessary to pass from the elementary indices to an aggregate measure for the whole industry. Used weights corresponds to the expenditure on that service in the base year.

For this industry of economic activity there wouldn't be too many practical problems in changing into a chain index for volume calculations. As regards to the State we can have all the required information on the cost structure yearly; nevertheless, it would be very time spending an yearly change of such data.

For the other institutions providing education, also if the budget structure would give detailed information, there would be problems with the time lag necessary to have availability of these data. This is particularly relevant for the Municipalities Budgets, for which the full availability of the complete budget, and not of the provisional estimations used for the compilation of accounts at current prices, is delayed of two years, and sometimes also three, with respect to the last year of estimations. So, in such cases it would be necessary to use, as reference for the weights calculation, an old structure. This would propose again the problem to avoid by using chaining indices.

### *Health: hospital treatments for inpatients*

The used structure of costs is based on a detailed analysis of treated illnesses. The economic-functional classification of cost incurred by Bodies providing health services would have been the most adequate structure; however these data are seldom available. Usually, available information concern compensation of employees, expenditure on goods and services, though they are not desegregated by activity. These data were integrated in National Accounts to define the value of output. The average cost of one hospitalisation day by discipline has been used as the basis to get the cost indicator, which is represented by the average cost for a complete treatment by discipline.

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<sup>28</sup> By definition the CPI should comprehend in its basket each kind of economic transaction which cause a transaction in money for the consumer.

By using a procedure which requires several steps, it has been linked to the constraint given by the National Accounts estimation for the monetary value of output for the base year, which is defined as the sum of costs incurred, being the service a non-market one.

For this field of activity it would be a serious problem to adopt a changing weighting scheme in that the average cost for a complete treatment by discipline is not currently calculated by the health institutions providing the service.

### *General public services and other services*

As regards to these services, for which an input method for the calculation has been used, as mentioned before, we must distinguish between compensation of employees and the other input factors, in that they have been separately deflated.

Compensation of employees has been estimated in volume terms using the average wage method. A large database with data related to General Government employees wages by level and activity has been developed. The resulting Laspeyres volume index uses compensations, for the base year 1995, as weights. This index is given by the ratio: compensations at constant prices for the current year / compensations for the base year

$$I_q^t = \frac{\sum_{i=1}^n w_i^0 l_i^t}{\sum_{i=1}^n w_i^0 l_i^0}$$

t= current year

0= base year 1995

$l_i$  = employee number for activity i, represented by the individual item in the employment matrix

$w_i$  = per capita compensation for the activity i

n= number of lines in the matrix

For branches where input based methods are used, the volume index is represented by the ratio: the output at constant prices for the current year/ the output for the base year.

$$I_q^t = \frac{\sum_{i=1}^n c_i^t}{\sum_{i=1}^n c_i^0}$$

t= current year

0= base year 1995

$c_i$  = cost element of wage: compensation, intermediate consumption, ...

i= number of factors of production

Problems could arise in trying to reconstruct this weighting structure, especially for years before the base year because of lack of so analytic data. So, if we need to pass to a chain index we ought to face the serious problem of recalculating the quoted matrix yearly.

For the other production inputs, such as intermediate consumption, no remarkable difficulties have been found for the deflation. Intermediate consumption was deflated using inputs price indices, i.e. goods and services purchased by the examined branches; these prices were determined by specific processing on price indices from our Department to deflate the annual value added by branch. Consumption of fixed capital was deflated using the series of General Government gross capital formation at constant prices, calculated in the framework of permanent inventories. Taxes were

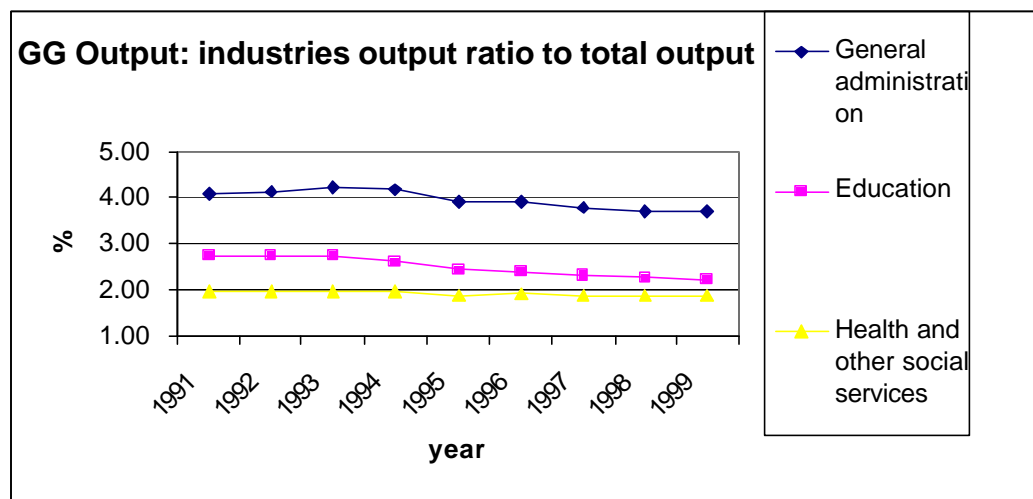
deflated applying the same method used for intermediate consumption, because it was difficult to obtain a quantity indicator as suggested by ESA95<sup>29</sup> on the basis of the specific goods purchased. Regarding the chaining there wouldn't be, at least from a theoretical point of view, any problem in the changing of the index methodology.

### A summary remark

It could be noted that the chaining method, also if it has a lot of desirable properties from the statistical side, would require such a great effort to be implemented within output methods for the non-market sectors that, from a practical point of view, it would almost make preferable the input methods for the volume measure. In fact one of the first requirements of output method is to divide each area into a list of activities, each of one coincides with the elementary services performed, and they should be as much homogeneous as possible. Then the problem of determining so analytic weights arise, especially for those activities where it doesn't exist a budgeting report by economic and functional classification. To recalculate them yearly would be a very hard task, without the co-operation of the institutional units involved.

### Some results

As regards to General Government production with respect to the entire output<sup>30</sup> it can be observed that during the Nineties it has lost one point in percentage, from 9,2% of total output of the country



in 1991 to 8,2 % in 1999.

As shown by the figure Education has been the branch which has lost more importance with respect to total output over the period. This can be read in terms of the output indicator used which is, basically, influenced by demographic factor, such as the decrease of the school population.

Health and social services have a quite stable trend on the total output. Quantity indicator used for health doesn't help in reading this trend. Several factors should be accounted for explanations:

1. health service reform, that has been introduced in 1992, and which has not been completely showed its effect before five or six years;
2. the structural reform of Health Local Units, interviewed in 1994-1995, which has determined a partial slow down<sup>31</sup> of activities in that period. This has been particularly problematic in that, moreover, 1995 is the base year for the constant prices estimations;

<sup>29</sup> ESA95 par. 10.47

<sup>30</sup> All these calculations have been performed considering market prices, and not basic prices.

<sup>31</sup> Evidences of this come also for the current prices estimations.

3. the already mentioned change in the remuneration system of health services.

General public administration shows also a decreasing trend due to the reduction of public employment but partly mitigated by the method used for the deflation of compensation of employees.

### **The result of using different methods to deflate General Government output**

There follow some remarks on the use of different methods to deflate GG output and we try to consider what are the movements in the resulting deflator. We think that such explanations are necessary to avoid, otherwise, misunderstanding in the use of such figures.

General government output deflator is defined as the ratio between the current price series and the constant price corresponding one. If we use an input method to deflate General government output, as described in a previous section, the deflator is nothing else than the weighted average of the deflators corresponding to compensation of employees, intermediate consumption and consumption of fixed capital. Being these quite smooth, the overall deflator<sup>32</sup> will also be smooth. It should also be considered that, in the short-term, there is a high correlation between current and constant price series; for instance if there is a sudden increase in the current price expenditure, due to the renewal of collective agreement, this has an immediate effect on the deflator<sup>33</sup> which shows a sudden increase, too. However if we use output indicators for constant price series, as it is the case of Health hospital services, numerator and denominator movements, in the short-period, are almost independent so that the resulting deflator could have an erratic trend. With referring to the situation of Health, it can be noted that in 1995 there has been a stagnation of activity<sup>34</sup> both on the current and the constant series, while in 1996, probably due to the introduction of DRG remuneration system, output indicator had a so sudden increase that it has been difficult to manage with it, also with smoothing techniques. In the meantime, the increase in the corresponding time series at current price<sup>35</sup> has shown a slower profile so that the result was a slower deflator than it would be expected otherwise. On the other hand a sudden increase in the current price series<sup>36</sup> probably has little immediate effects on the constant price data, so the deflator rises sharply.

The conclusion which could be drawn is that with the rise of the proportion of constant price General Government output derived by output measures, the overall deflator may become more erratic.

### **Definition of productivity**

Productivity is a very simple concept, probably too simple to achieve a simple solution to the measurement problem. It is the relation between output and input. The problem is in the definition and measurement of the various elements that enter in such a measure, such as output, quality, weights, resources or costs and their prices. Furthermore this is particularly difficult within the General Government where output is not sold on the market. This means both that we have a first difficulty in the output definition for the public sector, because it is not always obvious what is the output, and secondly there is no evidence on the weights to aggregate different outputs.

It must be pointed out that what we would like to do is a descriptive measure of productivity and not a measure of technological progress, or the production function or something similar inside the public sector. So we must be aware of the interpretation of the results. What we can get, at this stage

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<sup>32</sup> See Baxter (2000)

<sup>33</sup> In fact if we use the average wage method, the quantity indicator, given by the number of employees stratified as described, hardly will have sudden increases.

<sup>34</sup> In fact the current price series for final consumption expenditure on health, has shown a decrease of expenditure between 1994 and 1995

<sup>35</sup> due to the renewed coming into activity of the health system after the Local Health Units reform

<sup>36</sup> For instance due to the renewal of collective agreement

of the analysis, is a measure<sup>37</sup> of output in relation to inputs to draw remarks on increase or decrease of production. What we can gather from these raw measures couldn't give indications on economies of scale and technological progress. These items should be let to further analysis of productivity which will be designed to comprehend also measures on the use of capital.

In spite of our ambitious aim of measuring productivity there are some basic principles of measurement that must be decided in advance, and which should be in compliance with the intended use of the measurements<sup>38</sup>. First of all we remind that our reference scheme is given by the system of National Accounts, and so the public sector coincide with the General Government institutional sector. Then some other principles, matching the national accounts definition of service, must be followed:

1. Broad area of public sector should be covered, that is to say the used measurement must be as exhaustive as possible;
2. Output measures should be relevant in the consumers (final users) perspective;
3. Measures should be adjusted for quality changes;
4. Inputs should cover all the production costs;

We think that we are still far to get the overall productivity measure for General Government as we don't meet some of the requirements, such as that of the covered area by means of output indicators. As regards to quality changes we remind that a correction has been made for education, while the adoption of DRG classification of illness would probably go in that direction, because the change in the case-mix is expected to reflect the adoption on more sophisticated treatments, which should incorporate quality changes from year to year. In this case the quality changes would be implicit into the adopted indicators.

Nevertheless we are confident that a productivity measure for some industry would be performed.

### **Why haven't we a productivity measure for General Government yet?**

At this point we will try to explain the reason why our National Accounts haven't still a measure of productivity. We will do that with reference to the General Government institutional sector. As already explained we derive output at constant prices by adding up output for the different industries of Government. The methods used to derive such figures are not homogenous, because of the different data sources and of the scarcity of data on output indicators.

We suppose that, in principle, a proper measure of productivity could be calculated only if the volume of output comes from a calculation based completely on output indicators. In fact if we consider that actual productivity of government should separate the changes in the volume of outputs from the volume of inputs, used in the production process, we can't get a reliable measure of government productivity considering the entire government output.

Output estimation performed by input methods is logically linked to the inputs value at constant prices, used in the production process, in that government output is calculated as the sum of the various costs. Being labour cost, i.e. compensation of employees, the main part of the value of output, it derives that numerator and denominator, of the ratio that gives a row measure of productivity, are not independent. In this case the productivity trend we can derive is something not so far from the change in the underlying structure of public employment by professional level.

A more reliable productivity measure would be, instead, that calculated by using output indicators, in that the two ratio components are derived independently.

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<sup>37</sup> Notwithstanding we are skeptic on the possibility of deriving an overall productivity measure for General Government as a whole. In the next paragraph evidence for this is given.

<sup>38</sup> According to National accounts definitions productivity measures are not designed for the evaluation, in the sense of profitability, of public services, nor to punish or to hail the responsible, nor to extrapolate trends.

## **International recommendations for productivity measures**

When dealing with productivity we have been, or at least probably seemed, too much skeptic, but now we have found a support in our position, both for the most suitable measure and for the problem connected to the non market sectors. OECD<sup>39</sup> is working, at the moment, on the third draft of the productivity manual, which will be terminated by next November. There are evidence that “despite a large body of literature, no recent systematic, accessible and concise source of information exists to provide a guide to the different approaches, interpretation and statistical requirements of productivity measures at national or international level.” It is recognised that it is necessary to strike a balance between theoretically desirable characteristics of productivity measures and the reality of data availability or the costs of producing statistics. Broad trends can often be discerned with tools that do not live up to full theoretical standards as long as they are interpreted with the necessary caution. However, even simple indicators of productivity measures should be constructed in a manner that is consistent with more complicated ones, permitting extension and refinement if need be. It is also recognised that measurement of productivity at the industry level is a natural choice, given the existence of similar production function across units of observation. The sector-wide measures of productivity are to be developed as a second stage. On this draft of the manual there is also evidence of “leaving aside those activities where non-market producers dominate (...) These activities pose specific problems of productivity measurement, due to the difficulty or impossibility of observing market prices and/or defining output”.

## **Some results about productivity**

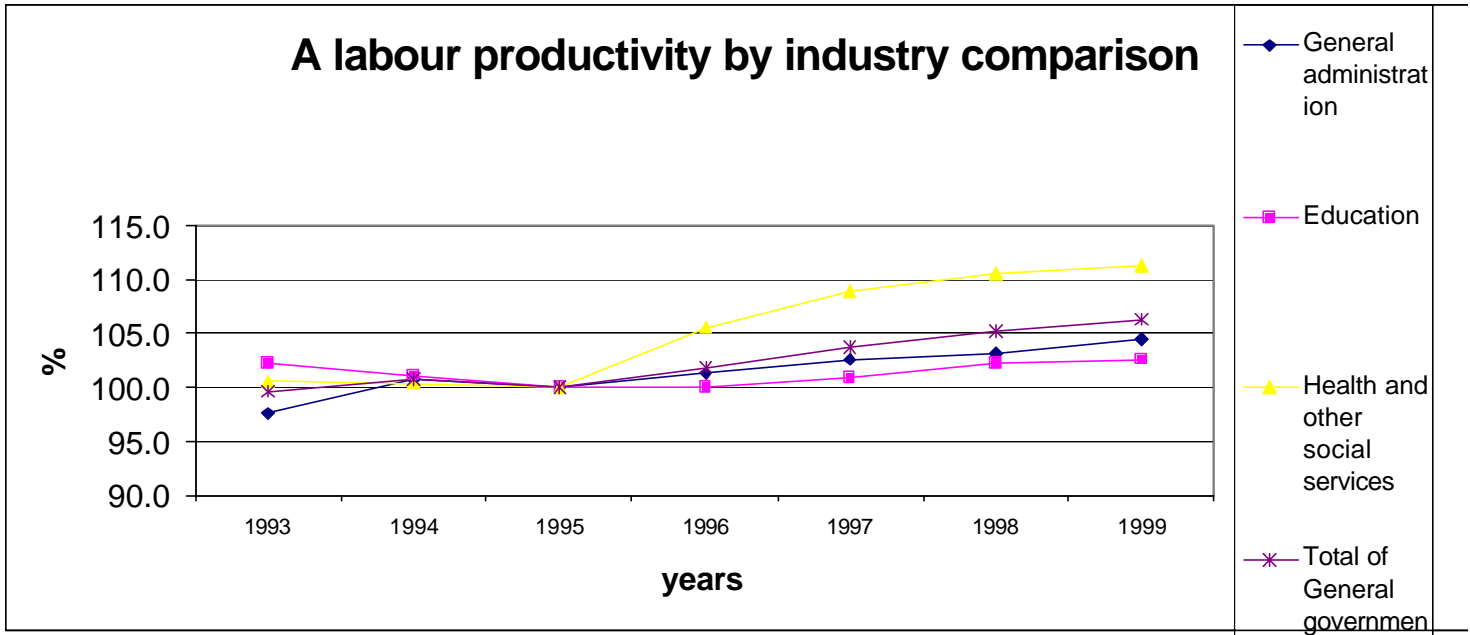
As the theory states, productivity is given as the ratio between output and the factors of production. At this stage of our work it is very difficult to find reliable quantity measures for the other factors of production except work, so the only calculation we could try to perform is to measure the labour productivity. To support our calculation it can be said that, in the specific case we are dealing with, the main part of output of General Government is obtained by using a production factors mix, where the technological components, which mainly relates to the use of capital, are not so relevant and probably the lack of inclusion in the calculation don't influence<sup>40</sup> too much the final results. Following previous remarks, a better analysis could be performed by considering General Government activities according to the different industries in which they are distributed. Considering the main industries, in terms of output produced and of the corresponding factors used in the production process, we focus on the previously described: General Administration, Education, Health and social services<sup>41</sup>. These branches are characterised by different ratios in the use of the input factors. Using output at constant prices as a measure of production and full time equivalent units as labour input measure we can calculate the product by labour unit (per capita produced output). Then by comparison with the base year 1995 we can assume the resulting index as a proxy of the underlying trend of productivity.

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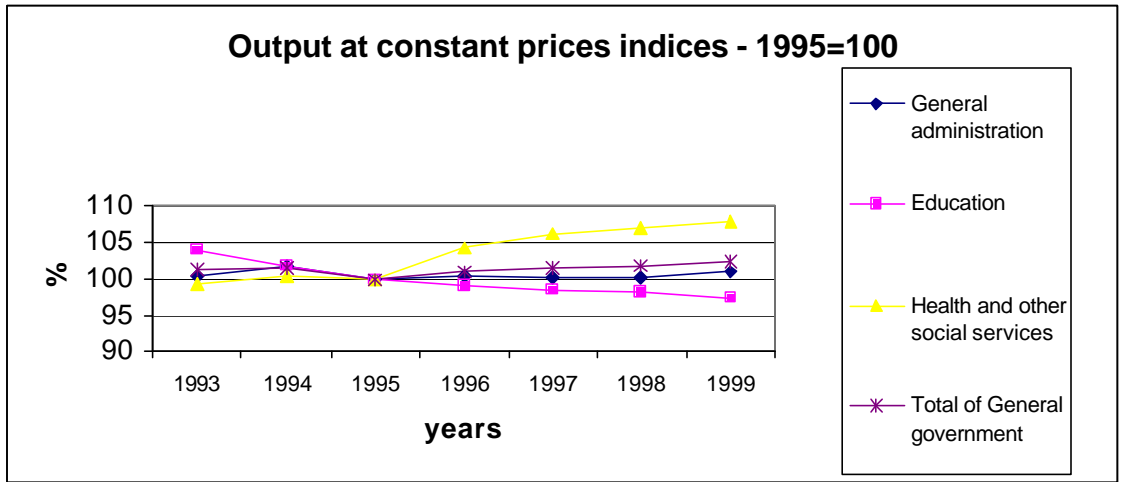
<sup>39</sup> See OECD (2000) “The OECD productivity manual”

<sup>40</sup> This is intended in the bias meaning.

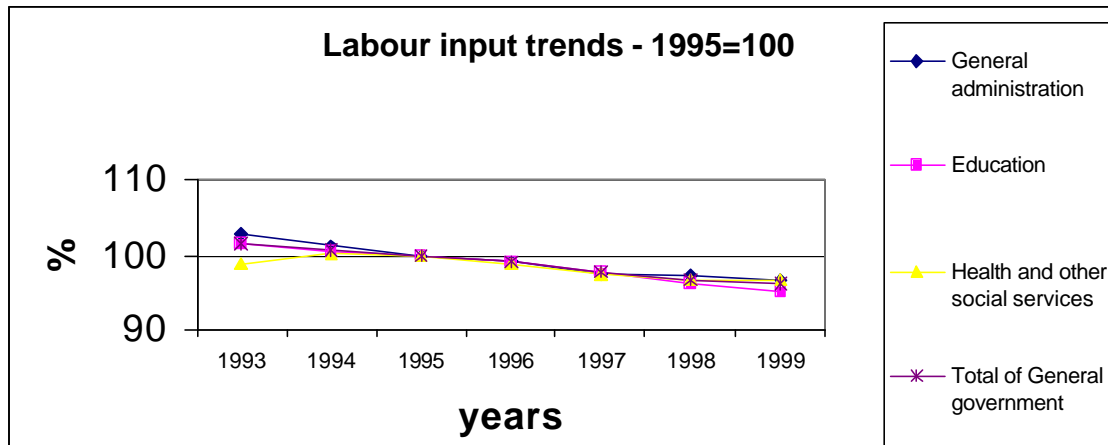
<sup>41</sup> To perform a better exercise on the productivity measure we will consider together the following services: Health hospital services, health services for outpatients and social services. This ensures, also, the coincidence of this aggregated branch with NACE.Rev1 class N



As it can be observed through the graph there is a clear sharp increase in 1996 in labour productivity for the industry of health and other social services. These should be considered with caution, but it must be considered perfectly coherent with the previous remarks on the effect of output indicator on the deflators of General Government. Otherwise if we have a look at the underlying figures of output at constant prices and labour input we can grasp that we cannot expect nothing else.







### **Concluding remarks and future developments**

The work described here represents a first approach to productivity measures for the non-market sector. We think that it should be done because of the introduction of the new methodologies implemented according to ESA95, which have required to use actual output indicators. We believe that in the next future some more topics should be developed to get a total productivity measure for this sector:

1. Output indicators should be used as much as possible;
2. Measure of the use of capital should be refined, also according to international recommendations;
3. Demographic factors, such as migration and ageing of population, which influence demand for services, should be compared with the used indicators;
4. Changes in legislation which might cause changes in the demand of services should be accounted for.

Nevertheless the results here presented are important given the relevance of labour as productivity factor in this sector.

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