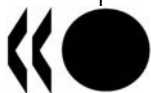


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## Working Party on National Accounts

### Comparison of input and output-based volume measures of education and health

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# *Comparison of input and output-based volume measures of education and health*

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## Introduction

This paper aims at proposing a comparison between the utilisation of output methods and input ones for the evaluation of non market services at constant prices. The comparison is made for the two most relevant areas of individual services, education and health. It ought to be recalled that this work takes stocks from other previous works of the Italian National Accounts on this issue.

This meeting is offering the occasion for the comparison that - as the ESA95 revision is going on, in a certain sense, by rethinking some of the previous consolidated guidelines - is also preliminary to a future analysis of productivity.

Our aim is, after a short description of the work done, already documented in our other previous papers<sup>1</sup>, to provide:

- the description of the data base for the two options, that support the methods;
- the comparison of results;
- the evaluation of the different effects on the key variables of the National Accounts framework.

## The framework of constant prices in National Accounts

The measurement of government output is included in the theoretical framework of the Italian national accounts evaluation in volume terms, that since the 2005 benchmark revision, adopted the chain-linking system. For the non market sector, measures based on output<sup>2</sup> methods for the two most relevant areas of individual services, education and health, are adopted. Further advancements were introduced with the revision of output indicators used up to the benchmark revision - due to the availability of new and reliable data sources - jointly with the studies for the introduction of additional measures. The benchmark revision was also used to implement the input methodology for the whole set of government activities by branch. This further effort was done so as to have an additional instrument for a cross-checking of the estimations.

### Deflation methods

The deflation methods for the non market production<sup>3</sup>, for which there doesn't exist any market price, are:

- INPUT methods: the value of the output at constant prices is based on the deflation of each cost component that, in the case of non-market services, contributes in forming its value (Compensation of employees, Intermediate Consumptions, Consumption of fixed capital, Other taxes on production).

$$P1_{PPY} = D1_{PPY} + P2_{PPY} + K1_{PPY} + D29_{PPY}$$

- OUTPUT methods: which provide for the identification of a volume component, by means of indices of the quantities produced of the service examined.
- Price indices.

The main innovations regarding the deflation process are:

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<sup>1</sup> D. Collesi, M. Anzalone, M. Marotta, D. Versace, S. Zannoni, *Improving the measurement of Government output in Italy*, 29th General Conference of The International Association for Research in Income and Wealth, 20-26 August 2006, Joensuu, Finland.

D. Collesi, D. Versace, S. Zannoni (2008), *Measurement of non market service: Output and outcomes*, 30th General Conference of The International Association for Research in Income and Wealth, 24-30 August 2008, Portoroz, Slovenia.

<sup>2</sup> As a result of the revision, up to now, more than 45% of the total government output is directly calculated in volume terms.

<sup>3</sup> As for the current prices, missing a market price, the evaluation of the non-market output is conventionally calculated as the sum of the costs.

- the passage from a fixed-base system, with 1995 as base year, to a system that evaluate the aggregates at prices of the previous year<sup>4</sup>;
- construction of annual supply matrices at prices of the previous year, distinguished per General Government and Non-profit Institutions serving households;
- deflation of the all industries of non-market production.

## Measuring Education volume output: description of the method

The public production of educational services is divided into the followings activity areas:

- School system
- Vocational training
- University education
- Subsidiary services to education

The index used for the evaluation of the output at the prices of the previous year is the Laspeyres volume index, in which the weights are the unitary costs of the single types of service produced, incurred in the previous year by the service provider, and the quantities are represented by the quantity indicators calculated on the basis of the number of students. The index used for the synthesis represents a summary of the indices relative to each type of service. The corrections for the quality changes are included in the calculation of the indices concerning scholastic education and university education.

### School system

Public school system is organized through the provision of education operated by state schools and other public schools at the local level<sup>5</sup>.

Scholastic education is supplied mainly in state schools, and is divided into four levels: pre-primary education, primary education, lower secondary and upper secondary education.

In the volume index the quantities are represented by the number of pupils in state schools and non-state schools.

The index is calculated at the most detailed level of analysis. The number of students of state and non-state schools is broken down into the four levels of education and, in upper secondary education, by type of institute: classical lyceum, scientific lyceum, teacher-training institutes and schools, vocational institutes, technical institutes, art institutes, art lyceums. Detailed breakdown of the basic data is essential in order to ensure homogeneity among the elementary indices and the costs assigned to them.

The corrective factor for quality changes is based on the number of pupils per class. The quality correction is done according to the education level<sup>6</sup>.

The volume index for school system used is a Laspeyres index, which takes on the following form:

$$\frac{\sum_{i=1}^{n.\_of\_levels\_of\_education} (P_{i,(t-1)} \cdot q_{i,(t-1)}) \cdot \frac{q_{i,t}}{q_{i,(t-1)}}}{\sum P_{i,(t-1)} \cdot q_{i,(t-1)}} = \frac{\sum_{i=1}^{n.\_of\_levels\_of\_education} P_{i,(t-1)} \cdot q_{i,t}}{\sum P_{i,(t-1)} \cdot q_{i,(t-1)}}$$

<sup>4</sup> In particular, the change from a fixed-base system to a chain index system has led, on the one hand, to revise the calculation methodologies of the aggregates in terms of volume and, on the other hand, to extend and complete the informative basis necessary for the transition to the new system. It ought to be mentioned the fact that the deflation system of the non-market sector has drawn considerable benefits from the refinement and consolidation of some of the data sources available, especially as regards the sector of General Government. In the case of the Non-profit Institutions serving households, the lack of informative sources available has made it extremely difficult, at least for the time being, to use methods different than the input ones; the production was thus calculated according to input methods.

<sup>5</sup> The state schools are local units of the Ministry of Education and the other public schools are local units of the local authorities (Municipalities, Provinces and Regions).

<sup>6</sup> More details could be found in: D. Collesi, M. Anzalone, M. Marotta, D. Versace, S. Zannoni, *Improving the measurement of Government output in Italy*, 29th General Conference of The International Association for Research in Income and Wealth, 20-26 August 2006, Joensuu, Finland.

where:

$i$  is the level of education (pre-primary, primary etc)  
 $t=2000...2007$  adopting predominance criteria, the generic school year  $(t-1)/t$  corresponds to the year  $t$

$\frac{q_{i,t}}{q_{i,(t-1)}}$  quantity indicator<sup>7</sup> of level of education  $i$

$(p_{i,(t-1)} \cdot q_{i,(t-1)})$  weight (cost) associated to level of education  $i$  in the year  $t-1$ ;

At the numerator, for each level of education, the value of production is calculated at the previous year's prices.

### University education

The production of universities concerns two kinds of services<sup>8</sup>: Research and Development, for the part related to research, and Education, for the part concerning didactic services. Research and development services are deflated using the input method, while the education component is deflated with the output method.

The quantity indicator used is the number of enrolled students<sup>9</sup> per faculty and/or group of homogenous faculties, hereafter recalled as faculty.

Given the updated and more exhaustive data-set, with the benchmark revision<sup>10</sup>, it has been possible to calculate a per capita average cost for 18 faculties. This allows capturing the specific nature of each faculty. The model used for estimating the unitary cost per student is defined by using a methodology based on the standard cost per student<sup>11</sup>. The method for per capita cost calculation would benefit in future, from accountability according to cost centres that is going to be implemented by several universities.

### Volume index

The index used for the university production is a PPY Laspeyres volume index, in which the weight is the per capita cost in the year  $t-1$  and the quantity, referring to the current year  $t$ , is the number of enrolled students per faculty.

The index takes on the following form:

$$L_{t/t-1} = \frac{\sum_{j=1}^{18} c_{j,(t-1)} \cdot s_{j,t}}{\sum_{j=1}^{18} c_{j,(t-1)} \cdot s_{j,(t-1)}}$$

where:

$t$  is the time unit

<sup>7</sup> The indicator has been already corrected for quality.

<sup>8</sup> The division of university production is based on a research carried out by Istat about time length that university professors involve in didactics and research.

<sup>9</sup> The total number of enrolled students was used because starting from the academic year 2000/2001 the new didactic system came into force, and as a consequence the data concerning students in the courses are not homogenous for the period examined, provided that they are related to two different kind of university organisation. In the Italian case it was impossible to use the OECD classification of the university system because the areas do not take into account the faculties, but directly classify the various study courses.

<sup>10</sup> Before the benchmark revision, the stratification of faculties regarded 7 groups of faculties, see: Misura e Valutazione dei servizi pubblici, Il Mulino, Bologna 1995, edited by G. Certomà, V. Lo Moro, R. Malizia; in particular see paragraph 2.4 L'Istruzione universitaria. Istat calculated the average unitary cost per student starting from the unitary costs per faculty of the University "La Sapienza" of Rome.

<sup>11</sup> This methodology has been developed by the "Observatory for the Evaluation of the University System", Ministry of Education, Universities and Research. Please see "Il riparto della quota di equilibrio del fondo per il finanziamento ordinario delle università. Proposte per il triennio 1998 - 2000", DOC 3/98, Ministry of Education, University and Research, Observatory for the evaluation of the university system, June 1998. Calcolo degli indici di costo standard per studente, statistical annex to DOC 3/98, Ministry of Education, University and Research, Observatory for the evaluation of the university system, June 1998.

$C$  is the unitary cost of a student of the faculty  $j$   
 $S$  is the number of students enrolled in the faculty  $j$ .

### *Quality indicators*

According to Eurostat recommendation a qualitative correction, measuring the outcome of university, was applied in the volume component. The literature presents various indicators<sup>12</sup>, that allow evaluating the results of university production, but it does not give a unique method to measure the efficiency and/or effectiveness of the university. Two indicators have been selected for this correction:

- The ratio between the enrolled "regular students" in the course  $SC_{jt}$  and the total number of enrolled students  $S_{jt}$
- The reduction of the distance between the actual number of years for graduation  $LE_{jt}$  and the theoretical length  $LT_{jt}$ .

Regular students (students who did not exceed the legal length of their degree) were calculated considering the year of first registration in the Italian university. This is not valid for students enrolled in specialised degree courses, introduced with the new didactic system. The indicator is at maximum equal to 1 if all enrolled students are attending their proper year of attendance. Those faculties for which the indicator is close to 1 are the most efficient.

The actual time for graduation is calculated for graduates from each degree, considering the year of first registration and then grouping by faculty the various actual times. The theoretical time was calculated considering the legal length of every degree attended by graduates, and then again grouping them by faculty. The correlation between theoretical time and actual time is 1 if all students graduate within the legal duration of the course. In this case, too, the index close to 1 means that the university education process has an effective result.

Being that the two indicators have the same direction, they both tend to 1, the simplest aggregation to measure the efficiency and/or effectiveness of the educational procedures has been preferred, supposing that both indicators have the same weight.

The corrective factor applied is:

$$q_{j,t} / q_{j, (t-1)}$$

where

$$q_{jt} = ((SC_{jt} / S_{j,t}) + (LT_{j,t} / LE_{j,t})) / 2$$

## **Measuring Health volume output: description of the method**

The method for estimating the value of output at prices of the previous year strictly concerns the production of Hospital services<sup>13</sup>; these services fall into the category of hospital assistance produced by using own hospital facilities and personnel employed by the National Health Service.

The volume index used is based on the DRG classification of hospital discharges<sup>14</sup> according to Eurostat guidelines (2001 *Handbook on measuring prices and volume in National Accounts*).

The clinical cases treated, classified by DRG, represent the basis for the remuneration procedure for hospital services, that is to say, how much the National Health Service should have to reimburse to the hospitals for the services supplied.

The DRG classification applied in Italy is made up of 492 DRG, aggregated, in turn, into 25 Major Diagnostic Categories (MDC) which include all the illnesses concerning a single organ or system, following the division into sectors by the International Classification of Diseases (ICD).

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<sup>12</sup> See: Analisi di efficienza ed efficacia del sistema universitario italiano attraverso nuove metodologie statistiche multivariate robuste, RDR 3/04, Ministry of Education, University and Research, Observatory for the evaluation of the university system, April 2004. It is worth noticing that the analysis applied by the Committee serves the purpose of measuring the effectiveness and/or efficiency for each Italian athenaeum.

<sup>13</sup> The measurement in volume terms of the output of the hospital activities branch exclusively concerns the services supplied to in-patients. The complementary activities, functional in supplying the service itself, are included in NACE L.

<sup>14</sup> The application of this classification replaced the previously used method, in which the indicator, which was made up of the number of patients subdivided into treatment units according to grouping of hospital disciplines, represented a proxy of the method currently applied.

The information necessary to attribute correctly a DRG to a hospitalisation event is derived from the *Hospital Discharge Form*<sup>15</sup>, that is a continuous survey of the information concerning each patient discharged from public and private hospital throughout national territory.

This survey describes the clinical aspects of in-patient care (diagnosis and relevant symptoms, surgery, diagnostic-therapeutic procedures, prosthesis implants, discharge procedures) as well as the organisational aspects (for example: hospitalisation and discharge operative unit, internal transfers, subject sustaining the costs of in-patient care).

With regard to the cost, the source of data is made up of the sets of fees defined at a national and regional level based on which the National Health Service refunds for the services supplied.

The Ministry of Health laid down the general criteria for establishing the fees of hospital services. The regions and autonomous provinces can choose the procedures for applying the fees, which may be articulated according to their own needs; for example they can be modified on the basis of the different types of suppliers and/or on the basis of the complexity of the treated cases. In the meantime, the regions and autonomous provinces have the chance to yearly update the fees valid in their own territory.

## Volume index

The index used for the volume measurement of the hospital services is a PPY Laspeyres volume index, in which the weighting is made up of the cost of discharge sustained in the year t-1 by type of service offered and the quantities are represented by the patients discharged from the public hospitals, classified by DRG in the year t:

$$L_{t,t-1} = \frac{\sum_{i=1}^2 \sum_{j=1}^3 \sum_{h=1}^{492} p_{i,j,h,(t-1)} \cdot q_{i,j,h,(t)}}{\sum_{i=1}^2 \sum_{j=1}^3 \sum_{h=1}^{492} p_{i,j,h,(t-1)} \cdot q_{i,j,h,(t-1)}} \times 100$$

where:

i=1,2	is the type of In-patient care (Ordinary, Day Hospital)
j=1...3	is the type of activity (Acute, Rehabilitation, Long-term)
h=1,...,492	DRG
p	is the average cost per discharged patient
q	number of discharged patients

A correction was applied to the index for qualitative changes in the service provided, in coherence with requests from Eurostat. The variable considered for the correction is based on the availability of large diagnostic apparatus with high-tech content at a regional level. In this case, as for education, a quality correction has been implemented, based on the input used in the production of the health services.

## Input methods

The input methods are currently used for the evaluation of collective service at constant prices; they also serve for the residual part of the government individual services. The calculation is based on the deflation of compensation of employees according to the AW method, as suggested by the Eurostat Task Force on NACE L services.

The deflation of the other components of output cost, that is to say other taxes on production, intermediate consumptions<sup>16</sup> and consumptions of fixed capital, does not presents any relevant difficulties.

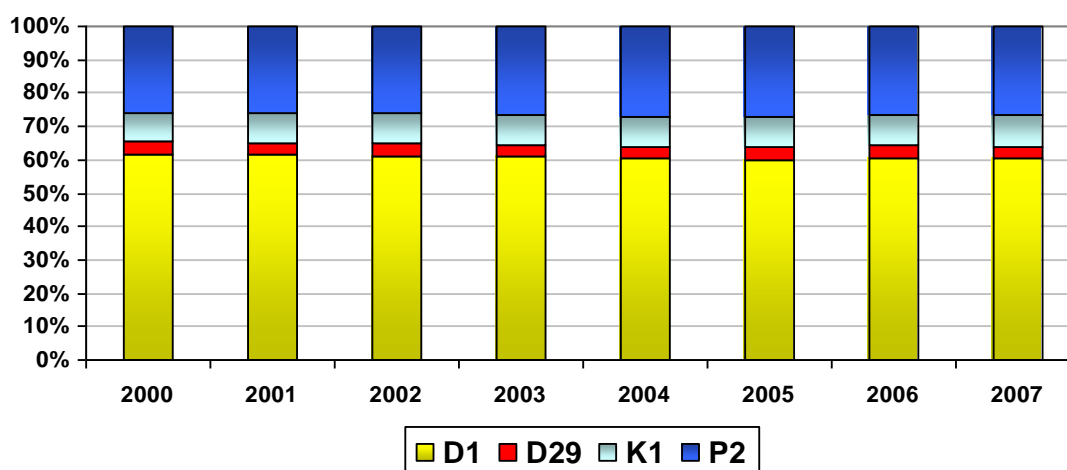
<sup>15</sup> Survey (SAL\_00018) entitled "Discharged patients from public and private care institutes", inserted in the National statistics programme 2005-2007 and previous editions.

<sup>16</sup> According to the Council regulations n. 1889/2002 FISIM have been included in the Government intermediate consumption. Regarding this issue a specific deflation method has been developed.



It could be noted that for the government sector as a whole compensation of employees is by far the most relevant part of output cost, and of value added as well. Nonetheless the analysis by kind of service, shows different patterns of this component cost. Figure 1 provides the full picture of government output cost at current prices for the years 2000 - 2007. The implementation of the AW method requires the availability of a wide database on the composition of government employment, by level of categories containing details both on the quantities - number of civil servants by level of occupational profile - and on the corresponding monetary figures - wages and salaries.

**Figure 1 - Percentage incidence of the component cost of the Government non-market output. Current prices, 2000 - 2007**



### The Average Wages Method for Compensation of employees

Compensations of employees, as defined in ESA95 par. 4.02, are valued at constant prices via the estimation of the labour input, as foreseen by the AW method<sup>17</sup>, which uses the average<sup>18</sup> wages and salaries per categories of employees.

The calculation of the average wages and salaries is carried out on the categories of workers identified during the stratification of the elementary information. This is done so as to find categories of products as homogeneous as possible. In this way the breakdown of the value between the price and volume component should be automatically ensured by the very detailed level of analysis by category, where the intertemporal changes/shift of categories imply changes in the volume component, while the wage increases in the categories should represent the price effect.

The elementary information is aggregated using the Laspeyres index, coherently with the Eurostat recommendations for the volume measures of the national accounts aggregates<sup>19</sup>.

$$IL_i^{t/t-1} = \frac{\sum_{jk} w_{jk}^{t-1} l_{jk}^t}{\sum_{jk} w_{jk}^{t-1} l_{jk}^{t-1}}$$

where

<sup>17</sup> For a complete description of the AW method, please see Collesi et al. (2006).

<sup>18</sup> The numbers of hours worked could be even a better indicator to be used in this context. Unfortunately the data availability in this field is limited to the General government as a whole (considered as Institutional sector); there isn't any analysis of Government by branch of activities.

<sup>19</sup> "The volume measures available at an elementary level of aggregation are to be aggregated using the Laspeyres index [...]. The price measures available at an elementary level of aggregation should be aggregated using the Paasche level [...]", quotation from "Handbook on price and volume measures in national accounts", Eurostat, 2001.

$t_{-1}$  = previous year

$t$  = current year

$l_{j,k}$  = volume component: number of employees

$w_{j,k}$  = price component: per capita wages and salaries.

In order to apply the AW method, figures regarding the number of the General Government employees and the relative expenditures held in the Annual Count Survey (CA), adequately integrated with other sources, had been used. The Annual Count Survey, produced yearly by the State accounting department, provides a periodical and updated basis on public employment trends and related labour costs.

The implementation of the AW method has required a standardization of the elementary data to make them homogenous in order to aggregate them in categories that can be separately deflated.

The work involved the occupational profiles – that foresees different kinds of contract: fixed-term contract, open-ended contract and a part-time contract- and the wage and salary profiles; a further step has been represented by the passage from an institutional approach to a scheme according to the kind of activity.

In particular, it was necessary to reconstruct the data regarding:

- The volume component, made up of the information relative to the number of the public employees;
- The price component, made up of the information on the compensation of employees.

### **Other components of the output costs**

The other taxes on production are deflated by using the AW Method, given that the most important tax is the Regional Tax on Productive Activities (IRAP), established in 1998 that is basically levied on the labour costs.

The intermediate consumptions are deflated, using input price indices, relative to the goods and services acquired by the industries considered and used in the production processes. These indices result from some specific elaborations carried out on the prices indices, in the deflation procedure of the annual value added by industry. The estimates of the input prices are calculated as a weighted average of prices at national production for intermediate uses and the average unit values at import of all industries that provide intermediate input to the industry considered. As already mentioned the FISIM component are separately deflated.

The estimate of the consumption of fixed capital in volume terms required to construct the corresponding series of gross fixed capital formation obtained by means of the deflation of the series at current prices. The calculation of the deflators is based on the series of gross fixed capital formation by owner industry and by good for the total economy.

### **Comparison between input and output methods**

The following paragraphs presents an attempt to compare the result from the application of the two methodologies (input method versus output method) applied to Education and Health services. The work is done by presenting the impact on the calculation of the relevant aggregates of the National Accounts, that is to say: output, value added and General Government final consumption expenditure.

Figures are taken from the elaboration currently in use for the GDP evaluation at current and constant prices related to the 2008 edition of the Italian National Accounts.

The output methods include the quality adjustments as explained in other previous works<sup>20</sup> according to the *2001 Eurostat Handbook on price and volume measures in national account*, where the quality correction for the A methods is explicitly requested. The incoming ESA95 Revision foresees a different treatment of the quality correction: in order to not disagree with the 2001 Handbook a proposal have been made in order to include quality adjustments only in

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<sup>20</sup> See note 1.

separate measurements to be included in voluntary satellite accounts, and to keep them off the core of National accounts measurements<sup>21</sup>.

In our view the compilation of satellite accounts, as a possible way for the inclusion of quality corrections and, in this sense, for the consideration of A-methods, is dangerous because of the possible misleading results that a double accountability of the government production in volume would determine. The exclusion of quality correction in the NA and its inclusion in a satellite account, designed to expand the NA for possible uses in productivity measurement etc., should determine, in our view, a shadow system of National Accounts which potentially could generate a great confusion for the users, economic and institutional researchers, and for the producers, national accountants, too. Eurostat proposal on the use of satellite account for the A-methods is, in our view, a distortion of the use of satellite account which, nevertheless, should be consistent with the core NA, having some measures in common, and whose main task is to enlarge specific themes of NA without conflicting with NA itself.

The output indicators used should be considered as a whole, fully determined only when including the quality adjustment, whenever the statisticians agree on its inclusion; the consideration of the quality correction should be left to the sensitiveness of the statistician who is in charge of the measure of government output.

## Comparisons for Education

Table 1 shows the difference between input and output method concerning the Education output. The time series in volume terms are expressed at prices of the previous year. The table contains output and compensation of employees at current prices too and the price index (the implicit deflator).

**Table 1 - Education Output at constant prices: comparison between input and output method**

	2000	2001	2002	2003	2004	2005	2006	2007
	_____ previous year price, millions euro _____							
Input method	48,795	51,292	52,042	56,238	59,541	56,619	59,305	60,859
Output method	48,622	51,148	54,073	55,875	57,304	56,788	59,781	61,670
<i>Difference</i>	-173	-144	2,031	-363	-2,237	169	476	811
	_____ current prices, millions euro _____							
Output	50,099	52,897	54,858	57,963	56,551	60,173	61,119	64,665
Compensation of employees	41,506	43,660	45,971	48,322	46,476	49,654	50,996	54,540
	_____ price index, previous year = 100 _____							
Input method	102.7	103.1	105.4	103.1	95.0	106.3	103.1	106.3
Output method	103.0	103.4	101.5	103.7	98.7	106.0	102.2	104.9

The output at constant price deriving from the input method is obtained deflating the component concerning the compensation of employees by the AW method as explained earlier in the paper. The AW method has been applied at the compensation of employees as whole without any distinction among the levels of education. An attempt to breakdown the compensation of employees to take into account the level of education, that is doing the calculation by product, will be done later in this paper.

The compensation of employees is the main component of the output. In the period under examination it represents more than 83 per cent of the output at current prices. This explains the relevant effect that the changes in this aggregate, due to the contract renewals, have on the output price index (the implicit deflator). High values of the implicit deflator are usually shown in correspondence with high levels of output at current prices (in conjunction with the contract renewal).

<sup>21</sup> For more details, refer to the document "Price and Volume measures - Conclusions from the workshop of 13 March 2008" presented at the 2<sup>nd</sup> of July 2008 Meeting of the Directors of the European NA.

**Table 2 - Education Final Consumption expenditure at constant prices: comparison between input and output method**

	2000	2001	2002	2003	2004	2005	2006	2007
	_____ previous year price, millions euro _____							
Input method	46,870	49,304	49,941	54,013	57,124	54,080	56,926	58,425
Output method	46,697	49,160	51,972	53,650	54,887	54,249	57,402	59,236
<i>Difference</i>	-173	-144	2,031	-363	-2,237	169	476	811
	_____ price index, previous year = 100 _____							
Input method	102.7	103.2	105.5	103.1	94.6	106.4	103.1	106.4
Output method	103.1	103.5	101.4	103.8	98.4	106.1	102.2	105.0

The differences between the two methods are reflected as a whole on the Final Consumption expenditure (Table 2), that in the case of Education corresponds almost at all to the output. This is true also for the deflator. The case of Health is different: actually in this case the two key aggregates of National Accounts are not so close because of the Social transfers in kind, that enter in the Final consumption expenditure and not in the output.

**Table 3 - Education Value added at constant prices: comparison between input and output method**

	2000	2001	2002	2003	2004	2005	2006	2007
	_____ previous year price, millions euro _____							
Input method	43,876	45,582	46,694	50,677	53,509	50,327	53,452	55,109
Output method	43,703	45,438	48,725	50,314	51,272	50,496	53,928	55,920
<i>Difference</i>	-173	-144	2,031	-363	-2,237	169	476	811

The same considerations of output hold for the Value Added.

### Comparison in case of stratification of input by type of Education

**Table 4 - Education Output at constant prices: comparison between input and output method**

	2001	2002	2003	2004	2005	2006
	_____ previous year price, millions euro _____					
Input method, of which:	51,215	51,989	56,181	59,535	56,599	59,299
Compensation of employees by level of education:	42,116	43,166	46,811	49,484	46,416	49,348
<i>Scholastic and other education</i>	39,570	40,561	43,898	46,585	43,465	46,189
<i>University</i>	2,453	2,531	2,794	2,804	2,857	3,060
<i>Subsidiary services to education</i>	93	74	119	95	94	99
Output method	51,148	54,073	55,875	57,304	56,788	59,781
<i>Difference</i>	-67	2,084	-306	-2,231	189	482
	_____ current prices, millions euro _____					
Output	52,897	54,858	57,963	56,551	60,173	61,119
Compensation of employees	43,660	45,971	48,322	46,476	49,654	50,996
	_____ price index, previous year = 100 _____					
Input method	103.3	105.5	103.2	95.0	106.3	103.1
Output method	103.4	101.5	103.7	98.7	106.0	102.2

When the input method is applied by stratifying according to the type of Education the result is very close to that obtained without the breakdown. This could actually mean that the stratification, already enclosed in the method, is detailed enough to allow to catch the differences since the beginning; on the other hand it could also mean that there is no relevant difference in the ratio between prices (compensation of employees) and quantities (number of teachers, etc.) among the level of Education.

**Table 5 - Education Final Consumption expenditure at constant prices: comparison between input and output method**

	2001	2002	2003	2004	2005	2006
	_____ previous year price, millions euro _____					
Input method	49,227	49,888	53,956	57,118	54,060	56,920
Output method	49,160	51,972	53,650	54,887	54,249	57,402
<i>Difference</i>	-67	2,084	-306	-2,231	189	482
	_____ price index, previous year = 100 _____					
Input method	103.3	105.6	103.2	94.6	106.4	103.1
Output method	103.5	101.4	103.8	98.4	106.1	102.2

**Table 6 - Education Value added at constant prices: comparison between input and output method**

	2001	2002	2003	2004	2005	2006
	_____ previous year price, millions euro _____					
Input method	45,505	46,641	50,620	53,503	50,307	53,446
Output method	45,438	48,725	50,314	51,272	50,496	53,928
<i>Difference</i>	-67	2,084	-306	-2,231	189	482

As a suggestion for future works we propose a table that presents the analysis of public employment by level of Education that could provide a sound basis for a deeper investigation. Further analyses are required in order to make assumption on the distribution of particular categories of workers.

**Table 7 - Percentage distribution of public employees by occupation profile and level of education**

Detailed of occupation profile	Level of education							Total
	Pre-primary education	Primary education	Pre-primary and primary education	Lower secondary education	Upper secondary education	Lower and upper secondary education	Not allocated by level of education	
<b>Managers</b>	-	-	-	-	-	-	<b>0.69</b>	<b>0.69</b>
Headmaster	-	-	-	-	-	-	0.68	0.68
General manager	-	-	-	-	-	-	0.00	0.00
<b>Levels</b>	<b>8.22</b>	<b>24.39</b>	<b>1.17</b>	<b>17.73</b>	<b>24.82</b>	<b>1.05</b>	<b>21.94</b>	<b>99.31</b>
Accountant	0.16	-	-	-	0.14	-	5.32	5.62
Assistant	-	-	-	-	0.02	-	13.73	13.75
Coaching staff	-	-	-	-	-	-	0.26	0.26
General manager	-	-	-	-	-	-	0.86	0.86
Staff	-	-	-	-	-	-	0.08	0.08
Teacher	7.33	21.47	1.17	15.37	22.92	1.05	-	69.31
Teacher for "special classes"	0.73	2.91	-	2.36	1.74	-	-	7.74
Technician	-	-	-	-	-	-	1.69	1.69
<b>Total</b>	<b>8.22</b>	<b>24.39</b>	<b>1.17</b>	<b>17.73</b>	<b>24.82</b>	<b>1.05</b>	<b>22.62</b>	<b>100.00</b>

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## Comparisons for Health

As for Health some of the previous conclusions still hold, also whether to a relative small extent, being the weight of compensation of employees less relevant with respect to the total output. Furthermore for Health there is not always a contemporary application of the wage contract renewal so as to show relevant peaks in the corresponding years. Actually there is a further relevant factor that has impact on Health output at current prices: the "cut" of intermediate consumption that in this field are more important than for Education. When passing to examine the effect of the different methods on the aggregate Final consumption expenditure the relevant role of Social transfers in kind should be kept in mind. This item is often subject to budget constraints, as it happens to intermediate consumption, also whether not necessarily in conjunction with them. Also political actions/measures that aims at introducing efficiency in Health may have effect on the expenditure for Social transfers in kind.

**Table 8 - Health output at constant prices: comparison between input and output method**

	2000	2001	2002	2003	2004	2005	2006	2007
	_____ previous year price, millions euro _____							
Input method	29,805	32,784	34,641	36,557	37,800	41,337	43,564	47,436
Output method	30,460	33,738	34,984	36,262	38,119	41,984	44,926	46,659
<i>Difference</i>	655	954	343	-295	319	647	1362	-777
	_____ price index, previous year = 100 _____							
Input method	107.0	104.2	103.4	101.0	107.9	105.1	106.7	98.3
Output method	104.7	101.2	102.3	101.8	107.0	103.5	103.4	99.9

**Table 9 - Health Final Consumption expenditure at constant prices: comparison between**

	2000	2001	2002	2003	2004	2005	2006	2007
	previous year price, millions euro							
Input method	34,869	38,066	40,474	43,341	45,529	49,491	51,943	56,203
Output method	35,524	39,020	40,817	43,046	45,848	50,138	53,305	55,426
<i>Difference</i>	655	954	343	-295	319	647	1362	-777
	price index, previous year = 100							
Input method	106.4	103.8	103.2	100.8	106.8	104.5	105.7	98.8
Output method	104.5	101.3	102.3	101.5	106.1	103.1	103.0	100.2

**Table 10 - Health Value added at constant prices: comparison between input and output method**

	2000	2001	2002	2003	2004	2005	2006	2007
	previous year price, millions euro							
Input method	21,174	23,386	24,458	25,422	25,809	27,836	29,066	31,355
Output method	21,829	24,340	24,801	25,127	26,128	28,483	30,428	30,578
<i>Difference</i>	655	954	343	-295	319	647	1,362	-777

## Impact of the main aggregates of Government inside the GDP calculation

The following two tables show the impact on the GDP of the input and output methods with reference to Final consumption expenditure and Value added.

**Table 11 - Final consumption expenditure: Impact of input and output methods on GDP**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>GDP chain-linked volumes</b> (2000 = 100, millions euro)	1,191,057	1,212,713	1,218,220	1,218,013	1,236,671	1,243,525	1,266,420	1,284,868
<b>Government final consumption expenditure in Education and Health/GDP (%)</b>								
Input method	7.2	7.2	7.2	7.4	7.5	7.6	7.4	7.3
Output method	7.2	7.3	7.4	7.6	7.6	7.7	7.6	7.6

**Table 12 - Value added: Impact of input and output methods on GDP**

	2000	2001	2002	2003	2004	2005	2006	2007
<b>GDP chain-linked volumes</b> (2000 = 100, millions euro)	1,191,057	1,212,713	1,218,220	1,218,013	1,236,671	1,243,525	1,266,420	1,284,868
<b>Government Value added in Education and Health/GDP (%)</b>								
Input method	5.7	5.7	5.6	5.7	5.7	5.7	5.6	5.5
Output method	5.7	5.8	5.9	5.9	5.8	5.8	5.8	5.7

## Conclusions

This paper examines the results of a comparison between the input and output method applied to the education and health services.

The comparison between the two methods has highlighted several problems both on the theoretical and on the practical grounds.

The input method implies to determine a price for each product, that is for each level of education or for each Diagnosis Related Group in the case of Hospital services.

An appropriate application of an input method would imply to work on a detailed database that, for the time being, does not exist.

With regard to:

- the School system, as showed in the table 7, in the database currently used the 23 per cent of workers are not allocated by level of education (that is by product);
- the University, in the database used, the workers are analysed into two professional categories without any distinction by faculties. The whole service is considered as an unique product;
- the Health services, it does not exist neither the possibility to breakdown the employees by professional categories nor the possibility to associate the professional categories to a Diagnosis Related Group. Also in this case the service is considered as a whole.

Furthermore the substitution of output methods with input ones would also prevent from the calculation of whatever kind of productivity measure of government sector.



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