Public service productivity estimates: treatment of unmeasured output

Introduction

It is not always possible to find direct output measures corresponding to some of the elements of spending in particular COFOGs (Classification of Functions of Government). Examples include health programmes aimed at changing individuals' behaviour, e.g. anti-smoking campaigns, child protection activity and fire prevention activity. These areas are not public goods where one unit of output can satisfy the needs of all consumers collectively (such as defence spending). So in principle it should be possible to develop direct measures for these areas, such as numbers of programmes delivered. But, at present there are no readily available administrative data that give a picture of actual activity which is consistent in different geographical areas and over time.

In the absence of improved data (the ideal solution) some assumption must be made about what these areas contribute to output. The best compromise will depend upon exactly what data are available. At a minimum there will be data on the current price expenditure in the sub-COFOG where there are no activity data. In addition there may be disaggregated data on the volume of inputs, or more likely, data on the breakdown of input current price expenditure sufficient to allow use of a more closely targeted price deflator than the one used for the whole COFOG.

There are three main possibilities:

- leave out unmeasured areas from the calculated output index. This is the current treatment within public service productivity articles.
- assume volume of unmeasured outputs equals inputs, by either measuring the volume of inputs directly, or by deflating expenditure in the unmeasured area by a suitable price index.
- assume that productivity growth in the unmeasured area equals productivity growth in the measured area.

Leave out unmeasured areas of the calculated output index

Since the level of an index has no particular significance, this is equivalent to assuming that output in the unmeasured area increases at the same rate as measured output in the relevant COFOG[1].

[1] When combining this COFOG with other areas, as in the Total Productivity Article, the index will be weighted by the spending in the whole COFOG. Thus all the output, both measured and unmeasured, will count

Denote the (unknown) volume of unmeasured output at time t by U_t and the volume of measured output at time t by M_t. Then this assumption can be written as

$$(1) \quad \frac{U_{t+1}}{U_t} = \frac{M_{t+1}}{M_t}$$

The weakness of this measure is that it takes no account at all of any of the information that we actually possess, especially the growth in current price expenditure in the area. However quickly or slowly this expenditure grows our assumed output growth never changes.

While justifiable for small amounts of expenditure, the assumption is harder to justify for large and/or (especially) fast changing areas of expenditure. Of course the best course would be to collect real data on actual activity, but in its absence it may be better to use a measure which is in some ways influenced by the actual growth in spending in the area instead of being completely independent of it. The problem, of course, is that spending departments may appear in a good light simply by increasing spending without any evidence that the spending produces activity, reducing the departmental incentive to collect better activity data.

This first method has been used for some small parts of expenditure across UKCeMGA outputs and for, what has now become a substantial part of English healthcare spending, expenditure outside the NHS. This may be reconsidered for the next healthcare productivity article.

Inputs equals output (using a general price index)

The second method is to simply deflate the actual growth in the unmeasured area by some general price index, such as the GDP deflator and assume that the growth in U is equal to the rate of growth of deflated real expenditure in the area.

Let P_t be the relevant price index and E_t^u be the current price expenditure in the unmeasured area. Then this assumption can be written as

$$(2) \quad \frac{U_{t+1}}{U_t} = \frac{E_{t+1}^u}{E_t^u} \frac{P_t}{P_{t+1}}$$

This method uses the actual growth in expenditure in the unmeasured area, but no other sub-COFOG specific information. This method is not currently used in ONS outputs.

Inputs equals output (using a more specific price deflator)

A third method is to revert to the pre-1998 method and treat the unmeasured area as an inputs=outputs area. This is what is recommended in international and European guidance for (implicitly whole COFOG) areas for which activity data are not available. In practice data measuring input volumes directly are often not available. So, as implemented, this method would

then involve deflating current expenditure by the closest approximation to a price index for inputs into the unmeasured area as can be obtained. Denoting the input into unmeasured activity price index at time t by P_t^u we have

$$(3) \quad \frac{U_{t+1}}{U_t} = \frac{E_{t+1}^u}{E_t^u} \frac{P_t^u}{P_{t+1}^u}$$

In practice the deflator P_t^u / P_{t+1}^u may be replaced by the deflator derived from the input prices for the whole COFOG P_t^i / P_{t+1}^i, where $\mathbf{P_t^i}$ is the input price in period t. So equation (3) would become

$$(3a) \quad \frac{U_{t+1}}{U_t} = \frac{E_{t+1}^u}{E_t^u} \frac{P_t^i}{P_{t+1}^i}$$

Either version of equation (3) will reduce to (2) if the relevant input price deflator is the same as the overall price index, such as the GDP deflator, used in method 2. This method is currently used where there are large and well-defined parts of spending that have no associated activity measures, notably the child protection part of Children's Social Care.

Assume that productivity growth in the unmeasured area is equal to productivity growth in the measured index

The final method is to assume that productivity in the area where activity is not measured grows at the same rate as productivity in the measured index, i.e.

$$(4) \quad \frac{U_{t+1}}{U_t} \frac{I_t^u}{I_{t+1}^u} = \frac{M_{t+1}}{M_t} \frac{I_t^m}{I_{t+1}^m}$$

Where I_t^u and I_t^m are the volumes of inputs into the unmeasured and measured areas, respectively. Replacing these volumes with their deflated equivalents – where E_t^m is the

expenditure on the measured area of output, and P_t^m is the input price of expenditure on measured output; re-arranging and solving for $\frac{U_{t+1}}{U_t}$ gives

$$(5) \quad \frac{U_{t+1}}{U_t} = \left(\frac{E_{t+1}^u}{E_t^u}\frac{E_t^m}{E_{t+1}}\right)\left(\frac{P_t^u}{P_{t+1}^u}\frac{P_{t+1}^m}{P_t^m}\right)\frac{M_{t+1}}{M_t}$$

The first term on the right hand side of equation (5) shows how expenditure moves in the unmeasured area compared to the unmeasured area.

Similarly the second term shows how input prices in the unmeasured prices move relative to input prices in the whole COFOG.

If expenditure growth is the same in measured and unmeasured and if input prices move in the same way in measured and unmeasured, then (5) reduces to (1). Indeed (5) can be reduced to all the other equations by appropriate restrictions.

Conclusion

The best approach would be to collect data on currently unmeasured activity. In the absence of this, there is a case for using an alternative approach to that currently used within productivity articles.

Forthcoming articles where the inclusion of unmeasured output is a significant issue will consider which alternative method is most appropriate, given the degree of information that is available on specific input prices and expenditure in unmeasured areas.