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Harmonising volume measures for non-market services in the EU – lessons learned from the past and challenges ahead

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BACKGROUND

1 - Eurostat has played in the last decade a very active role in the harmonisation of price and volume measures in national accounts at European level. A particular emphasis has been placed on improvements for non-market services. In 1997, the Eurostat National Accounts Working Group meeting declared the area of non-market services to be the most urgent area for improvement, as the input methods being used were considered to be incomparable and of insufficient quality. It took subsequently several years of discussions in task forces and the above-mentioned Working Group for the countries to agree in majority on the type of output methods that should be used instead. In 2002, a formal decision was taken to implement output methods for individual services like health and education at the latest in 2006. A major topic in the harmonisation of volume measures is the measurement of quality changes. Eurostat pursued the work and, in particular, organised a workshop on the issue of quality in November 2007. This paper analyzes the discussion and developments on this topic over the last decade, including on the intricate links between output, outcome and quality. It then analyses some lessons learned by Eurostat during this process and discusses the challenges ahead.

I. GENERAL PRINCIPLES FOR PRODUCTIVITY MEASUREMENT

A. Market output

2 - The choice of volume measurement methods in national accounting is closely linked to the issue of productivity measurement. So, improving the public services productivity measurement was one of the main objectives of the studies which led to major changes in methods for non-market volume measurement. Consistency of methods being one of the main qualities of national accounts, it is worthwhile to first review the standard concepts and methods applied in market sectors.

3 - Productivity is a measure of the efficiency of output, and in general terms it is calculated as the ratio of the volume of output (or value added) to the volume of the factors of production (like labour or capital) used during the production process. It is also possible to calculate a multifactor productivity as the ratio of output volume to an index representing the combined volume of all factors of production. For the sake of simplicity we shall be referring only to the productivity of labour, which is the measure most commonly used for productivity.

4 - If an economy produced only a single product, for example corn, measuring productivity would be a relatively simple matter: all one would have to do would be to divide the quantity of corn produced by the number of hours of labour needed to produce it. Unfortunately for the national accountant, however, a real economy encompasses thousands of different products; this means that output cannot be calculated directly on the basis of quantities, since aggregating quantities of dissimilar products is meaningless. National accountants resolve this

initial difficulty by introducing the notion of volume. The idea is simple: in a market economy the problem of aggregation is resolved by assigning prices to the products to make them comparable, so that global output can be expressed by its monetary value. This value changes over time under the combined influence of variations in both the quantities produced and their prices. One simple method for preserving the advantage of monetary valuation while eliminating the effect of price changes, so as to retain only the effect of changes in quantities, is to calculate the value of output by freezing prices. National accountants thus expanded the notion of quantity by introducing the notion of output volume, which they define as output at constant prices. In practical terms, while it is not feasible – given the vast number of products involved – to measure all prices and quantities, as a strict application of the method would require, it is nonetheless generally possible to calculate the value of global output at current prices from the aggregate of company turnover. In practice, then, volume is commonly calculated by dividing the value of output at current prices by a price index, which is obtained by grouping products into categories as homogenous as possible and calculating price changes for each category on the basis of a limited sample of items. This method presupposes that prices within each group will move in a broadly similar fashion, so that there would be no advantage, in terms of additional accuracy, in monitoring each product separately.

5 - The same measurement difficulties exist with regard to labour, since labour is not a uniform quantity but has qualifying factors, e.g. training and experience, that have to be taken into account. The methods used to calculate the volume of hours worked are similar to those described for calculating output volume.

B. Why is it so difficult to measure productivity in the government sector?

6 - Public services differ from other products in that they are made available to the user, either free of charge or at a price that bears no relation to the cost of production and is thus not economically significant. This being the case, either it is simply not possible to attach a price to public services or the price does not reflect the conditions of supply and demand. The method described above for calculating output volume thus cannot be applied directly, since it presupposes the existence of meaningful prices.

7 - An alternative to the business sector method of calculating output volume by weighting quantities by prices might be to use a different weighting system. Here, however, another and even more fundamental difficulty arises: that of defining units of quantity for public services. How, for example, can one fix, in a simple manner, quantity indices for national defence services? The number of men under arms might be one possibility, but the importance of military equipment makes this fairly meaningless as an index.

8 - National accountants thus had to look for other solutions. The conventional method has been to define the output value of non-market services, which have no real price, by the sum of their costs. There is certain logic to this. Just as the price of a market product represents the amount that the consumer is willing to pay in order to acquire it, so the cost of public services, which are addressed to users rather than consumers in the true sense, represents the financial commitment that the public is prepared to make in order to secure them, for the citizens collectively (via their representatives) determine the budget allocated to these services. In other words, the citizens play the same role in the non-market economy as consumers in the market economy. In these terms, when quantities can be defined, the notion of unit cost equates, in public services, to that of price in the business sector. This ought to mean that, as

long as it is possible to measure quantities, it is possible to determine prices for public services and thus to apply the constant price method for calculating output volume.

9 - Since, however, it is not possible to assign quantities to all public services, national accountants had to seek some other way to calculate output volume. Applying the system used in the business sector, where output volume is calculated by dividing the value of output by a price index, price indices can be assigned to public services, where output is the sum of costs (intermediate consumption, compensation of employees, consumption of fixed capital, other taxes – less other subsidies – on production). The initial idea was thus to calculate the output volume of non-market services by dividing each element of output cost by a corresponding price index. This is known as the input method, and for years it has been the only system used by national accountants.

10 - The input method does, however, have one major drawback, in that it does not reflect changes in productivity, especially when productivity is measured on the basis of value added rather than output. In public services, value added consists almost entirely of payroll costs, which means that changes in value added more or less parallel changes in pay levels; this is true both for constant prices and for current prices. This means that while adoption of the input method made it possible to calculate output volume for public services, it was useless for measuring productivity. Furthermore, by assuming zero productivity gain for public services, it also tends to underestimate the productivity gains for the national economy as a whole.

The introduction of 'output methods'

11 - The impossibility of measuring productivity using the input method generated increasing pressure for the adoption of new methods from economists as well as policy-makers. Since the use of the input method was explained by the lack of quantity indices for public services, the initial focus was on looking for areas in which it would be possible to define units of quantity for these services. A distinction was thus made between two types of public services: collective services and individual services. Collective services, which include for example defence, police and justice services, are those supplied simultaneously to all members of the community or one of its sub-groups. Their primary characteristic is that the quantity available to the community is not reduced by the amount supplied to an individual. Individual services, on the other hand, are those intended to satisfy the needs of members of individual households, and once acquired are no longer available to others. For collective services it was decided to continue, at least initially, to apply the input method, since defining quantity indices for these services would raise too many problems. One of the principal difficulties, cited in the international System of National Accounts (SNA 1993), lies in the preventive character of collective national services (the aim of the police is to prevent crime, that of the army to prevent war), which makes it difficult to assign quantities to them.

12 - With regard to individual services, the SNA 1993 recommends defining quantity units for education and health services, noting that "there is no mystique about non-market health or education services which make changes in their volume more difficult to measure than volume changes for other types of output". The European Union follows these recommendations and prohibits the use of the input method for non-market health and education services. Eurostat's 2001 *Handbook on price and volume measures in national accounts* specified the quantity indices to be used: in education services, for example, the number of pupil hours was adopted as a quantity index for primary and secondary education.

Once quantity units had been defined for these services, it became possible to calculate their output volume by weighting, in each case, the quantities produced by their costs.

The issue of quality

13 - The application of the output method did, however, cause problems in some countries. In the United Kingdom, for example, increases in national health spending were not accompanied by an increase in output volume as measured by the output method, which translated into a decline in the productivity of the public health service. The question was therefore raised as to whether this apparent deterioration was in fact real or whether it was the result of the inadequacy of the measuring instrument. In the field of hospital care, for example, the quantity index used by Eurostat is the number of treatments provided. If the unit cost of treatments increases, this is not necessarily because the public health service has become less efficient; it may simply be that a greater number of costly treatments were dispensed. If these costly treatments were also more effective, that is, of better quality, the increase in average treatment cost is not necessarily a sign of a decrease in the productivity of the health service. This is where the problem of quality comes in: it is not enough to define quantity indices for public services; the quality of these services must also be taken into account if changes in productivity are to be calculated accurately. The problem was, then, to find a way of measuring output that took quality into account; and the British Government asked Sir Tony Atkinson to address this problem.

14 - The notion of quality was in fact already present in national accounting. It was linked to the need to define the homogenous product categories required to utilise the concepts of price and volume. Quality as defined in the System of National Accounts (SNA 1993) and the European System of Accounts (ESA 1995) is directly associated with the notion of homogeneity, a category of products being homogenous if constituted by units of the same quality. In these terms, taking account of quality in calculating volume means defining classes of products narrow enough that all the products in any given class can be considered as homogenous from the point of view of their physical characteristics, place of delivery, time of delivery, and conditions of sale. Quality in this sense implies no value judgement, no ranking; at most, using prices as weights in calculating volume amounts to considering an expensive product as of better quality than a cheap one. In the case of public services, this approach consists in grouping services in categories narrow enough to be considered homogenous and using their costs as weights.

15 – The Eurostat Handbook on price and volume measures in national accounts (2001) introduced the notion of outcome in the measurement of output, considering that "the quality of the output lies in its results, i.e. in the outcome." This approach was adopted and developed by Atkinson who published his final report in 2005..

The notion of outcome

16 - In essence, outcome based methods returned to the basic aim of measuring productivity: measuring productivity means measuring the efficiency of production. In considering public services they reversed the proposition: since there is no satisfactory way of directly measuring their productivity, let us measure their efficiency and deduce their productivity from the result. The advantage of this approach was that use could be made of the numerous studies on the efficiency of the public services. For example, the aim of the education services is to improve the population's level of education, and that of the health services to increase life

expectancy and improve health. But levels of education and life expectancy depend on numerous factors, and not solely on the action of the public services. And so outcome is defined as the variation in the level of education or life expectancy that could be explained by the action of the public services alone. If it is possible to define representative quantitative indices for, e.g., the level of education of the population, it is also possible, using econometric methods, to measure the impact of the public services on these indices and hence to deduce an evolution in their output volume. Following the publication of the Eurostat Handbook and of the Atkinson Report, numerous efforts were made by individual European countries and by the OECD to implement their recommendations. More precisely, Eurostat Handbook defined three types of price and volume measures, distinguishing between A methods, considered as the most appropriate, B methods, regarded as still acceptable; and C methods, which are not acceptable. In the case of non- market health and education services, the methods based on outcome were classed as A methods, simple output methods were classed as B methods, and input methods as C methods, that is, not acceptable.

II. THE IMPLEMENTATION OF THE NEW METHODS IN THE EU MEMBER STATES

17 - With a few exceptions, Eurostat gave the older Member States until the end of 2006 to eliminate non-acceptable methods (C methods), in particular input methods in the fields of health and education. To monitor and support the application of this regulation, Eurostat:
- Asked the Member States to prepare and transmit to Eurostat an inventory of the methods they used to measure prices and volumes.
- Checked these inventories and reported to the countries on the conformity of their methods with the new rules.
- Sent the Member States a list of questions (in 2006) to monitor the extent of elimination of C methods and compliance with the new rules.
- Conducted information missions in 7 countries (Netherlands, Belgium, Spain, Czech Republic, Finland, Germany, United Kingdom) in order to contribute to the definition of the best methods.
- Held a workshop on measuring quality in public services in November 2007, to try to harmonise the methods used across Europe.
- Organised a workshop on measuring prices and volumes in public services in March 2008 as a preliminary to drafting the new European System of Accounts.

18 - By 2006 it had become obvious that the use of A methods was still the exception in the field of non- market health and education services and that some Member States were even having difficulties in eliminating their C methods (input methods), especially in the health sector.

19 - The information missions and the workshop on measuring quality in public services revealed that national accountants in many countries had strong reservations about the introduction of outcome-based methods for measuring output volume, for reasons both practical and theoretical.

20 - First of all, there is no doubt that outcome methods diverge substantially from the methods used in the field of market goods and services. Outcome methods suppose that that the public institutions have definite objectives and seek to measure the extent to which these objectives are reached. In the business sector, national accounting never tries to determine the objectives of the various economic agents, but simply measures prices and volumes that are objectively observable by the statisticians. The need to specify the objectives pursued by the

public services is the weakest point of the outcome method. What, for example, is the objective of the health service? To prolong life? To fight disease? It is clearly difficult, if not impossible, to define a single objective; and once one accepts multiple objectives the problem arises, for the national accountant, of how to weight them. Should, for example, one year of good health count for more than two years of ill health? Who can legitimately answer this question? The experience of the European countries involved has shown that it is practically impossible to reach a consensus on the question of objectives. More than that, even when it was possible to agree on an objective it was still very difficult to define a numerical indicator to measure it. Finally, outcome methods place a burden of responsibility on national accountants, because their estimates can influence very important decisions even though the data on which they are based are extremely flimsy.

21 - Nor are outcome methods the only ones that are debated. Indeed, the chief accountants of several Member States have proposed a return to input methods. One problem with the simple output method, besides the fact that it does not always allow quality to be properly taken into account, is that of comparability at the European level, since its results depend largely on the level of aggregation of the sets of goods and services to which it is applied. This point was a particular focus of attention at the November 12-13 2007 workshop on measuring quality in non market services, which found that output methods tend to converge with the input method when they are applied to increasingly narrow categories (see box).

22 - There are two obvious conclusions to be drawn from this finding. The first is that applying the output method at a very detailed level gives results very close to the input method, and thus precludes any possibility of tracing meaningful changes in the productivity of public services. The second is that, *a contrario*, the only way to trace changes in productivity using an output method is to use it at a sufficiently aggregated level. But there are two problems with this, the first having to do with the choice of aggregation criteria. Defining aggregation criteria means defining homogenous classes, that is, classes within which all elementary services are equivalent. Taking the education system as an example, if we divide education into three categories, primary, secondary and tertiary, then considering primary education as a homogenous category means considering all primary schools as equivalent, whatever their costs, which means that all those with higher unit costs, such as the special schools for handicapped children, must be judged less productive than the others. But the national accountant has no objective means of deciding whether the additional resources allocated to the education of handicapped children are legitimate or not and thus whether it is acceptable to work on the basis of such a broad aggregate as primary education. The second difficulty concerns outcomes. The output method applied at too aggregated a level does not show an increase in productivity when the government decides to allocate additional resources to public services to improve their quality: on the contrary, it mechanically traces a downturn.

III.   FUTURE DEVELOPMENTS

23 - These considerations were debated at the workshop on measuring prices and volumes organised by Eurostat on 13-14 March 2008 to decide which methods should be retained in the revised European System of Accounts. The recommendation of the Member States' experts at the workshop was to include, on an optional basis, output methods based on outcome in satellite accounts.

24 - In the fields of health and education, output methods applied at a sufficiently detailed level would become the reference methods. In the health field, with its characteristically marked diversity and volatility, input methods are also accepted when output methods do not give satisfactory results. These decisions are in line with the recommendations in the revised System of National Accounts (SNA 2008). Of course, insofar as the methods recommended converge with input methods with regard to their results, they cannot trace meaningful changes in the productivity of the public services. But national accountants thought it was preferable to stick with tried and true methods based on sound estimates at the expense of not showing meaningful changes in productivity rather than adopt methods based on controversial conventions and shaky statistical foundations. In their view it is essential to avoid the risk of suggesting changes in productivity whose meaning is unclear, which could lead policymakers and decision-takers astray.

25 - For some experts abandoning the outcome methods would amount to considering that it is impossible to measure productivity gains in non-market services. This position is difficult to accept. It is therefore necessary to pursue research and work on this issue. However, it is also clear that one cannot ignore the specificity of non-market services, nor throw into question the fundamental principles of the national accounts.

26 - The valuation of non-market services by their production cost rests on an implicit logic which is not without consequence on the definition of the prices and of the volumes. To explain it, the simplest is certainly to start from an example. First of all let us regard corn production as situation of reference. The wheat cultivation is done on a more or less fertile land, the most fertile land being exploited first. Population growth leads to cultivate a land requiring increased work for the same quantity of corn. The economic theory shows that, in perfect competition, the corn price is equal to its production cost on last cultivated land, i.e. the least fertile. If the corn is perfectly homogeneous, its price is the same on all the plots of land so that the profit is nil on the least fertile plot and maximum on the most fertile one.

27 - Now, let us consider the case of an economy where the wheat cultivation would be practiced by civil servants on a land belonging to Government, the corn being distributed free of charge. The national accounts evaluate non-market service output, such as that of all the products, by the monetary expenditure that it would be advisable to carry out to obtain it. This expenditure corresponds to its output cost, i.e. mainly to intermediate consumption, compensation of employees and consumption of fixed capital. To take up again the example of corn production, corn non-market output is valued at its cost, e.g. 600, value lower than the same output in a market economy (e.g. 1000, supposing that the profit is 400). This lower value can be explained by two reasons; the first one resides in the fact that production does not use private capital which has to be remunerated, but public capital belonging to the community.

28 - The second reason, much more fundamental for the issue of prices and volumes, refers to the nature of non-market output, which really does not refer to the produced corn but to the activity necessary for obtaining it. Indeed, if the corn were the output of the non-market activity, the unit of quantity would be, for example, the quintal of corn and its price the cost of a quintal of corn. But this cost, therefore this price, is different from a plot to the other since a less fertile plot requires more work for the same quantity of corn. Since, in national accounts, a product can have only one price, it is possible to deduce that it would be necessary to distinguish as many corn qualities as there are plots. But, if it is supposed that the corn is perfectly homogeneous and that its quality does not depend on the plot on which it is

cultivated, one can deduce that non-market output does not cover corn because corn can have only one price. Therefore, the agricultural work is actually the non-market output and not the corn.

29 - In this example, the aim of production is not however the agricultural work for itself, but corn production. Corn can therefore be regarded as the "outcome" of non-market output, since it is a measurable intermediary between output which is agricultural work and corn utility which is not directly measurable. Corn output depends obviously on many other factors than agricultural work, for example weather, quality of the seeds, etc. It is therefore necessary for measuring the effectiveness of the non-market service to eliminate all these factors. But, first of all, let us place ourselves in the most favorable circumstances, that where corn output depends only on ground work and on cultivated plots. Since the objective of the outcome *method* is the public service efficiency measurement in its ground work activity, it has to be judged taking into account the difficulty level, i.e. of the cultivated plots fertility. The fact that a fertile plot gives more corn than a less fertile one does not involve that work is more effective on a fertile plot; the wheat harvests of two plots can really give an indication on the effectiveness of work only if these plots are of identical fertility. The outcome *method* would amount then to measuring non-market output by corn quantities but by distinguishing as many qualities of corn as there is of different unit costs and that even if corn is physically perfectly homogeneous. The various corn qualities would be weighed up by their cost, the corn coming from a less fertile ground being endowed with a more important weight than that coming from a more fertile plot. In this case, the volume of production could indeed be calculated from an output method with use of correction coefficients to take account explicitly of quality. In the outcome method, the calculation of the volume would first retain the hour worked as a unit of quantity, then would introduce an explicit quality correction equal to corn output per hour of work.

30 - The presented example refers obviously to a situation which does not exist generally, however its conclusions can be extended to other fields like that of education. If we decide, for example, to measure the production of the public education services by the number of points obtained by the pupils to an examination, the production price would correspond to the unit cost of obtaining a point. But since pupils are all different, both by their talents and by the means which they have, it is not possible to determine a single price because all the points are not as easy to gain. It would be therefore necessary to bring together the pupils in categories corresponding to homogeneous unit costs. The "good" pupils would correspond at low prices and the "bad" pupils at high prices. Thus, even under the most favorable conditions, the outcome *method* has to apply to a detailed level to be relevant; it requires therefore an important data collection. But these difficulties of a practical nature appear secondary vis-à-vis the principal obstacle which indisputably remains the almost impossibility of determining a single result indicator.

31 - Vis-a-vis the difficulties, the national accountants have to determine in which direction to focus their efforts and to this end they have to start with answering the fundamental question: does the measure of efficiency really belong to the field of the national accounts? Concerning the market sector, the answer has to be nuanced. It is clear that productivity, such as it can be measured from the national accounts results, corresponds to a certain form of efficiency. But this efficiency concerns above all the aptitude of the production system to produce more with identical means, or what is equivalent, to maintain its production with less means. It does not concern directly the aptitude of the productive system to satisfy the needs of the users. For example, if a drug is replaced by much more effective a drug but at similar prices and at

similar cost, that will not modify in any way the productivity of the economy such as national accounts measure it. Examining whether the supply of products actually meets the needs of users would constitute a new challenge for the national accounts but it is probable that it would be well unlikely to raise it successfully in the market sector if one considers the size and the diversity of this sector.

32 - Does one have consequently to try to measure the efficiency of the public services within the central framework of the national accounts? Is a national accounting system resting on two different logics in terms of productivity measurement for the market and non-market sectors really viable? After a long period of research and of experimenting, the majority of the European national accountants answer today negatively to these questions. They propose therefore continuing the studies on the efficiency of the public services within the framework of satellite accounts since those can incorporate not only monetary data but also effectiveness indicators based on non-monetary data. This proposal rests on the observation that many difficulties would disappear if the constraint were given up to retain only one-dimensional result indicators. Indicator batteries that users could, if they wish, weigh up according to their needs, would certainly allow to resolve the situation and to continue research in the important field of the efficiency of the public services.

33 - Theoretically, in national accounting, a given product can have only one price. In the context of non market services, this implies that two services with different unit costs must be considered as different and classed in two different categories of the nomenclature used to calculate volume by the output method. Thus, all the services grouped in any single category must have the same unit cost. This can be taken a step farther, so that all non- market services in any given category should have the same unit input quantities, since otherwise diverging input prices would lead to different unit costs and thus to classification in different nomenclature categories.

34 - This means that, in strict compliance with national accounting rules, a non- market service is categorised by the quantity structure of its inputs, and if this structure changes over time one must consider that a new product has appeared. Assuming, for simplicity's sake, that the value of output is the sum of intermediate consumption and salaries, the hypothesis of the stability over time of the quantities structure of inputs implies that the value of output at current prices for all products i can be written as:

$$\sum_i IC_i^1 + \sum_i S_i^1 = \sum_i IC_i^0 . \frac{q_i^1}{q_i^0} . p_{IC} + \sum_i S_i^0 . \frac{q_i^1}{q_i^0} . p_S$$

where the exponent 0 refers to the base period and the exponent 1 to the current period, p_{IC} is the intermediate consumption index for the current period and p_S the salaries index. The input method divides intermediate consumption and salaries by their respective price indices. This gives a volume equal to:

$$V = \sum_i IC_i^0 . \frac{q_i^1}{q_i^0} + \sum_i S_i^0 . \frac{q_i^1}{q_i^0}$$

$$V = \sum_i (IC_i^0 + S_i^0) . \frac{q_i^1}{q_i^0} = \sum_i \frac{IC_i^0 + S_i^0}{q_i^0} . q_i^1$$

which is also the formula for calculating volume by the output method. In other words, when the output method is applied to the theoretically narrowest possible level of product nomenclature, it gives the same outcome as the input method.

35 - This result can be illustrated using an example from the education sector. Let us suppose that the teachers' salaries are the only cost and that there are only two types of classes, classes of 20 pupils and classes of 25 pupils. The table below describes the situation at the base period, the quantity index being the number of pupils:

	Classes of 20 pupils	Classes of 25 pupils	Total
Number of classes	4	5	9
Number of pupils	80	125	205
Cost of one teacher	100	100	100
Total cost=output	400	500	900
Unit cost of one pupil	5	4	4.4

36 - In the following period, the number of classes of 20 and 25 pupils has changed and the total number of pupils has fallen from 205 to 200. The output method applied to aggregate pupils shows a drop in volume equal to the drop in the number of pupils. The output method applied to the detailed level gives a constant volume, as it is shown in the table below. In this case, the output method gives the same result of the input method.

	Classes of 20 pupils	Classes of 25 pupils	Total
Number of classes	5	4	9
Number of pupils	100	100	200
Cost of one teacher	110	110	110
Output at current prices	550	440	990
Output at constant prices (n. pupils)	500	400	900
Growth rate (in volume)	25.0%	-20.0%	0.0%