

FEATURE

Robin Youll
Office for National Statistics

Dealing with potential bias in early estimates of GDP

SUMMARY

Historically, Office for National Statistics (ONS) early estimates of the growth of the volume of gross domestic product (GDP) have tended to be revised up on average. This article considers why this has occurred and ONS's response to reducing the potential for such bias in future. It concludes that there is insufficient evidence for ONS to make an explicit aggregate level adjustment to these early estimates to anticipate potential future bias, and that there are many more fundamental reasons why it should not make such an adjustment. Instead, ONS should continue to research the reasons for any bias, and seek to reduce or remove it altogether.

Timely economic statistics of the growth in gross domestic product (GDP) are needed by users so that their decisions better reflect current economic circumstances. The Office for National Statistics (ONS) GDP Preliminary Estimate First Release provides a timely source of evidence to meet this need, and is based on relevant information available at the time. The release is published just 25 days after the reference quarter, when only about 40 per cent of the data used in the final estimates are available. This figure increases to 67 per cent by the time of the UK Output, Income and Expenditure First Release, published around 55 days after the quarter, and reaches 80 per cent by the time of the Quarterly National Accounts First Release, about 85 days after the quarter. For a more detailed account of the GDP revisions process and recent revisions

history, see Skipper (2005).

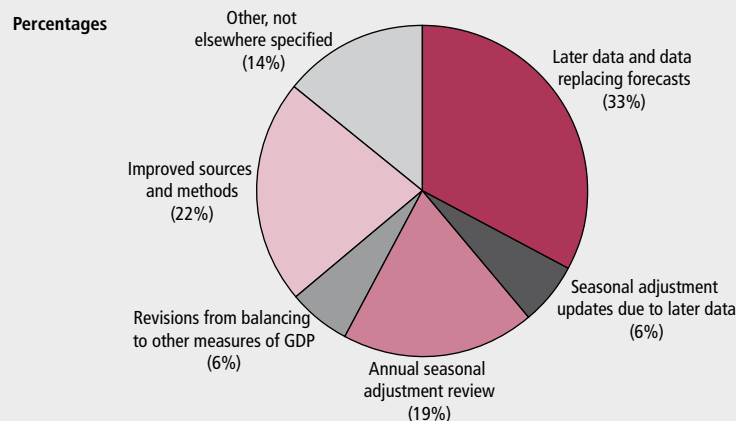
This process of updating estimates as more information becomes available does, of course, lead to revision of the earlier estimates, and therefore there is an expected and explicit trade-off between the timeliness and reliability of these estimates.

This article examines the extent to which, historically, early estimates of growth have tended to underestimate later estimates. It goes on to suggest some possible reasons for this, and considers the case for making an explicit adjustment to the early estimates to counter any possible bias. It then looks at responses to this issue from key users such as the Bank of England and, finally, ONS's own response.

The GDP revisions process

Revisions to estimates of the growth of the volume of GDP occur for a variety

Figure 1
Revisions to quarterly growth rates of GDP(O) data published in June 2007: by cause (Q1 2005 to Q1 2007)



of reasons, for example, as late responses received from businesses in ONS sample surveys are incorporated into the estimates; from regular and planned updates to the structures used to compile aggregates (such as updating of the gross value added weights based on annual surveys); and one-off methodological improvements – for instance, the introduction of annual chain-linking, and changes in the national accounting framework.

ONS monitors the impact of each type of revision as a standard part of the compilation of estimates of GDP. So, for example, **Figure 1** shows the causes of revisions to the output measure of GDP (GDP(O)) for periods between Q1 2005 and Q2 2007, published in the National Accounts *Blue Book* in June 2007 (Skipper 2007).

This shows that around 40 per cent of the total revision introduced in the 2007 *Blue Book* was caused by routine updates, that is, taking on late data and their re-seasonal adjustment. The annual review of seasonal adjustment and improvements to methods and sources accounted for a further 40 per cent of the revision.

ONS uses information of this kind to support research into ways of reducing revisions in future estimates. Notably, this

research currently includes an examination of the extent to which routine revisions, from taking on late data and re-seasonal adjustment, have contributed to upward revisions to GDP in the past.

Are ONS early estimates 'biased'?

The question of whether, and to what extent, ONS early estimates of GDP might be biased has been debated for some time.

Figure 2 shows vintages of estimates of quarterly growth of GDP over the period 1994 to 2008.

It is clear from this that the range of the estimates is considerable. Also, the latest estimates appear on average to be higher than the first estimates. Analysis in ONS (see, for example, Richardson and Mai 2004, and most recently Chamberlin 2007), demonstrates that revisions over this period have been significantly different from zero.

The Bank of England has also conducted much research into this topic, and most recently has published analysis which describes the extent of the upward revision, and sets out how forecast techniques might be used to anticipate this (see, for example, Cunningham *et al* 2007). Indeed, statistically significant upward revision of early estimates of GDP is a phenomenon

experienced by most developed countries. A recent Organisation of European Co-operation and Development study (McKenzie 2007) shows that all major economies, except the United States, have a tendency to revise early estimates upwards, with the magnitude of the revision being similar to that seen for the UK estimates, as illustrated in **Figure 3**.

Why have revisions tended to be positive? There are no definitive studies of the causes of upward revisions to GDP, and many of the reasons may be idiosyncratic. However, some general causes might be identified, for example:

- there may be a tendency for new methods to identify changes in productivity more accurately than previous methods. For instance, the Index of Services development programme has very often led to 'input' methods (for example, those based on changes in employment) being replaced by those based on price-adjusted sales. More generally, methods for quality adjustment of volume measures of GDP have been much improved in recent years, and may account for some the upward revision
- at the time of the release of the early estimates, only limited 'hard' data are available, and compilers of National Accounts estimates may therefore need to make adjustments to the input data. These are generally based on well-understood properties of the compilation process, for example whether imputation methods tend to under or overestimate the final data, and on the extent to which future revision is deemed likely. Additionally, compilers may adjust the detailed forecasts included in the estimates if these have tended to under or overestimate growth in the past. These judgements and adjustments may tend to be conservative on average so that, during a period of sustained economic growth, this tendency could lead to upward revision when real data replace forecast estimates
- the development of methods for the measurement of emerging or rapidly changing sectors, for example telecommunications and information technology, may lag behind the growth of these sectors
- more generally, in the UK, early estimates of GDP growth are in the main based on the 'production' approach to GDP, where changes in

Figure 2
Estimates of quarter-on-quarter growth of GDP first, latest and range of estimates

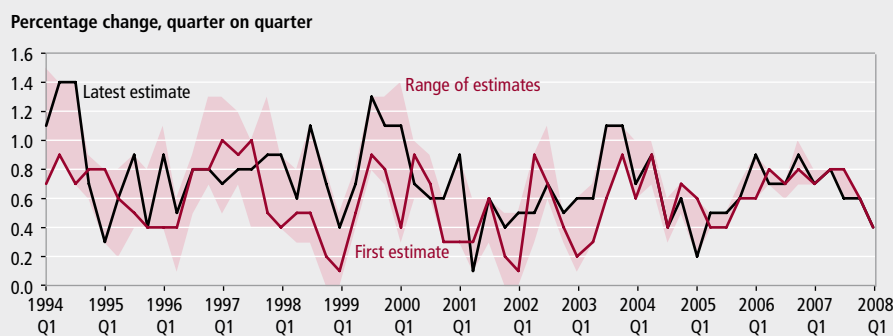
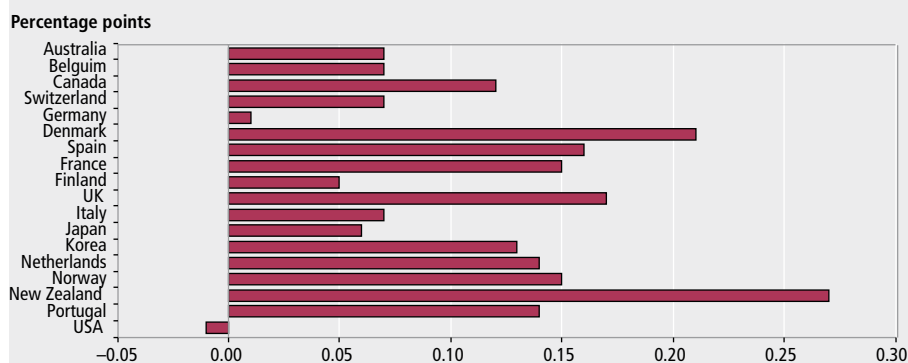


Figure 3
Mean revision to quarter-on-quarter growth of GDP for main OECD countries, May 1995 to June 2007



output are used as a proxy for changes in gross value added (GVA), with the ratio between output and GVA assumed fixed in the short term. In reality, as production activities become more efficient, this ratio will tend to decrease. This may, therefore, create a tendency for later estimates to show stronger growth than the early estimates

Revisions from all of these causes can often be measured directly, and so general theories about causes can in principle be tested. While research in ONS continues in this area, it is already understood that much of the upward revision does arise from methodological changes. One approach to demonstrate this is to consider when revisions occur: if they arise predominantly during the early stages of the evolution of an estimate (for example, during the first six months) this would suggest that late data might be a cause of revision. In turn, this should promote improvements to imputation and forecasting methods, for example.

On the other hand, if revisions occur mainly during the period after late data have been taken on (say after six months), this would suggest that less regular sources of revisions, for example, methodological changes and taking on annual benchmark data, might be significant. **Figure 4** shows when revisions have occurred over the

period 1992 to 2008. In the figure, ‘month 2’ refers to estimates published one month after the first estimates, and so on; and the maximum number of periods are used as the basis of each average (for example, the average revision between month 36 and the latest estimate is based on all periods between January 1995, 36 months after the start of the period considered, and May 2008).

This shows that around four-fifths of the total average upward revision during this period occurred more than six months after the first estimate. This is consistent with the view that revisions are caused primarily by less regular events, for example, methodological changes. As a result, modelling the behaviour of the revisions process is made significantly more difficult.

Should ONS adjust early estimates of GDP?

Despite the foregoing, it is still reasonable to ask whether ONS could anticipate the extent of upward revisions and, if so, if it is appropriate to correct for this by a formal ‘bias adjustment’. The remainder of this article considers this issue.

ONS does not currently make any formal adjustment for potential bias in the early estimates. In part this is because of the inherent difficulties in estimating an appropriate adjustment. In particular:

- while, on average, early estimates have been revised up in the last ten to 15 years, there are many occasions when particular estimates have been revised down (see, for example, Figure 1). If ONS were to make an adjustment to the calculated growth of GDP of, say, 0.1 per cent to each quarterly growth rate (which is roughly the mean revision in recent periods) then, while this might reduce bias on average, it will overstate significantly some estimates (those which are prone to be revised down). This phenomenon may be particularly important at turning points in the economic cycle. Indeed, most revisions studies only include data for the period since the early 1990s, and therefore at best include one complete economic cycle. There is therefore limited data on which to model the behaviour of revisions at turning points
- the extent of upward bias changes over time, so that predicting revisions to particular point estimates of growth becomes highly judgemental. For example, the mean average revision, which is normally taken as the measure of bias, varies considerably depending on the length of the period over which the average is taken, and the time span considered. For example, **Figure 5** shows the average revision to GDP between the first and latest estimates, using a three-year moving average over the period Q1 1997 to Q1 2008. For some periods, the first estimates have been revised up by as much as 0.27 percentage points, while more recently the average revision over three years is actually negative. This instability in the average revision makes modelling of the revisions process highly dependent on the period chosen as the basis of the model
- one method for making explicit bias adjustments to official GDP estimates might be to use data from external, non-official sources. Research in ONS suggests that this can be risky because of the uncertainty surrounding the external estimates themselves, and the extent to which they provide a robust basis for adjustment. In ONS’s view, the effectiveness of using non-official estimates as a basis for predicting revisions to official estimates of GDP remains unproven. Furthermore, external surveys are not subject to the same public scrutiny, and private institutions can be perceived as representing a particular lobby in

Figure 4
Mean revisions: by stage of GDP production, 1992 to 2008
Percentage points

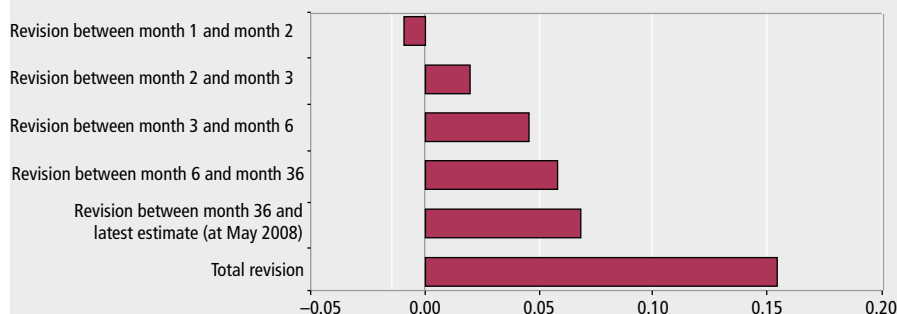


Figure 5
Mean revisions to GDP based on three-year end-point moving average
Percentage points



the political arena, and so have a declared interest in the message they are presenting. There would be a clear danger if official statistics were perceived by the public as reflecting their message in any formal way

- the underlying revision process itself is not stable, making forecasting expected revisions particularly difficult. For example, in 2007, the suspension of the usual *Blue Book* production round (see Beadle 2007) deferred revisions until 2008. Models of the revisions process which include this period may work less well, unless adjusted 'off model' to accommodate this
- many of the occurrences of upward revision to GDP result from one-off causes, for example, the methodological changes introduced as part of the development programme for the Index of Services. The introduction of new deflators for producer price indices in 2003 also led to upward revision. The fact that the particular reasons for these revisions will not occur again in future reduces the power of past revisions to act as a basis for forecasting likely future revisions

Furthermore, ONS chooses not to make formal adjustment as a matter of principle, because:

- estimates of GDP are produced as part of an integrated set of National Accounts. The balanced estimates of GDP take on data for income, expenditure and output, and provide considerable detail of growth within institutional sectors and industries. A 'top-down' adjustment to GDP, based on an aggregate model of historical revisions say, could not be allocated in a meaningful way. A 'bottom-up' approach to adjustment would be impractical because the historical pattern of revisions is considerably more volatile than for the aggregate
- ONS can, and does, provide much information about historical revisions to GDP. However, the process of forecasting future revisions is ultimately one of judgement, for example which indicators to use, their representativeness of past revisions, their performance as predictors of revisions, and so on. It would be inappropriate for ONS, as the official producer of estimates of GDP growth, to make such judgements, although individual users are of course free to do so. See Chamberlin (2007) for a fuller treatment of this point

- ONS estimates are compiled according to international standards which ensure comparability of UK estimates with those of other countries. Making formal adjustments based on judgement would be inconsistent with these standards

The roles of ONS and the Bank of England

This section considers the respective roles of ONS and the Bank of England in estimating growth in the economy. Bank staff have for some time generated alternative best guesses of GDP growth based on the pattern of revisions in ONS estimates and on external indicators like the Confederation of British Industry's Industrial Trends Survey and the Chartered Institute of Purchase and Supply indicators of growth (Cunningham *et al* 2007).

As already noted, ONS, as the official statistics authority, must ensure the transparency and internal coherence of published estimates, and has an obligation to meet national accounting standards worldwide. Combining official and external survey-based estimates would compromise this. On the other hand, as a user, the Bank can make economic judgements based on official estimates as well as other 'softer' evidence. More generally, the role of economic analysis of the type performed by the Bank may be viewed as simply needing to provide a better-than-evens chance of improving understanding of the current economic conjuncture.

It is legitimate to ask, though, whether the credibility of ONS may be damaged by the Bank's explicit use of external business surveys in estimating economic growth. In response to such questions, the Bank's Chief Economist, Charles Bean, has characterised the issue as follows (Bean 2007):

[the Bank's] work on data uncertainty [is seen by some] as indicative of a loss of faith in ONS by the Bank, [and] has led us to begin production of our own independent estimates of the key macroeconomic indicators. This represents a major misunderstanding of our respective roles and of the aims of our data uncertainty work. ONS's task is primarily one of measurement. This is a particularly difficult task in an evolving economy and one that they execute outstandingly well. Moreover, the data produced by ONS represents far and away the single most important source of information for us. But we do know that early official estimates are contaminated by unavoidable

measurement error and therefore need to be interpreted in the light of our economic understanding and other available sources of information. Just as we do not have the resources to get into serious measurement of the economy, so it would be inappropriate for ONS to stray too far from measurement into interpretation. This just represents the natural division of labour between us.

ONS response to potential bias in early estimates

On balance, ONS considers it inappropriate for ONS, as the official producer, to make explicit adjustments to early estimates of GDP to anticipate future revisions. Rather, ONS addresses this issue in a number of ways:

- by providing users with a variety of metadata and analysis of historical revisions to inform their own judgements. In this regard, ONS is probably the most transparent official statistical agency in the world, and is the only one that publishes detailed real-time revisions data sets (so called 'revisions triangles') as part of the regular release of GDP
- to reduce the source of revisions through continued research and development into methods and systems, and analysis of the causes of historical revisions. As part of this, the ONS programme for the modernisation of National Accounts will balance the three measures of GDP (income, expenditure and output) each quarter rather than each year, and so allow revisions arising from this process to be taken on sooner
- by informal use of information from external surveys as part of the compilation of the official estimates. ONS regards these surveys as a useful basis to confirm the official data and so, as part of the validation of the detailed sources used to estimate GDP growth, comparisons with these indicators occasionally leads ONS to question returned data with contributors, and to correct these if necessary

Conclusions

Users rely on ONS early estimates of GDP growth, alongside other information, to gain an understanding of the current state of the economy. Users want these estimates to both coincide with the current period as closely as possible, while also acting as reliable approximations of the final

estimates. As such, ONS needs to make a judgement about the optimal timetable for the release of these early estimates, based on the known trade-off between reliability and timeliness. Conversely, users need to be aware of this trade-off and of the nature of the revision process. To help users understand this process, ONS publishes considerable metadata relating to historical revisions at the time of each GDP statistical release, as well as regular and occasional articles on the revisions process.¹

Some users, like the Bank of England, may wish to factor into their economic decisions judgements about the likelihood, magnitude and direction of future revisions. However, ONS has a duty to report its best estimates of economic growth according to well-defined international standards. Furthermore, ONS considers that there are significant difficulties with making explicit adjustments to GDP growth to anticipate likely revisions, and so does not make them.

While ONS recognises a clear role for external surveys as early indicators of economic change, ultimately users need to understand the detail that drives the headline stories in GDP growth. This is only available from the official estimates, which are based on hundreds of different data sources, including extensive surveys of households and businesses. This detail is vital to inform economic policy decisions, but it takes time for all these data to become complete.

Work in ONS to understand the underlying process that leads to revision continues, for example, the development of models of the evolution of GDP estimates to help identify causes of revisions. In addition, it is anticipated that the modernisation of the National Accounts methods and systems in the coming period will further help to reduce revisions.

Notes

- 1 These are just some of the trade-offs between the various components of quality that ONS needs to consider. For a detailed consideration of these issues, see ONS Guidelines on Measuring Statistical Quality at: www.statistics.gov.uk/downloads/theme_other/guidelines_subject.pdf and ONS Quality Management Protocol at: www.statistics.gov.uk/about_ns/cop/downloads/qualitymanagement.pdf

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CONTACT

 elmr@ons.gsi.gov.uk