Methods explained

Methods explained is a quarterly series of short articles explaining statistical issues and methodologies relevant to ONS and other data. As well as defining the topic areas, the notes explain why and how these methodologies are used. Where relevant, the reader is also pointed to further sources of information.

The quarterly alignment adjustment

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SUMMARY

Gross Domestic Product (GDP), or the size of the economy, can be measured in three ways. These are the output, income and expenditure approaches. ONS routinely measures all three for the UK economy, but publishes a single 'coherent' estimate of GDP. This article explains the role of alignment adjustments in reconciling the output, income and expenditure data.

Estimates of the quarterly growth in the volume measure of Gross Domestic Product (GDP) are produced in each of the three months following the reference quarter. The preliminary estimate, published around 25 days after the reference quarter, is based on only partial information covering in total about 40 per cent of the components of economic output. The second and third vintages of quarterly GDP, published around 55 and 85 days after the reference quarter respectively, are based on more hard data and offer an expanded breakdown of activity by both industry and sector.

These second and third estimates are based on data for all three approaches of measuring economic activity, that is output, income and expenditure. The estimates based on the three measures are inevitably different, since they use a range of different data sources, and estimation methodologies. To provide users of GDP with a single 'coherent' estimate of GDP growth, ONS applies what is known as an alignment adjustment to bring the measures in line. In the UK the output measure is taken as the best short-term estimate of GDP growth, and so the other two measures are aligned to this. For GDP measured according to the income approach the alignment adjustment is applied to Gross Operating Surplus (GOS) of private non-financial corporations, and for GDP measured through the expenditure approach the alignment adjustment is applied to the Change in Inventories component.

Short-term GDP estimation and the introduction of the alignment adjustment

The history of modern GDP data production in the UK can essentially be pivoted around the Pickford Report (Government Economic Statistics: A Scrutiny Report; 1989), which made widespread recommendations for the process and presentation of data within the UK. It resulted in a number of methodological improvements within the National Accounts, including the introduction of new short-term turnover surveys which vastly improved the coverage of the service sector. This process facilitated the introduction of the preliminary estimate of GDP in April 1993

(for Q1 1993) and highlighted the need for an aligned estimate in the production of the second and third estimates. Until this point the three approaches were presented as individual estimates with no attempt to establish a consistent growth rate. Instead, the simple average of the three separate estimates was published.

It is relatively easy to highlight the weakness of applying equal weights to each of the three methods of measuring GDP when compiling an 'average' headline figure (while also providing the three estimates in their own right). We can plot a 'real time' estimate of the annual growth rate of GDP by each measure from 1980-1991, showing the provisional estimates of GDP - taken from the Central Statistics Office (CSO) Economic Trends release (a forerunner to this journal). These growth rates are given at factor cost, rather than market price but serve to illustrate the vast divergences which can exist in any given quarter and how this might feed through into policy and analysis (see **Figure 1**).

The data presented do not represent a time-series as such, but a snap-shot of the first available income, expenditure and output data as would have been witnessed by government and other interested bodies on a real-time basis.

Considering the period in the immediate run up to the review of government statistics, the divergence between the three measures is apparent. For example, through the first two quarters of 1988, GDP from the output approach was growing at over 5 per cent on the same quarter in 1987, whilst from the income approach growth averaged over 4 per cent. Both these results represented a performance well beyond the estimated trend growth for the economy at the time (estimated by the Treasury at around 2.5 per cent at the time of the 2009 Budget). Over the same period however, expenditure data reported growth around trend, between 2-3 percentage points below the other measures.

If we examine the divergence between the three measures in 1988 quarter three, we highlight the need to apply some preferential ordering of the relative qualities of these measures.

Taking a simple average of the growth rates, GDP was expanding at around 2 per cent on a four quarter basis, however, the output measure of growth was 4.3 per cent and the expenditure measure was -1 per cent.

The nature of the divergence between the three series is not

Figure 1
Unaligned GDP estimates 1980–1991

Growth, per cent

Note:

1 The gap in expenditure data between 1981 Q1 and 1981 Q4 was due to industrial action.

Source: Economic Trends

Figure 2
Unaligned growth series against aligned series

Growth, per cent

Source: Economic Trends

consistent over the observed period. It was not evident that any one of the measures was 'always' stronger or weaker than any other and as such there does not appear to be any repeated bias or constant gap between the measures.

Short-term GDP measures and the alignment adjustment

To make a meaningful alignment adjustment, there must be a statistical reason for supporting one approach to measurement of GDP in advance of the other two. If we consider the process behind quarterly GDP estimates we will be able to explain the rationale behind ONS's approach to aligning the UK output, income and expenditure release (second estimate of GDP growth in the reference period) and the Quarterly National Accounts a month later.

The preliminary estimate of GDP is based mostly upon short-term turnover surveys of the production and service industries (around 93 per cent of output taken in combination). The other major component is the construction sector (around 6 per cent) and is based upon Experian survey data. There are data for the first two months of the quarter whilst the final month has a

high forecast element and as such will be subject to revision as additional information becomes available. Overall, the proportion of information based upon actual data at the time of the preliminary estimate is just over 40 per cent.

By the time of the second estimate, turnover data covering the final month of the reference period is available. At this time, there is also around 50–60 percent data content available to produce estimates of GDP from the expenditure and income approaches. Consequently, a provisional set of estimates for all three approaches and revisions to the initial estimates of output figures can be made. It is worth noting that the most recent quarter is the only one open to revision during this stage of the estimation process.

At the Quarterly National Accounts release (the final quarterly estimate) a more detailed set of sectoral accounts data are produced, taking on revisions to previous quarters as well as the present quarter (with the current and previous year open for revision). There are more data available on the expenditure and income sides, much of which are supplied by household and firm based labour market and expenditure surveys as well as other government departments and

organisations. The Experian construction data have been replaced by the ONS output in the construction industry data produced on a national accounts basis (and as such not identical to the separate construction release). Overall, the data content of output is over 90 percent at this stage of estimation, with expenditure estimates representing just under 90 percent data and income data content of just over 70 percent.

It is apparent that the actual data content of the output measure is greater than the other two approaches and as such it has lower forecast content. But greater than this, output is a more stable indicator of short-term growth, with fewer erratic components than the income and expenditure approaches.

It is also the case that the data content and detail provided in the first estimate is limited, this is the trade-off inherent in producing a timely measure of GDP and as such there is an inevitable potential for revision as forecasts are replaced by data.

The alignment adjustment is applied to the individual components of income and expenditure which are subject to the highest level of data uncertainty. This approach is easier and requires fewer assumptions than applying the adjustments on an ad hoc basis to the individual components. Ad hoc data adjustments will generally be applied where there are obvious anomalous data errors in survey responses or known factors which require an adjustment (known underlying survey quality issues). As such the alignment adjustment is the final stage in producing a coherent set of quarterly accounts, offering a single growth rate for policy makers.

As stated above, the alignment adjustment is applied to smooth the path of growth for income and expenditure measures of GDP in line with output. This smoothing effect can be demonstrated by considering the aligned growth rate in GDP against that where the alignment adjustment has been stripped from the two measures shown in **Figure 2**.

The adjustment is applied to equate the following;

$$\begin{aligned} & [\text{GDP(O)}_t / \text{GDP(O)}_{t-1}] - 1 \\ &= [\text{GDP(E)}_t / \text{GDP(E)}_{t-1}] - 1 \\ &= [\text{GDP(I)}_t / \text{GDP(I)}_{t-1}] - 1 \end{aligned}$$

At the time of the Output, Income and Expenditure release this is an adjustment to the level of GDP in the current period. At the time of Quarterly National Accounts when the current and previous year are open to revisions, the extra data taken on and adjustments made are such that the alignment can change in t-i as well as at time t. It is at this point that the process of aligning to output growth but also smoothing is carried out whilst constraining the overall series to a zero alignment adjustment on an annual basis. This smoothing approach also avoids the problem of any large level shifts between quarter four and quarter one figures across years, which simpler growth alignment might cause.

The two components where alignment is applied are the change in inventories series for expenditure and the gross operating surplus of the private non-financial corporation (PNFC) sector in the income data.

GOS is broadly representative of the profits made by commercial enterprises. The estimate of GOS is derived as the residual between the total of remuneration of employees and operating costs and the total income accrued from production (after addition of taxes and less subsidies). It does not include net property income and excludes holding gains from the process of accruing inventories.

The data content of operating income is quite low at the second estimate of GDP and it is not until the annual administrative and business survey data become available that a firm data set emerges. It is the area with the highest degree of data uncertainty and is therefore used as the component where the alignment adjustment will be applied.

From the perspective of expenditure measure of GDP, the change in inventories is calculated from the quarterly stocks inquiry and is based on the difference between the opening and closing 'book value' of inventory holdings. These holdings are then adjusted to remove any holding gains which may have accrued during the quarter (reflecting changes in the valuation of stocks) and then deflated to account for price movements. This leads to a volume measure of the change in inventories over the quarter.

The quarterly alignment adjustment is constrained to sum to zero over the course of a calendar year. It therefore serves the purpose of smoothing the quarterly paths of income and expenditure to bring them in line with the output estimates without impacting upon the annual totals. As data content improves, the quarterly alignment adjustment is generally reduced. This is because incomplete data and forecast estimates or proxy measures are replaced by full survey information and more precise administrative data.

The alignment applied to GOS and change in inventories series are published at Quarterly National Accounts (Table M) allowing the calculation of an unaligned estimate. These unaligned estimates however, are obviously not consistent with the headline figure for the whole economy.

As the alignment adjustment is applied to bring growth rates of income and expenditure measures into line with output (not levels) and because the adjustment is constrained to sum to zero over the course of a calendar year there will generally be a statistical discrepancy between the levels of the three series for years which have not undergone the blue book balancing process. This statistical discrepancy amounted to a £1.4 billion negative adjustment to expenditure (in constant prices) for 2008 and adds up to a £1.6 billion negative adjustment for the year to date (up to quarter three) in 2009.

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