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MEASURING REAL VALUE ADDED IN SERVICE ACTIVITIES: EXPERIENCE IN OECD COUNTRIES

Introduction.

1. The purpose of this note is to describe the methods used by some OECD countries to estimate value added at constant prices. The note is based on the OECD publication *"Services: Measuring Real Annual Value Added"* published in 1996. Most OECD countries have programmes to improve the estimation of gross output and value added in service activities. For this reason, the information in this note may not represent the current situation for some of the countries cited below. However, the picture given here is still broadly correct.

Types of methods used.

2. A large variety of different methods have been devised by countries to estimate the real value added of service activities. The various methods can be classified into double indicator and single indicator methods.

3. ***Double indicator*** methods take into account changes in both outputs and inputs of goods and services, and value added is derived as a residual by subtracting constant price estimates of intermediate consumption from constant price estimates of gross output. ***Single indicator methods*** consist in estimating constant price value added using a single variable, the movements of which are assumed to be correlated with those of value added. Double indicator methods are, from a theoretical standpoint, superior to single indicator methods, since they take into account changes of both outputs and inputs and derive value added as a residual, in conformity with its definition.

4. Table 1 lists the various methods in use. They are classified into double and single indicator methods and by the types of variables used.

5. Method 1) - double deflation - is generally considered preferable to others from a conceptual point of view because not only is constant price value added obtained as a residual, but also because price relatives tend to be more stable over time than the quantity relatives that are used in extrapolation methods. The former can take into account new products as they appear on the market and progressively eliminate obsolete ones as they disappear without creating breaks in time series. Quantity relatives, on the other hand, may take on extreme values varying between infinity and zero as new commodities are offered on markets and old ones disappear, thus causing erratic movements in value added.

Table 1. Methods used by OECD countries to estimate real value added in services.

Double indicator methods
1) **Double deflation**: in double deflation, current price series of gross output and of intermediate consumption are both deflated by price indices which measure the change in prices of output on the one hand and of inputs of goods and services on the other.
2) **Double extrapolation**: in double extrapolation, base year values of gross output and of intermediate consumption are extrapolated using deflated value or physical quantity indices, and derive constant price value added by subtraction.
3) **Extrapolation / deflation** consists in deriving constant price value added from an extrapolated series of base year estimates of gross output, using output deflated value or physical quantity indices and a deflated series of current price intermediate consumption using price indices (or vice versa, though this is more rarely the case).
Single indicator methods
4) **Direct deflation** of current price value added by a gross output price index, a consumer price index, or its relevant components.
5) **Direct extrapolation** of base year value added using a gross output deflated value index.
6) **Direct extrapolation** of base year value added using indices based on physical quantity output measures. This approach differs from *5)* in that the basic data used to construct the extrapolator are expressed in physical units of output and not in deflated monetary units.
7) **Direct deflation** of current price value added by a price index of intermediate consumption.
8) **Direct deflation** of current price value added by a wage rate index.
9) **Direct extrapolation** of base year value added by a deflated value index of intermediate consumption.
10) **Direct extrapolation** of base year value added using an index of deflated compensation of employees
11) **Direct extrapolation** of base year value added by an index based on physical quantities of inputs other than labour.
12) **Direct extrapolation** of base year value added by an index of numbers employed.
13) **Direct extrapolation** of base year value added by an index of man-hours worked.
14) **Direct extrapolation** of base year value added by an index of hours or man-hours worked adjusted For change in labour productivity.
Other methods
Other methods are also used that cannot be classified into the groups described above. For example, the measurement of constant price value added may combine output and input indicators (e.g. the number of pupils and the number of teachers for educational services). Another example is the use of data relative to a different service activity than the one being measured, but closely related to it, for lack of any data on the latter; for example, data on transport activities may serve as a proxy indicator for storage when no information on storage is available. A third example is the use of data on constant price private consumption for those industries which primarily serve consumers.

6. In methods 2) and 3) the indices used for extrapolation may be based on *deflated values* of output or intermediate consumption or, more commonly, on *physical quantities* such as ton- kilometres, numbers of persons employed, number of medical consultations, etc. These methods have the advantage of taking into account both elements that are used to define value added. On the other hand, they have the disadvantage that quality changes are not easily taken into account, particularly when physical quantity indices are used.

7. Single indicator methods 4), 5) and 6) use indicators that refer to gross output. The other methods use single indicators that refer to inputs, including labour inputs.

Most commonly used methods

8. In practice many of the methods listed above are rarely used. Table 2 shows the most commonly used methods and the kinds of activities to which they are most often applied.

Table 2. Commonest methods and kinds of service activities for which they are typically used.

Method used (numbers refer to the list of methods given in Table 1)	**Kinds of activities for which the methods are most commonly used.** (*Italics* indicate non-market services)
1) Double deflation	Trade, hotels and restaurants, transport, post and telecommunications, financial services, real estate, renting equipment, legal, accounting and other business services, education, health, cultural and entertainment services.
4) Direct deflation of current price value added by a gross output price index	Hotels and restaurants, financial service education, cultural and entertainment services.
5) Direct extrapolation of base year value added using a gross output deflated value index.	Trade, post and telecommunications, financial services, real estate, renting equipment, cultural and entertainment services.
6) Direct extrapolation of base year value added using indices based on physical quantity output measures.	Transport, post and telecommunications.
8) Direct deflation of current price value added by a wage rate index.	*Public administration and defense, education, non-profit institutions, other non-market services.*
12) Direct extrapolation of base year value added by an index of numbers employed.	Post and telecommunications, financial services, legal, accounting and other business services, education, health, cultural and entertainment services, *health, cultural and entertainment services, education, non-profit institutions, other non-market services.*

Relative Importance of Different Methods: Shares in Service Value Added

9. Table 3, which refers to various years from 1990 to 1993, shows how much of value added in services is obtained by double and single indicator methods. Column 2 refers to the deflation of both gross output and intermediate inputs; column 3 covers all other double indicator methods, notably when gross output is

Table 3. Share of constant price value added in services by estimation method.

	Double Indicator Methods		Single Indicator Methods		TOTAL
	Double deflation	Other	Direct deflation of value added	Direct extrapolation of value added	
United States	49.6	4.4	20.5	25.5	100.0
Japan	100.0				100.0
Germany	61.5		18.3	20.2	100.0
France	42.5	31.8	25.7		100.0
United Kingdom			7.7	92.3	100.0
Italy	80.4	18.2		1.4	100.0
Canada	72.4		8.1	19.6	100.0
Austria	17.2	38.6		44.2	100.0
Belgium	4.2	0.2	52.1	43.5	100.0
Denmark	100.0				100.0
Finland	28.6	14.5	54.7	2.2	100.0
Ireland			10.0	90.0	100.0
Netherlands	26.6	24.5		48.9	100.0
Spain	5.0	0.6	34. 3	60.1	100.0
Sweden	20.8	24.8	1.9	52.5	100.0
Switzerland			37.8	62.2	100.0
Turkey			93.6	6.4	100.0
New Zealand			4.5	95.5	100.0
Average shares (unweighted)	33.8	8.7	20.5	36.9	100.0

obtained by extrapolation of base year values. Column 4 covers all single indicator methods that involve deflation of current price value added whatever type of deflator is used; column 5 refers to all methods involving extrapolation of base year value added whatever kind of extrapolator is used.

10. The bottom row gives the unweighted average shares. These suggest that direct extrapolation of base year value added (column 5) is the most important approach accounting for about 37% of service value added for these 18 countries. Double deflation is the next most important (34% of service value added), while direct deflation of value added by a single indicator accounts for 20% of value added. In terms of popularity, direct extrapolation is used by 15 countries. Direct deflation and double deflation are used by 13. Nine countries use other double indicator methods.

11. The key finding from this table is the extensive use of single indicator methods. These account for an (unweighted) share of just under 60% of total service value added compared to just over 40% for double indicator methods. The popularity of single indicator methods, despite the acknowledged theoretical advantages of double indicator methods, may be partly explained by the difficulty of making reliable estimates of intermediate consumption at constant prices. Another reason, however, is that extrapolation of base year value added using employment or hours worked is a popular technique for service activities where output is difficult to define - e.g. public administration and defense - or where output is difficult to measure - e.g. financial and insurance services.

Difficult services.

12. Some services are particularly difficult to estimate at constant prices - those where the ***nature of the output*** is unclear or those which are provided on a ***non-market basis***.

13. One example is the ***financial intermediation service*** provided by banks. For this service many countries extrapolate base year value added by an index of employment or deflate current value added by a wage index. There has been considerable discussion in the last few years about the nature of bank output and a consensus appears to be emerging that the best measure of the output of financial intermediation services is provided by the total of a banks financial assets and liabilities. Using this approach, the value added of banks could be estimated as follows:

- The average level of bank deposits for the period is calculated by averaging outstanding deposits at the beginning and end of the period.
- The average level of bank loans is calculated in the same way.
- Average levels of deposits and loans are then added and deflated by some general price index such as the CPI or the implicit deflator of domestic demand.
- This provides an index to extrapolate either base year value added or base year gross output.
- If it used to extrapolate gross output, real value added is obtained by deducting an estimate of real intermediate inputs - e.g. office supplies, electricity, rents etc. - which would usually be obtained by deflation of current value intermediate consumption.

14. ***Non-market services*** present difficulties both because the nature of the output is obscure and because there are no market prices for their output. What, for example is the output of a statistical office? Is it the number of questionnaires processed, the number of field interviews carried out or the number of reports issued? How does quality enter the picture - from better analysis of the data, use of more reliable survey procedures or better presentation of statistical reports? For these reasons, most statistical offices

obtain real value added for non-market services by the "input" approach - either by deflating compensation of employees and depreciation or by extrapolating their base year values by quantity indicators.

15. The input approach has the obvious disadvantage that it does not properly take account of changes in labour productivity. It can do this to some extent if employees are classified by grade or skill-levels so that a shift in the composition of the labour force from less to more skilled staff will produce some increase in real value added. But it will not be possible to capture changes in productivity from, say, better management or use of better equipment. The statistical office of the European Union (Eurostat) has recently examined some of these issues through a series of task forces in which OECD has also participated. Innovative approaches are also being developed in New Zealand and Australia. Below is a summary of current thinking on best practices for measuring real value added in some of these difficult non-market areas.

Health services.

16. For *hospital care* the services provided by hospitals are classified into "***diagnostic related groups***" (DRGs), i.e. groups of diseases requiring similar kinds of treatment. Within each DRG the costs of a sample of ***complete treatments*** is then calculated and price relatives of these costs are aggregated into a hospital price index using total expenditures on each DRG as weights. The main originality of this approach is that it focuses on the overall costs of the treatment. In the past most attempts to construct price indices for hospitals have looked at the prices of individual "acts", such as providing a meal, x-ray examination, physiotherapy, providing particular kinds of drugs etc. By looking instead at the overall costs of treating a particular medical condition it is possible to capture quality improvements through advances in medical technology.

17. This same approach - using DRGs and completed treatments - can also be used to construct a volume index. In this case the numbers of completed treatments within each DRG are weighted by the total costs associated with each DRG to provide a volume index to extrapolate base year values.

18. For the services of *general practitioners* and for *ambulance services*, the number of consultations and the number of emergency calls, respectively, can be used as volume indices of output.

Education services.

19. The basic output measure here is the number of ***student hours*** - a measure that captures changes in both the numbers of students and the amount of instruction that they receive. Student hours are classified according to the level and kind of study involved. These different types of student hours are then weighted together by their total costs. The effect of this is that a student hour of secondary education counts as more output than a student hour at primary level; a student hour in physical sciences counts as more output than a student hour in liberal arts.

20. The approach described above will not capture changes in the quality of education. Such changes could arise from higher or lower student teacher ratios, from improvements in teaching training, from imposition of higher test standards, or from closer government examination of school performance. No consensus has yet emerged as to whether adjustments for these kinds of quality changes should be made nor, if so, how it should be done.

Public administration and defence.

21. For some of the units included in PAD, it appears at first sight fairly simple to identify output and to develop corresponding volume measures. For example, the output of a tax office is the number of tax assessments completed, the output of a passport office is the number of travel documents processed, the output of the government archives is the number of documents processed, etc. In practice, however, attempts to compile volume indices based on the number of tasks completed have been unsatisfactory. This is partly because the administrative records are poorly designed for statistical purposes and partly because they often miss important quality changes. New tax laws may make it harder or easier to complete a tax assessment; the passport office may be operating under changing instructions about the extent of investigation required for travel documents to be issued. Counting the number of tasks completed may not, therefore, be an appropriate way to measure their output.

22. In addition, there are many functions carried out by governments that have no obvious output. These include foreign representation by diplomats, policy analysis in finance ministries and the supervisory functions of ministries dealing with environmental standards or rules of competition.

23. For these various reasons, most countries are resigned to the use of input methods to calculate real value added in most PAD activities. The general approach is to classify government employees by grade or skill-levels. The numbers in each group are then weighted by the total wage bill for that group to obtain a volume index of government employment. This index captures changes in labour productivity arising from changes in the composition of the labour force.

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